

STANDARD SPECIFICATIONS for ROAD, BRIDGE and MUNICIPAL CONSTRUCTION



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|----|--|------------|
| 1 | DIVISION 1 GENERAL REQUIREMENTS | 1-1 |
| 2 | SECTION 1-01 DEFINITIONS AND TERMS | 1-1 |
| 3 | 1-01.1 General..... | 1-1 |
| 4 | 1-01.2 Abbreviations..... | 1-1 |
| 5 | 1-01.2(1) Associations and Miscellaneous..... | 1-1 |
| 6 | 1-01.2(2) Bid Items of Work and Units of Measurement | 1-4 |
| 7 | 1-01.3 Definitions | 1-5 |
| 8 | SECTION 1-02 BID PROCEDURES AND CONDITIONS..... | 1-11 |
| 9 | 1-02.1 Responsible Bidder..... | 1-11 |
| 10 | 1-02.2 Supplemental Bidder Responsibility Criteria Form (SBRC) | 1-11 |
| 11 | 1-02.3 Estimated Quantities..... | 1-12 |
| 12 | 1-02.4 Examination of Bid Documents and Project Site..... | 1-12 |
| 13 | 1-02.4(1) General..... | 1-12 |
| 14 | 1-02.4(2) Subsurface Information | 1-13 |
| 15 | 1-02.5 Form and Style of Bid | 1-13 |
| 16 | 1-02.6 Addenda | 1-13 |
| 17 | 1-02.7 Bid Guaranty..... | 1-13 |
| 18 | 1-02.8 Noncollusion Requirement..... | 1-13 |
| 19 | 1-02.9 Bid Submittal | 1-14 |
| 20 | 1-02.9(1) General..... | 1-14 |
| 21 | 1-02.9(2) Change of Bid Submittal Date | 1-14 |
| 22 | 1-02.9(3) Bidder/Subcontractor List | 1-14 |
| 23 | 1-02.9(4) Inclusion Plan | 1-14 |
| 24 | 1-02.10 Modification or Withdrawal of Bid..... | 1-15 |
| 25 | 1-02.11 Additive, Alternate, Deductive..... | 1-15 |
| 26 | 1-02.12 Public Opening of Bids | 1-15 |
| 27 | 1-02.13 Irregular Bids | 1-15 |
| 28 | 1-02.14 Disqualifications of Bidders..... | 1-15 |
| 29 | SECTION 1-03 AWARD AND EXECUTION OF CONTRACT | 1-15 |
| 30 | 1-03.1 Consideration of Bids..... | 1-15 |
| 31 | 1-03.1(1) Bid Tabulation | 1-15 |
| 32 | 1-03.1(1)A Reciprocal Preference for Resident Contractors..... | 1-15 |
| 33 | 1-03.1(1)B Identical Bid Totals..... | 1-16 |
| 34 | 1-03.1(2) Claim of Error and relief of award..... | 1-16 |
| 35 | 1-03.1(3) Declaration of the Lowest Responsive Bid | 1-16 |
| 36 | 1-03.1(4) Pre Award Information and Rights of the Owner | 1-16 |
| 37 | 1-03.2 Award of Contract..... | 1-16 |
| 38 | 1-03.3 Required Documents for Execution of the Contract..... | 1-17 |
| 39 | 1-03.3(1) Evidence of Insurance | 1-17 |
| 40 | 1-03.3(2) Payment and Performance Bond | 1-17 |
| 41 | 1-03.3(3) Agreement Form | 1-17 |
| 42 | 1-03.4 Failure to Execute the Contract | 1-17 |
| 43 | 1-03.5 Return of Bid Guaranty | 1-17 |
| 44 | 1-03.6 Protests | 1-17 |
| 45 | SECTION 1-04 SCOPE OF WORK | 1-18 |
| 46 | 1-04.1 Intent of the Contract | 1-18 |
| 47 | 1-04.1(1) Bid Items Included in the Bid | 1-19 |
| 48 | 1-04.1(2) Bid Items Not Included in the Bid | 1-19 |
| 49 | 1-04.2 Coordination of Contract Documents..... | 1-19 |
| 50 | 1-04.3 Changes | 1-19 |
| 51 | 1-04.4 Dispute and Claims Resolution Process..... | 1-20 |
| 52 | 1-04.4(1) Dispute Resolution Sequence | 1-20 |
| 53 | 1-04.4(2) DisputeS..... | 1-20 |
| 54 | 1-04.4(3) Claims | 1-21 |
| 55 | 1-04.4(4) Mediation..... | 1-23 |
| 56 | 1-04.4(5) Litigation | 1-23 |
| 57 | 1-04.4(6) Audits | 1-24 |
| 58 | 1-04.5 Variation in Estimated Quantities..... | 1-24 |
| 59 | 1-04.6 Differing Site Conditions - "Changed Conditions" | 1-24 |
| 60 | 1-04.7 Progress Estimates and Payments..... | 1-25 |
| 61 | 1-04.8 Use of Buildings or Structures | 1-25 |
| 62 | 1-04.9 Use of Materials Found On the Project Site..... | 1-25 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|--|------|
| 1 | 1-04.10 | Project Cleanliness and Final Cleanup | 1-25 |
| 2 | SECTION 1-05 | CONTROL OF WORK | 1-26 |
| 3 | 1-05.1 | Authority of Engineer | 1-26 |
| 4 | 1-05.2 | Authority of Assistants and Electrical Safety Observer | 1-27 |
| 5 | 1-05.2(1) | Authority of Assistants | 1-27 |
| 6 | 1-05.2(2) | Authority of Electrical Safety Observer | 1-27 |
| 7 | 1-05.3 | Submittals | 1-27 |
| 8 | 1-05.3(1) | General..... | 1-28 |
| 9 | 1-05.3(1)A | Electronic Submittals..... | 1-28 |
| 10 | 1-05.3(1)B | Non-Electronic Submittals..... | 1-28 |
| 11 | 1-05.3(1)C | Bulk Sample Submittals | 1-28 |
| 12 | 1-05.3(1)D | Submittal Numbering..... | 1-28 |
| 13 | 1-05.3(1)E | General Submittal Distribution and Format Summary | 1-28 |
| 14 | 1-05.3(2) | Submittal Transmittal and Response Form (ST&R Form) | 1-29 |
| 15 | 1-05.3(3) | Contractor Submittal Delivery and Review Timelines..... | 1-30 |
| 16 | 1-05.3(4) | Submittal Control Document..... | 1-30 |
| 17 | 1-05.3(5) | Early Submittals | 1-30 |
| 18 | 1-05.3(6) | Contractor's Request for Information, Substitutions, and Deviations..... | 1-30 |
| 19 | 1-05.3(7) | Technical Submittal Descriptions | 1-31 |
| 20 | 1-05.3(8) | Submittal Review and Possible Response Actions | 1-31 |
| 21 | 1-05.3(9) | Actions by Contractor Before Submittal Return by Engineer | 1-32 |
| 22 | 1-05.3(10) | Resubmittals..... | 1-32 |
| 23 | 1-05.3(11) | Shop Drawings | 1-32 |
| 24 | 1-05.3(11)A | Shop Drawings Varying from Contract Requirements..... | 1-32 |
| 25 | 1-05.3(12) | Submittal Prepared by Professional Engineer or Other Licensed Professional..... | 1-32 |
| 26 | 1-05.3(13) | As-Built Records Submittals | 1-33 |
| 27 | 1-05.3(14) | Contractor's Failure to Provide or Complete Submittals and Progress of the Work | 1-33 |
| 28 | 1-05.4 | Conformity With and Deviations from Drawings and Stakes..... | 1-33 |
| 29 | 1-05.5 | Construction Stakes..... | 1-33 |
| 30 | 1-05.6 | Inspection of Work and Materials..... | 1-34 |
| 31 | 1-05.7 | Defective Work and Unauthorized Work..... | 1-35 |
| 32 | 1-05.8 | Engineer's Right to Correct and Recover Costs for Defective or Unauthorized Work..... | 1-36 |
| 33 | 1-05.9 | Equipment and Machinery | 1-36 |
| 34 | 1-05.10 | Guarantees and Warranties..... | 1-36 |
| 35 | 1-05.10(1) | General Guaranty and Warranty | 1-36 |
| 36 | 1-05.10(2) | Warranty of Title | 1-36 |
| 37 | 1-05.11 | Final Inspection..... | 1-37 |
| 38 | 1-05.11(1) | Substantial Completion Date | 1-37 |
| 39 | 1-05.11(2) | Final Inspection and Physical Completion Date | 1-37 |
| 40 | 1-05.11(3) | Operational Testing, and Operation and Maintenance (O&M) Manuals | 1-37 |
| 41 | 1-05.12 | Completion and Contract Close Out | 1-38 |
| 42 | 1-05.13 | Superintendents, Labor, and Equipment | 1-38 |
| 43 | 1-05.13(1) | General..... | 1-38 |
| 44 | 1-05.13(2) | Performance..... | 1-39 |
| 45 | 1-05.13(3) | Construction Stormwater Pollution Prevention Coordination | 1-39 |
| 46 | 1-05.13(3)A | Certified Erosion and Sediment Control Lead (CESCL)..... | 1-39 |
| 47 | 1-05.13(3)B | Tree, Vegetation and Soil Protection Lead..... | 1-39 |
| 48 | 1-05.13(3)C | Spill Prevention and Response Lead | 1-40 |
| 49 | 1-05.13(3)D | Temporary Discharge Lead..... | 1-40 |
| 50 | 1-05.13(3)E | Temporary Dewatering Lead..... | 1-40 |
| 51 | 1-05.13(4) | Emergency Contact List | 1-40 |
| 52 | 1-05.14 | Cooperation with Other Contractors | 1-40 |
| 53 | 1-05.15 | Methods of Serving Notices | 1-40 |
| 54 | 1-05.16 | Water and Power | 1-40 |
| 55 | 1-05.17 | Oral Agreements..... | 1-40 |
| 56 | SECTION 1-06 | CONTROL OF MATERIALS | 1-40 |
| 57 | 1-06.1 | Approval of Materials Before Use | 1-40 |
| 58 | 1-06.1(1) | Named Products..... | 1-41 |
| 59 | 1-06.1(2) | Request for Substitution of Material | 1-41 |
| 60 | 1-06.1(3) | Materials Without Substitution | 1-41 |
| 61 | 1-06.2 | Samples and Tests for Acceptance of Materials..... | 1-41 |
| 62 | 1-06.3 | Manufacturer's Certificate of Compliance | 1-41 |
| 63 | 1-06.4 | Handling and Storage of Materials..... | 1-42 |
| 64 | 1-06.5 | Requirements for Testing and Test Results From Private Laboratories and Individuals..... | 1-42 |
| 65 | 1-06.6 | Sieves for Testing..... | 1-43 |

| | | |
|----|--|------|
| 1 | SECTION 1-07 LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC..... | 1-43 |
| 2 | 1-07.1 Laws to Be Observed | 1-43 |
| 3 | 1-07.1(1) General..... | 1-43 |
| 4 | 1-07.1(2) Safety Rules and Standards..... | 1-43 |
| 5 | 1-07.1(3) Non-Skid Surface | 1-43 |
| 6 | 1-07.2 State Taxes | 1-43 |
| 7 | 1-07.2(1) General..... | 1-43 |
| 8 | 1-07.2(2) State Sales Tax Rule 171..... | 1-44 |
| 9 | 1-07.2(3) State Sales Tax Rule 170..... | 1-44 |
| 10 | 1-07.2(4) Services..... | 1-44 |
| 11 | 1-07.3 Management and Disposal of Waste | 1-44 |
| 12 | 1-07.3(1) General..... | 1-44 |
| 13 | 1-07.3(2) Submittals..... | 1-45 |
| 14 | 1-07.3(3) Contractor Follow-Up Documentation Required For the Engineer | 1-45 |
| 15 | 1-07.3(4) Recyclable Materials | 1-45 |
| 16 | 1-07.4 Sanitation..... | 1-45 |
| 17 | 1-07.5 Prevention of Environmental Pollution and Preservation of Natural Resources | 1-46 |
| 18 | 1-07.5(1) General..... | 1-46 |
| 19 | 1-07.5(2) Water Quality..... | 1-46 |
| 20 | 1-07.5(2)A State Department of Fish and Wildlife..... | 1-46 |
| 21 | 1-07.5(2)B Washington State Department of Ecology | 1-46 |
| 22 | 1-07.5(3) Air Quality..... | 1-48 |
| 23 | 1-07.5(4) Noise Pollution | 1-48 |
| 24 | 1-07.5(5) Archaeological and Historic Preservation..... | 1-48 |
| 25 | 1-07.5(6) Threatened and Endangered Species..... | 1-48 |
| 26 | 1-07.5(7) Construction Within and Adjacent To Water..... | 1-48 |
| 27 | 1-07.5(8) Wetlands | 1-49 |
| 28 | 1-07.5(9) Liability and Payment | 1-49 |
| 29 | 1-07.6 Permits | 1-49 |
| 30 | 1-07.6(1) Contractor Obtained Permits | 1-49 |
| 31 | 1-07.6(2) Owner Obtained Permits | 1-49 |
| 32 | 1-07.7 Load Limits | 1-49 |
| 33 | 1-07.7(1) General..... | 1-49 |
| 34 | 1-07.7(2) Load Limit Restrictions | 1-49 |
| 35 | 1-07.8 High-Visibility Apparel..... | 1-50 |
| 36 | 1-07.8(1) Traffic Control Personnel..... | 1-50 |
| 37 | 1-07.8(2) Non-Traffic Control Personnel..... | 1-50 |
| 38 | 1-07.9 Wages | 1-50 |
| 39 | 1-07.9(1) Prevailing Wage Rates..... | 1-50 |
| 40 | 1-07.9(1)A General | 1-50 |
| 41 | 1-07.9(1)B Applicability of Federal Prevailing Wage Rates..... | 1-51 |
| 42 | 1-07.9(1)C Wage Rates | 1-51 |
| 43 | 1-07.9(1)D Overtime | 1-51 |
| 44 | 1-07.9(1)D1 Written Overtime Agreement..... | 1-51 |
| 45 | 1-07.9(2) Payroll Reports..... | 1-52 |
| 46 | 1-07.9(3) Enforcement..... | 1-52 |
| 47 | 1-07.9(4) Posting Notices | 1-52 |
| 48 | 1-07.9(5) Prevailing Wages for Apprentices | 1-52 |
| 49 | 1-07.9(6) Prevailing Wage Disputes | 1-53 |
| 50 | 1-07.9(7) Required Documents..... | 1-53 |
| 51 | 1-07.9(8) Audits | 1-53 |
| 52 | 1-07.10 Reserved | 1-53 |
| 53 | 1-07.11 Social Equity in Contracting..... | 1-53 |
| 54 | 1-07.11(1) Equal Benefits | 1-54 |
| 55 | 1-07.11(2) Labor standards | 1-54 |
| 56 | 1-07.11(3) Women and Minority Businesses and Non-Discrimination Requirements..... | 1-54 |
| 57 | 1-07.11(3)A Affirmative Efforts..... | 1-55 |
| 58 | 1-07.11(4) Employment Non-Discrimination Requirements | 1-55 |
| 59 | 1-07.11(5) Records..... | 1-56 |
| 60 | 1-07.11(6) Apprentice Utilization..... | 1-56 |
| 61 | 1-07.11(6)A General | 1-56 |
| 62 | 1-07.11(6)B Apprentice Utilization Requirements and Goals..... | 1-56 |
| 63 | 1-07.11(6)C Apprentice Utilization Plan | 1-56 |
| 64 | 1-07.11(6)D Changes to the Apprentice Utilization Requirement..... | 1-57 |
| 65 | 1-07.11(6)E Apprentice Utilization Reporting..... | 1-57 |
| 66 | 1-07.11(6)F Monitoring | 1-57 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|--|-------------|
| 1 | 1-07.26 | No Waiver of Owner’s Legal Rights; Assignment of Claims for Damages for Anti Trust Law Violations... | 1-70 |
| 2 | 1-07.27 | Reserved | 1-70 |
| 3 | 1-07.28 | Notifications Relative to Contractor’s Activities | 1-70 |
| 4 | 1-07.29 | Discoveries of Contaminated Material(s), Dangerous Waste(s) and TSCA Waste(s)..... | 1-75 |
| 5 | 1-07.29(1) | General..... | 1-75 |
| 6 | 1-07.29(2) | Present Site Characterization..... | 1-75 |
| 7 | 1-07.29(3) | Discoveries..... | 1-75 |
| 8 | 1-07.29(4) | Testing..... | 1-76 |
| 9 | 1-07.29(5) | Payment | 1-76 |
| 10 | SECTION 1-08 PROSECUTION AND PROGRESS..... | | 1-76 |
| 11 | 1-08.1 | Preliminary and On-Going Matters | 1-76 |
| 12 | 1-08.1(1) | Copies of Contract..... | 1-76 |
| 13 | 1-08.1(2) | Contract Conferences and Meetings | 1-76 |
| 14 | 1-08.1(2)A | Preconstruction Conference..... | 1-76 |
| 15 | 1-08.1(2)B | Preoperational Conferences | 1-76 |
| 16 | 1-08.1(2)C | Weekly Progress Meetings | 1-77 |
| 17 | 1-08.1(3) | Subcontracting | 1-77 |
| 18 | 1-08.1(4) | Hours of Work | 1-78 |
| 19 | 1-08.1(5) | Reimbursement for Overtime Work of Employees of Owner | 1-78 |
| 20 | 1-08.2 | Assignment..... | 1-78 |
| 21 | 1-08.3 | Critical Path Schedule and Schedule Constraints..... | 1-78 |
| 22 | 1-08.3(1) | Critical Path Schedule | 1-78 |
| 23 | 1-08.3(1)A | General Requirements | 1-78 |
| 24 | 1-08.3(1)B | Schedule Types | 1-79 |
| 25 | 1-08.3(1)B1 | Preliminary CPM Schedule | 1-79 |
| 26 | 1-08.3(1)B2 | Baseline CPM Schedule | 1-79 |
| 27 | 1-08.3(1)B3 | CPM Schedule Update..... | 1-80 |
| 28 | 1-08.3(1)B4 | Look-Ahead Schedule..... | 1-80 |
| 29 | 1-08.3(1)C | Submittals | 1-80 |
| 30 | 1-08.3(1)D | Early Completion..... | 1-81 |
| 31 | 1-08.3(1)E | Payment..... | 1-81 |
| 32 | 1-08.3(2) | Schedule Constraints | 1-81 |
| 33 | 1-08.4 | Notice to Proceed and Prosecution of the Work | 1-81 |
| 34 | 1-08.5 | Time for Completion | 1-81 |
| 35 | 1-08.6 | Suspension of Work..... | 1-82 |
| 36 | 1-08.7 | Maintenance During Suspension..... | 1-82 |
| 37 | 1-08.8 | Time Extensions and Delays Entitlement and Compensation | 1-83 |
| 38 | 1-08.8(1) | General..... | 1-83 |
| 39 | 1-08.8(2) | Non-Excusable Delays | 1-83 |
| 40 | 1-08.8(3) | Excusable Delays | 1-84 |
| 41 | 1-08.8(3)A | General | 1-84 |
| 42 | 1-08.8(3)B | Compensable Delays | 1-84 |
| 43 | 1-08.8(3)C | Non-Compensable Delays | 1-85 |
| 44 | 1-08.8(4) | Concurrent Delays..... | 1-85 |
| 45 | 1-08.8(5) | Cost for SPU Crews Due To Contractor Delays | 1-85 |
| 46 | 1-08.9 | Liquidated Damages..... | 1-85 |
| 47 | 1-08.10 | Termination of Contract | 1-85 |
| 48 | 1-08.10(1) | Termination for Default | 1-85 |
| 49 | 1-08.10(2) | Termination for Public Convenience..... | 1-87 |
| 50 | 1-08.10(3) | Payment for Termination for Public Convenience | 1-87 |
| 51 | 1-08.10(4) | Termination Claim by Contractor..... | 1-87 |
| 52 | 1-08.10(5) | Termination for Delays Due To Litigation | 1-87 |
| 53 | 1-08.10(6) | Responsibility of the Contractor and Surety | 1-87 |
| 54 | 1-08.10(7) | Termination Before Completion..... | 1-87 |
| 55 | 1-08.10(8) | Debarment..... | 1-87 |
| 56 | SECTION 1-09 MEASUREMENT AND PAYMENT | | 1-87 |
| 57 | 1-09.1 | Measurement of Quantities..... | 1-87 |
| 58 | 1-09.1(1) | Unit weight - volume conversion factors for measurements | 1-88 |
| 59 | 1-09.2 | Weighing Equipment..... | 1-89 |
| 60 | 1-09.2(1) | General Requirements for Weighing Equipment | 1-89 |
| 61 | 1-09.2(2) | Specific Requirements for Batching Scales..... | 1-90 |
| 62 | 1-09.2(3) | Specific Requirements for Platform Scales | 1-90 |
| 63 | 1-09.2(4) | Specific Requirements for Belt Conveyor Scales | 1-91 |
| 64 | 1-09.2(5) | Underweighing / Overweighing Scales..... | 1-91 |
| 65 | 1-09.2(6) | Payment | 1-91 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|---|-------|
| 1 | 1-09.3 | Scope of Payment | 1-91 |
| 2 | 1-09.3(1) | General..... | 1-91 |
| 3 | 1-09.3(2) | Lump Sum Breakdown | 1-92 |
| 4 | 1-09.4 | Equitable Adjustment for Changes | 1-92 |
| 5 | 1-09.4(1) | Changes in Contract Work | 1-92 |
| 6 | 1-09.4(2) | Changes in Law or Taxes..... | 1-92 |
| 7 | 1-09.5 | Deleted or Terminated Work..... | 1-93 |
| 8 | 1-09.6 | Force Account..... | 1-93 |
| 9 | 1-09.6(1) | General..... | 1-93 |
| 10 | 1-09.6(2) | Labor | 1-94 |
| 11 | 1-09.6(3) | Materials..... | 1-94 |
| 12 | 1-09.6(4) | Equipment | 1-95 |
| 13 | 1-09.6(5) | Services..... | 1-95 |
| 14 | 1-09.6(6) | Force Account Mobilization | 1-96 |
| 15 | 1-09.6(7) | Contractor Markup on Subcontractors and Services Acting in the Manner of a Subcontractor | 1-96 |
| 16 | 1-09.7 | Payment for Mobilization | 1-97 |
| 17 | 1-09.8 | Payment for Material on Hand | 1-97 |
| 18 | 1-09.9 | Payments..... | 1-97 |
| 19 | 1-09.9(1) | Progress Estimates | 1-97 |
| 20 | 1-09.9(1)A | Final Progress Payment..... | 1-98 |
| 21 | 1-09.9(2) | Retainage Options..... | 1-98 |
| 22 | 1-09.9(3) | Owner's Right to Withhold and Disburse Certain Amounts | 1-99 |
| 23 | 1-09.9(4) | Contract Completion and Retainage Release | 1-100 |
| 24 | 1-09.9(4)A | Request for Contract Completion Date | 1-100 |
| 25 | 1-09.9(4)B | Completion Date | 1-100 |
| 26 | 1-09.9(4)C | Release of Retainage..... | 1-101 |
| 27 | 1-09.10 | Audits..... | 1-101 |
| 28 | 1-09.10(1) | General..... | 1-101 |
| 29 | 1-09.10(2) | Claims | 1-101 |
| 30 | 1-09.10(3) | Required Documents for Audits..... | 1-101 |
| 31 | 1-09.11 | Prompt Payment to Subcontractors and Persons Supplying Labor, Materials and Supplies | 1-102 |
| 32 | 1-09.11(1) | General..... | 1-102 |
| 33 | 1-09.11(2) | Progress Payments and Prompt Payment to Subcontractors..... | 1-102 |
| 34 | 1-09.11(3) | Unsatisfactory Performance by Subcontractor | 1-102 |
| 35 | 1-09.11(4) | Payment of Retainage to Subcontractors | 1-102 |
| 36 | 1-09.11(4)A | Requirements..... | 1-102 |
| 37 | 1-09.11(4)B | Conditions | 1-103 |
| 38 | 1-09.11(5) | Incorporation of Provisions | 1-103 |
| 39 | 1-09.11(6) | Other Subcontract Payment Provisions..... | 1-103 |
| 40 | 1-09.11(7) | Subcontractor Claims Against Bonds | 1-103 |
| 41 | SECTION 1-10 | TEMPORARY TRAFFIC CONTROL | 1-103 |
| 42 | 1-10.1 | General..... | 1-103 |
| 43 | 1-10.1(1) | Description | 1-104 |
| 44 | 1-10.1(2) | Materials..... | 1-104 |
| 45 | 1-10.2 | Traffic Control Management | 1-105 |
| 46 | 1-10.2(1) | General..... | 1-105 |
| 47 | 1-10.2(2) | Traffic Control Manager (TCM)..... | 1-106 |
| 48 | 1-10.2(3) | Traffic Control Supervisor (TCS) | 1-106 |
| 49 | 1-10.2(4) | Contractor's Refusal or Failure to Act..... | 1-107 |
| 50 | 1-10.2(5) | Traffic Control Plans..... | 1-107 |
| 51 | 1-10.2(5)A | Content and Submittal Requirements | 1-107 |
| 52 | 1-10.2(5)B | Conformance to Established Standards..... | 1-108 |
| 53 | 1-10.2(5)C | General Traffic Control Restrictions | 1-109 |
| 54 | 1-10.2(5)D | Reserved..... | 1-109 |
| 55 | 1-10.3 | Traffic Control Labor, Procedures and Devices | 1-109 |
| 56 | 1-10.3(1) | Traffic Control Labor..... | 1-109 |
| 57 | 1-10.3(1)A | Flaggers and Spotters..... | 1-110 |
| 58 | 1-10.3(1)B | Other Traffic Control Labor | 1-110 |
| 59 | 1-10.3(1)C | Traffic Control Peace Officers | 1-110 |
| 60 | 1-10.3(2) | Traffic Control Procedures..... | 1-110 |
| 61 | 1-10.3(2)A | One-Way Traffic Control | 1-110 |
| 62 | 1-10.3(2)B | Lane Closure Setup/Takedown..... | 1-110 |
| 63 | 1-10.3(2)C | Mobile Operations | 1-111 |
| 64 | 1-10.3(2)D | Patrol & Maintain Traffic Control Measures..... | 1-111 |
| 65 | 1-10.3(3) | Traffic Control Devices | 1-111 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--|--|------------|
| 1 | 1-10.3(3)A | Construction Signs | 1-111 |
| 2 | 1-10.3(3)B | Sequential Arrow Signs | 1-112 |
| 3 | 1-10.3(3)C | Portable Changeable Message Sign | 1-112 |
| 4 | 1-10.3(3)D | Barricades | 1-112 |
| 5 | 1-10.3(3)E | Traffic Safety Drums | 1-112 |
| 6 | 1-10.3(3)F | Barrier Drums | 1-112 |
| 7 | 1-10.3(3)G | Traffic Cones | 1-112 |
| 8 | 1-10.3(3)H | Tubular Markers | 1-113 |
| 9 | 1-10.3(3)I | Warning Lights and Flashers | 1-113 |
| 10 | 1-10.3(3)J | Transportable Attenuator | 1-113 |
| 11 | 1-10.3(3)K | Portable Temporary Traffic Control Signal | 1-113 |
| 12 | 1-10.3(3)L | Paint Lines and Legends | 1-114 |
| 13 | 1-10.3(3)M | Lighting Devices | 1-114 |
| 14 | 1-10.3(3)N | Speed and Parking Control | 1-114 |
| 15 | 1-10.4 | Measurement | 1-114 |
| 16 | 1-10.5 | Payment | 1-114 |
| 17 | DIVISION 2 EARTHWORK | | 2-1 |
| 18 | SECTION 2-01 CLEARING, GRUBBING, AND ROADSIDE CLEANUP | | 2-1 |
| 19 | 2-01.1 | Description | 2-1 |
| 20 | 2-01.1(1) | General | 2-1 |
| 21 | 2-01.1(2) | Classification | 2-1 |
| 22 | 2-01.2 | Clearing and Grubbing Disposal | 2-1 |
| 23 | 2-01.3 | Construction Requirements | 2-1 |
| 24 | 2-01.3(1) | Clearing | 2-1 |
| 25 | 2-01.3(2) | Grubbing | 2-1 |
| 26 | 2-01.3(3) | Limits of Clearing and Grubbing | 2-1 |
| 27 | 2-01.3(4) | Roadside Cleanup | 2-1 |
| 28 | 2-01.3(5) | Protection of Existing Improvements | 2-1 |
| 29 | 2-01.4 | Measurement | 2-2 |
| 30 | 2-01.5 | Payment | 2-2 |
| 31 | SECTION 2-02 REMOVE, ABANDON, OR RELOCATE STRUCTURES AND OBSTRUCTIONS | | 2-2 |
| 32 | 2-02.1 | Description | 2-2 |
| 33 | 2-02.2 | Material | 2-2 |
| 34 | 2-02.3 | Construction Requirements | 2-2 |
| 35 | 2-02.3(1) | General Requirements | 2-2 |
| 36 | 2-02.3(2) | Removal of Bridges, Box Culverts and Other Drainage Structures | 2-3 |
| 37 | 2-02.3(3) | Removal of Existing Street Improvements | 2-3 |
| 38 | 2-02.3(3)A | Remove Non Rigid Pavement and Untreated Roadway Surfaces | 2-3 |
| 39 | 2-02.3(3)B | Remove Asphalt Overlay | 2-3 |
| 40 | 2-02.3(3)C | Remove Rigid Pavement | 2-3 |
| 41 | 2-02.3(3)D | Remove Catch Basin, Sandbox, Valve Chamber, Maintenance Hole, or Inlet | 2-4 |
| 42 | 2-02.3(3)E | Curb Removal and Classification, and Remove Curb And Gutter | 2-4 |
| 43 | 2-02.3(3)F | Remove Sidewalk | 2-4 |
| 44 | 2-02.3(3)G | Remove Electrical and Traffic Control Devices | 2-4 |
| 45 | 2-02.3(3)H | Remove Guardrail | 2-5 |
| 46 | 2-02.3(3)I | Remove Tree | 2-5 |
| 47 | 2-02.3(3)J | Remove Pavement Marking | 2-5 |
| 48 | 2-02.3(3)K | Remove Sign and Post | 2-5 |
| 49 | 2-02.3(3)L | Removal of Existing Streetlight Equipment | 2-5 |
| 50 | 2-02.3(4) | Abandon Catch Basin, Valve Chamber, Maintenance Hole, or Inlet | 2-5 |
| 51 | 2-02.3(5) | Abandon and Fill, and Plug Pipe | 2-6 |
| 52 | 2-02.3(5)A | Abandon and Fill Pipe | 2-6 |
| 53 | 2-02.3(5)B | Plug Pipe | 2-6 |
| 54 | 2-02.3(6) | Sawing and Line Drilling | 2-6 |
| 55 | 2-02.3(6)A | Removal | 2-6 |
| 56 | 2-02.3(6)B | Pavement Joints | 2-6 |
| 57 | 2-02.3(7) | Salvage | 2-6 |
| 58 | 2-02.3(7)A | General | 2-6 |
| 59 | 2-02.3(7)B | Water Mains and Appurtenances | 2-6 |
| 60 | 2-02.3(7)C | Illumination, Signals, Electrical, and Signs | 2-6 |
| 61 | 2-02.3(7)D | Reinstalling Salvaged Electrical Material | 2-7 |
| 62 | 2-02.3(7)E | Gutter Brick, Pavement Brick and Cobblestone, and Granite Curb | 2-7 |
| 63 | 2-02.3(7)F | Drainage and Sewer Materials | 2-7 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|---|------|
| 1 | 2-02.3(8) | Street Saddles and Steel Plates | 2-7 |
| 2 | 2-02.3(8)A | General | 2-7 |
| 3 | 2-02.3(8)B | Street Saddles..... | 2-7 |
| 4 | 2-02.3(8)C | Steel Plates | 2-7 |
| 5 | 2-02.4 | Measurement..... | 2-8 |
| 6 | 2-02.5 | Payment | 2-9 |
| 7 | SECTION 2-03 | STRUCTURAL DEMOLITION | 2-10 |
| 8 | 2-03.1 | Description..... | 2-10 |
| 9 | 2-03.2 | Reserved | 2-11 |
| 10 | 2-03.3 | Construction Requirements | 2-11 |
| 11 | 2-03.4 | Measurement..... | 2-11 |
| 12 | 2-03.5 | Payment | 2-11 |
| 13 | SECTION 2-04 | EXCAVATIONS | 2-12 |
| 14 | 2-04.1 | Description..... | 2-12 |
| 15 | 2-04.1(1) | General..... | 2-12 |
| 16 | 2-04.1(2) | Classification | 2-12 |
| 17 | 2-04.1(3) | Protection of Existing Improvements | 2-12 |
| 18 | 2-04.2 | Reserved | 2-12 |
| 19 | 2-04.3 | Construction Requirements | 2-12 |
| 20 | 2-04.3(1) | General Requirements | 2-12 |
| 21 | 2-04.3(1)A | Stockpiling and Reuse of Excavated Material | 2-12 |
| 22 | 2-04.3(1)B | Disposal of Surplus and Unsuitable Material | 2-13 |
| 23 | 2-04.3(1)C | Wasting Material | 2-13 |
| 24 | 2-04.3(1)D | Deposit of Rock for Owner's Use | 2-13 |
| 25 | 2-04.3(1)E | Overbreak | 2-13 |
| 26 | 2-04.3(1)F | Slides | 2-13 |
| 27 | 2-04.3(1)G | Excavations Next to Streams | 2-13 |
| 28 | 2-04.3(1)H | Sluicing | 2-13 |
| 29 | 2-04.3(1)I | Unsuitable Foundation Excavations | 2-13 |
| 30 | 2-04.3(1)J | Objects Encountered..... | 2-14 |
| 31 | 2-04.3(2) | Permanent Slope Treatment | 2-14 |
| 32 | 2-04.3(3) | Hillside Terraces..... | 2-14 |
| 33 | 2-04.3(4) | Solid Rock Excavation..... | 2-14 |
| 34 | 2-04.3(4)A | Scaling and Dressing | 2-14 |
| 35 | 2-04.3(4)B | Stepped Slope Construction | 2-14 |
| 36 | 2-04.3(5) | Structure Excavations | 2-14 |
| 37 | 2-04.3(6) | Utility Excavations | 2-15 |
| 38 | 2-04.3(7) | Drain Pipe Excavations | 2-15 |
| 39 | 2-04.3(8) | Snow Removal | 2-15 |
| 40 | 2-04.4 | Measurement..... | 2-15 |
| 41 | 2-04.5 | Payment | 2-15 |
| 42 | SECTION 2-05 | DITCH AND CHANNEL CONSTRUCTION | 2-17 |
| 43 | 2-05.1 | Description..... | 2-17 |
| 44 | 2-05.1(1) | Classifications | 2-17 |
| 45 | 2-05.2 | Materials | 2-17 |
| 46 | 2-05.3 | Construction Requirements | 2-17 |
| 47 | 2-05.3(1) | General..... | 2-17 |
| 48 | 2-05.3(2) | In-Stream Log..... | 2-17 |
| 49 | 2-05.3(3) | Streambed Aggregate | 2-17 |
| 50 | 2-05.3(4) | Geotextile – Ditch Lining and Scour Control..... | 2-17 |
| 51 | 2-05.3(5) | Scour Control Matting..... | 2-17 |
| 52 | 2-05.3(6) | In-Stream Weir | 2-17 |
| 53 | 2-05.3(7) | In-Stream Bypass..... | 2-18 |
| 54 | 2-05.3(8) | Fish Bypass..... | 2-18 |
| 55 | 2-05.3(9) | Fish Screen | 2-18 |
| 56 | 2-05.3(10) | Maintenance Required During Construction..... | 2-18 |
| 57 | 2-05.3(11) | Scour Protection..... | 2-18 |
| 58 | 2-05.4 | Measurement..... | 2-18 |
| 59 | 2-05.5 | Payment | 2-19 |
| 60 | SECTION 2-06 | HAUL | 2-19 |
| 61 | 2-06.1 | Description..... | 2-19 |
| 62 | 2-06.2 | Reserved | 2-19 |
| 63 | 2-06.3 | Construction Requirements | 2-19 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--|--|------|
| 1 | 2-06.4 | Measurement..... | 2-19 |
| 2 | 2-06.5 | Payment | 2-19 |
| 3 | SECTION 2-07 PROTECTIVE SYSTEMS..... | | 2-19 |
| 4 | 2-07.1 | Description..... | 2-19 |
| 5 | 2-07.2 | Reserved | 2-20 |
| 6 | 2-07.3 | Construction Requirements | 2-20 |
| 7 | 2-07.3(1) | General..... | 2-20 |
| 8 | 2-07.3(2) | Safety Systems | 2-20 |
| 9 | 2-07.3(3) | Support and Safety Systems | 2-20 |
| 10 | 2-07.4 | Measurement..... | 2-20 |
| 11 | 2-07.5 | Payment | 2-21 |
| 12 | SECTION 2-08 DEWATERING | | 2-21 |
| 13 | 2-08.1 | Description..... | 2-21 |
| 14 | 2-08.2 | Reserved | 2-21 |
| 15 | 2-08.3 | Construction Requirements | 2-21 |
| 16 | 2-08.3(1) | General Requirements for Dewatering | 2-21 |
| 17 | 2-08.3(2) | Cofferdams..... | 2-22 |
| 18 | 2-08.3(3) | Placing Concrete in Foundation Seals | 2-22 |
| 19 | 2-08.3(4) | Dewatering Concrete Seals and Foundations | 2-23 |
| 20 | 2-08.4 | Measurement..... | 2-23 |
| 21 | 2-08.5 | Payment | 2-23 |
| 22 | SECTION 2-09 SUBGRADE PREPARATION AND PROTECTION | | 2-23 |
| 23 | 2-09.1 | Description..... | 2-23 |
| 24 | 2-09.2 | Reserved | 2-23 |
| 25 | 2-09.3 | Construction Requirements | 2-23 |
| 26 | 2-09.3(1) | General..... | 2-23 |
| 27 | 2-09.3(2) | Subgrade for Roadway Surfacing..... | 2-24 |
| 28 | 2-09.3(3) | Subgrade for Pavement..... | 2-24 |
| 29 | 2-09.3(4) | Subgrade in Rock..... | 2-24 |
| 30 | 2-09.3(5) | Subgrade for Structure | 2-25 |
| 31 | 2-09.4 | Measurement..... | 2-25 |
| 32 | 2-09.5 | Payment | 2-25 |
| 33 | SECTION 2-10 BACKFILLING | | 2-25 |
| 34 | 2-10.1 | Description..... | 2-25 |
| 35 | 2-10.2 | Materials..... | 2-25 |
| 36 | 2-10.2(1) | Selected Material..... | 2-25 |
| 37 | 2-10.2(2) | Borrow | 2-25 |
| 38 | 2-10.2(2)A | Borrow Sites..... | 2-25 |
| 39 | 2-10.2(3) | Controlled Density Fill | 2-26 |
| 40 | 2-10.2(3)A | Controlled Density Fill (Cdf)..... | 2-26 |
| 41 | 2-10.2(3)A1 | Controlled Density Fill For Pipe Bedding..... | 2-26 |
| 42 | 2-10.2(3)A2 | Controlled Density Fill For Trench Backfill | 2-26 |
| 43 | 2-10.2(3)A3 | Controlled Density Fill For Structure Backfill | 2-27 |
| 44 | 2-10.2(3)A4 | Controlled Density Fill Manufacturer's Certificate Of Compliance | 2-27 |
| 45 | 2-10.3 | Construction Requirements | 2-27 |
| 46 | 2-10.3(1) | General Requirements | 2-27 |
| 47 | 2-10.3(2) | Filling Abandoned Structures | 2-27 |
| 48 | 2-10.3(3) | Utility Backfill | 2-27 |
| 49 | 2-10.3(4) | Structure Backfill | 2-28 |
| 50 | 2-10.3(5) | Backfilling at Bridge and Trestle Ends..... | 2-28 |
| 51 | 2-10.3(6) | End Slopes..... | 2-28 |
| 52 | 2-10.3(7) | Controlled Density Fill | 2-28 |
| 53 | 2-10.4 | Measurement..... | 2-28 |
| 54 | 2-10.5 | Payment | 2-28 |
| 55 | SECTION 2-11 COMPACTION | | 2-29 |
| 56 | 2-11.1 | Description..... | 2-29 |
| 57 | 2-11.2 | Reserved | 2-29 |
| 58 | 2-11.3 | Construction Requirements | 2-29 |
| 59 | 2-11.3(1) | General Requirements | 2-29 |
| 60 | 2-11.3(2) | Compaction Control Tests..... | 2-30 |
| 61 | 2-11.4 | Measurement..... | 2-30 |
| 62 | 2-11.5 | Payment | 2-30 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | |
|----|--|------|
| 1 | SECTION 2-12 WATERING | 2-30 |
| 2 | 2-12.1 Description | 2-30 |
| 3 | 2-12.2 Reserved | 2-30 |
| 4 | 2-12.3 Construction Requirements | 2-30 |
| 5 | 2-12.3(1) General..... | 2-30 |
| 6 | 2-12.3(2) Source of Water Supply, Requesting Hydrant Permit, And Regulations Pertaining to Hydrant Use.... | 2-30 |
| 7 | | 2-30 |
| 8 | 2-12.4 Measurement..... | 2-31 |
| 9 | 2-12.5 Payment | 2-31 |
| 10 | SECTION 2-13 ROCK FACING | 2-31 |
| 11 | 2-13.1 Description..... | 2-31 |
| 12 | 2-13.2 Materials | 2-31 |
| 13 | 2-13.3 Construction Requirements | 2-31 |
| 14 | 2-13.3(1) Rock Facing | 2-31 |
| 15 | 2-13.3(1)A General | 2-31 |
| 16 | 2-13.3(1)B Rock Facing Keyway..... | 2-31 |
| 17 | 2-13.3(1)C Rock Selection | 2-31 |
| 18 | 2-13.3(1)D Rock Placement..... | 2-32 |
| 19 | 2-13.3(1)E Filter Material | 2-32 |
| 20 | 2-13.3(1)F Geotextile | 2-32 |
| 21 | 2-13.3(1)G Slope above Rock Facing | 2-32 |
| 22 | 2-13.3(2) Rebuild Rock Facing | 2-32 |
| 23 | 2-13.3(3) Relocate Rock Facing | 2-32 |
| 24 | 2-13.3(4) Contractor REquired EXPERIENCE | 2-33 |
| 25 | 2-13.3(5) Rock Facing for Hydrants..... | 2-33 |
| 26 | 2-13.4 Measurement..... | 2-33 |
| 27 | 2-13.5 Payment | 2-33 |
| 28 | SECTION 2-14 TRIMMING AND CLEANUP | 2-33 |
| 29 | 2-14.1 Description..... | 2-33 |
| 30 | 2-14.2 Reserved | 2-33 |
| 31 | 2-14.3 Construction Requirements | 2-33 |
| 32 | 2-14.4 Measurement..... | 2-34 |
| 33 | 2-14.5 Payment | 2-34 |
| 34 | SECTION 2-15 CONSTRUCTION GEOTEXTILE | 2-34 |
| 35 | 2-15.1 Description..... | 2-34 |
| 36 | 2-15.2 Materials | 2-34 |
| 37 | 2-15.3 Construction Requirements | 2-34 |
| 38 | 2-15.3(1) General..... | 2-34 |
| 39 | 2-15.3(2) Underground Drainage | 2-35 |
| 40 | 2-15.3(3) Separation | 2-35 |
| 41 | 2-15.3(4) Soil Stabilization | 2-35 |
| 42 | 2-15.3(5) Permanent Erosion Control and Ditch Lining..... | 2-35 |
| 43 | 2-15.3(6) Temporary Silt Fences | 2-35 |
| 44 | 2-15.4 Measurement..... | 2-35 |
| 45 | 2-15.5 Payment | 2-35 |
| 46 | SECTION 2-16 DIRECTIONAL DRILLING | 2-36 |
| 47 | 2-16.1 General..... | 2-36 |
| 48 | 2-16.2 Materials | 2-36 |
| 49 | 2-16.3 Construction Requirements | 2-36 |
| 50 | 2-16.3(1) Experience | 2-36 |
| 51 | 2-16.3(2) Drilling Equipment | 2-36 |
| 52 | 2-16.3(3) Proposed Bore Path - Preparatory Requirements | 2-37 |
| 53 | 2-16.3(3)A General | 2-37 |
| 54 | 2-16.3(3)B Existing Underground Facilities..... | 2-37 |
| 55 | 2-16.3(3)C One Number Locator Service – Additional Requirements..... | 2-37 |
| 56 | 2-16.3(3)D Exposing Existing Underground Facilities | 2-37 |
| 57 | 2-16.3(3)E Underground Facilities – No Depth Information or Unlocatable | 2-37 |
| 58 | 2-16.3(3)F Service Lateral Considerations | 2-38 |
| 59 | 2-16.3(3)G Select Underground Facilities – Special Requirements | 2-38 |
| 60 | 2-16.3(3)H Verification of Facilities - Existing and as Described in the Contract..... | 2-38 |
| 61 | 2-16.3(4) Progress Schedule Consideration | 2-38 |
| 62 | 2-16.3(5) Active and Passive Interferences and Drilling Equipment | 2-39 |
| 63 | 2-16.3(6) Submittal | 2-39 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|-------------------|---|------------|
| 1 | 2-16.3(6)A | General | 2-39 |
| 2 | 2-16.3(6)B | Submittal – Experience | 2-39 |
| 3 | 2-16.3(6)C | Submittal - Preparations Required Before Starting Drilling | 2-40 |
| 4 | 2-16.3(7) | Submittal – Required After Completion of Drilling | 2-40 |
| 5 | 2-16.3(8) | Pre-Drill Meeting and Other Meetings | 2-40 |
| 6 | 2-16.3(9) | Monitoring the Bore | 2-40 |
| 7 | 2-16.3(10) | Locate Tracking System | 2-41 |
| 8 | 2-16.3(11) | Launch and Receiving Locations and Pits..... | 2-41 |
| 9 | 2-16.3(12) | Match Site Conditions | 2-42 |
| 10 | 2-16.3(13) | Bend Radius..... | 2-42 |
| 11 | 2-16.3(14) | Prereaming and Back Reaming..... | 2-42 |
| 12 | 2-16.3(15) | Drilling Mud | 2-42 |
| 13 | 2-16.3(16) | Environmental Control..... | 2-42 |
| 14 | 2-16.3(17) | Slope Drilling and Submittal Requirements | 2-42 |
| 15 | 2-16.3(18) | Personal Protective Equipment (PPE)..... | 2-43 |
| 16 | 2-16.3(19) | Safe Working Zone..... | 2-43 |
| 17 | 2-16.3(20) | Daily Log and As-Built Drawing | 2-43 |
| 18 | 2-16.3(20)A | General | 2-43 |
| 19 | 2-16.3(20)B | Daily Log | 2-43 |
| 20 | 2-16.3(20)C | As-Built Drawings..... | 2-44 |
| 21 | 2-16.3(21) | Pullback and Re-Drill..... | 2-44 |
| 22 | 2-16.3(22) | Testing..... | 2-44 |
| 23 | 2-16.4 | Measurement..... | 2-44 |
| 24 | 2-16.5 | Payment | 2-44 |
| 25 | DIVISION 3 | PRODUCTION FROM QUARRY AND PIT SITES AND STOCKPILING | 3-1 |
| 26 | SECTION 3-01 | PRODUCTION FROM QUARRY AND PIT SITES | 3-1 |
| 27 | 3-01.1 | Description..... | 3-1 |
| 28 | 3-01.2 | Materials | 3-1 |
| 29 | 3-01.2(1) | General Source | 3-1 |
| 30 | 3-01.2(1)A | Approval of Source..... | 3-1 |
| 31 | 3-01.2(1)B | Stripping Quarries and Pits | 3-1 |
| 32 | 3-01.2(1)C | Preparation of Site | 3-1 |
| 33 | 3-01.2(1)D | Production Requirements..... | 3-1 |
| 34 | 3-01.2(1)E | Final Cleanup..... | 3-1 |
| 35 | 3-01.2(2) | Contractor Furnished Material Source..... | 3-1 |
| 36 | 3-01.3 | Reserved | 3-2 |
| 37 | 3-01.4 | Measurement..... | 3-2 |
| 38 | 3-01.5 | Payment | 3-2 |
| 39 | SECTION 3-02 | RESERVED | 3-3 |
| 40 | SECTION 3-03 | SITE RECLAMATION | 3-3 |
| 41 | 3-03.1 | Description..... | 3-3 |
| 42 | 3-03.2 | General Requirements..... | 3-3 |
| 43 | 3-03.2(1) | Sites | 3-3 |
| 44 | 3-03.2(1)A | Contractor Provided Sites | 3-3 |
| 45 | 3-03.2(1)B | Out of State Sites | 3-3 |
| 46 | 3-03.2(2) | Reclamation Plans | 3-3 |
| 47 | 3-03.2(2)A | Plans for Contractor Provided Sites | 3-3 |
| 48 | 3-03.3 | Construction Requirements | 3-4 |
| 49 | 3-03.3(1) | Erosion Control..... | 3-4 |
| 50 | 3-03.3(2) | Deviations from Approved Reclamation Plans | 3-4 |
| 51 | 3-03.4 | Reserved | 3-4 |
| 52 | 3-03.5 | Payment | 3-4 |
| 53 | DIVISION 4 | BASES | 4-1 |
| 54 | SECTION 4-01 | MINERAL AGGREGATES..... | 4-1 |
| 55 | 4-01.1 | Description..... | 4-1 |
| 56 | 4-01.2 | Materials | 4-1 |
| 57 | 4-01.3 | Construction Requirements | 4-1 |
| 58 | 4-01.4 | Measurement..... | 4-1 |
| 59 | 4-01.5 | Payment | 4-1 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | |
|----|---|-----|
| 1 | SECTION 4-02 MINERAL AGGREGATES WITH RECYCLED MATERIAL | 4-1 |
| 2 | 4-02.1 Description | 4-1 |
| 3 | 4-02.2 Materials | 4-1 |
| 4 | 4-02.2(1) Materials – With Recycled Aggregates | 4-1 |
| 5 | 4-02.2(2) Material – Recycled Aggregates Substitution Request | 4-2 |
| 6 | 4-02.2(2)A Submittal Requirements | 4-2 |
| 7 | 4-02.3 Construction Requirements | 4-2 |
| 8 | 4-02.4 Measurement | 4-2 |
| 9 | 4-02.5 Payment | 4-2 |
| 10 | SECTION 4-03 RESERVED | 4-2 |
| 11 | SECTION 4-04 BALLASTING AND CRUSHED SURFACING | 4-2 |
| 12 | 4-04.1 Description | 4-2 |
| 13 | 4-04.2 Materials | 4-2 |
| 14 | 4-04.3 Construction Requirements | 4-3 |
| 15 | 4-04.3(1) Equipment | 4-3 |
| 16 | 4-04.3(2) Subgrade | 4-3 |
| 17 | 4-04.3(3) Mixing | 4-3 |
| 18 | 4-04.3(4) Placing and Spreading | 4-3 |
| 19 | 4-04.3(5) Shaping and Compaction | 4-4 |
| 20 | 4-04.3(6) Miscellaneous Requirements | 4-4 |
| 21 | 4-04.3(7) Weather Limitations | 4-4 |
| 22 | 4-04.3(8) Hauling | 4-4 |
| 23 | 4-04.3(9) Hours of Work | 4-4 |
| 24 | 4-04.3(10) Shoulder Ballast | 4-4 |
| 25 | 4-04.3(11) Application of Dust Palliative | 4-4 |
| 26 | 4-04.3(12) Resurfacing of Oil Mat and Gravel Streets | 4-4 |
| 27 | 4-04.4 Measurement | 4-5 |
| 28 | 4-04.5 Payment | 4-5 |
| 29 | SECTION 4-05 FULL DEPTH ASPHALT PAVEMENT RECYCLING | 4-5 |
| 30 | 4-05.1 Description | 4-5 |
| 31 | 4-05.1(1)A Submittal | 4-5 |
| 32 | 4-05.2 Materials | 4-5 |
| 33 | 4-05.3 Construction Requirements | 4-5 |
| 34 | 4-05.3(1) Equipment | 4-5 |
| 35 | 4-05.3(2) Construction Method | 4-6 |
| 36 | 4-05.3(2)A Removal of Obstacles | 4-6 |
| 37 | 4-05.3(2)B Pulverization | 4-6 |
| 38 | 4-05.3(2)C Additives, Mixing and Compacting | 4-6 |
| 39 | 4-05.3(2)D Final Surface Preparation | 4-6 |
| 40 | 4-05.4 Measurement | 4-6 |
| 41 | 4-05.5 Payment | 4-7 |
| 42 | SECTION 4-06 ASPHALT TREATED BASE | 4-7 |
| 43 | 4-06.1 Description | 4-7 |
| 44 | 4-06.1(1) General | 4-7 |
| 45 | 4-06.1(2) Definition | 4-7 |
| 46 | 4-06.2 Materials | 4-7 |
| 47 | 4-06.3 Construction Requirements | 4-7 |
| 48 | 4-06.3(1) Asphalt Mixing Plant | 4-7 |
| 49 | 4-06.3(2) Preparation of Aggregates | 4-8 |
| 50 | 4-06.3(2)A Mix Design | 4-8 |
| 51 | 4-06.3(3) Heating of Asphalt Material | 4-8 |
| 52 | 4-06.3(4) Mixing | 4-8 |
| 53 | 4-06.3(5) Hauling Equipment | 4-8 |
| 54 | 4-06.3(6) Spreading and Finishing | 4-8 |
| 55 | 4-06.3(6)A General | 4-8 |
| 56 | 4-06.3(6)B Subgrade Protection Course | 4-8 |
| 57 | 4-06.3(6)C Finish Course | 4-8 |
| 58 | 4-06.3(7) Compaction and Density | 4-8 |
| 59 | 4-06.3(8) Anti Stripping Additive | 4-8 |
| 60 | 4-06.4 Measurement | 4-8 |
| 61 | 4-06.5 Payment | 4-8 |
| 62 | SECTION 4-07 FULL DEPTH PAVEMENT RECLAMATION | 4-9 |
| 63 | 4-07.1 Description | 4-9 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|-------------------|--|------------|
| 1 | 4-07.1(1) | Submittal | 4-9 |
| 2 | 4-07.2 | Materials | 4-9 |
| 3 | 4-07.3 | Construction Requirements | 4-9 |
| 4 | 4-07.3(1) | Equipment | 4-9 |
| 5 | 4-07.3(2) | Construction Method | 4-9 |
| 6 | 4-07.3(2)A | Pulverizing | 4-9 |
| 7 | 4-07.3(2)B | Distributing Additives..... | 4-10 |
| 8 | 4-07.3(2)C | Mixing..... | 4-10 |
| 9 | 4-07.3(2)D | Final Grading, Compacting, and Curing | 4-10 |
| 10 | 4-07.3(2)E | Patching and Correction of Defects..... | 4-10 |
| 11 | 4-07.4 | Measurement..... | 4-10 |
| 12 | 4-07.5 | Payment | 4-10 |
| 13 | DIVISION 5 | SURFACE TREATMENTS AND PAVEMENTS | 5-1 |
| 14 | SECTION 5-01 | SUBSEALING | 5-1 |
| 15 | 5-01.1 | Description..... | 5-1 |
| 16 | 5-01.2 | Materials | 5-1 |
| 17 | 5-01.3 | Construction Requirements | 5-1 |
| 18 | 5-01.3(1) | Proportioning Materials..... | 5-1 |
| 19 | 5-01.3(2) | Equipment | 5-1 |
| 20 | 5-01.3(3) | Construction | 5-1 |
| 21 | 5-01.4 | Measurement..... | 5-2 |
| 22 | 5-01.5 | Payment | 5-2 |
| 23 | SECTION 5-02 | BITUMINOUS SURFACE TREATMENT | 5-2 |
| 24 | 5-02.1 | Description..... | 5-2 |
| 25 | 5-02.1(1) | General..... | 5-2 |
| 26 | 5-02.1(2) | Bituminous Surface Treatment Class A..... | 5-2 |
| 27 | 5-02.1(3) | Bituminous Surface Treatment Classes B, C, and D..... | 5-2 |
| 28 | 5-02.2 | Materials | 5-2 |
| 29 | 5-02.3 | Construction Requirements | 5-3 |
| 30 | 5-02.3(1) | Equipment | 5-3 |
| 31 | 5-02.3(2) | Preparation of Roadway Surface..... | 5-3 |
| 32 | 5-02.3(2)A | Untreated Surfaces | 5-3 |
| 33 | 5-02.3(2)B | Treated Surfaces..... | 5-3 |
| 34 | 5-02.3(2)C | Soil Residual Herbicide | 5-3 |
| 35 | 5-02.3(3) | Application of Asphalt..... | 5-3 |
| 36 | 5-02.3(4) | Application Method of Aggregates..... | 5-4 |
| 37 | 5-02.3(5) | Additional Asphalt and Mineral Aggregate..... | 5-4 |
| 38 | 5-02.3(6) | Patching and Correction of Defects..... | 5-4 |
| 39 | 5-02.3(7) | Progress of Work..... | 5-4 |
| 40 | 5-02.3(8) | Protection of Structures | 5-5 |
| 41 | 5-02.3(9) | Unfavorable Weather | 5-5 |
| 42 | 5-02.3(10) | Anti Stripping Additive | 5-5 |
| 43 | 5-02.3(11) | Untreated Roadway Surfaces..... | 5-5 |
| 44 | 5-02.4 | Measurement..... | 5-5 |
| 45 | 5-02.5 | Payment | 5-5 |
| 46 | SECTION 5-03 | RESERVED | 5-5 |
| 47 | SECTION 5-04 | HOT MIX ASPHALT (HMA) AND WARM MIX ASPHALT (WMA) PAVEMENT | 5-5 |
| 48 | 5-04.1 | Description..... | 5-5 |
| 49 | 5-04.2 | Materials | 5-6 |
| 50 | 5-04.2(1) | Use of Substitute Materials..... | 5-6 |
| 51 | 5-04.3 | Construction Requirements | 5-6 |
| 52 | 5-04.3(1) | Terms Related To HMA..... | 5-6 |
| 53 | 5-04.3(1)A | WMA Requirements | 5-6 |
| 54 | 5-04.3(2) | Mixing Plant..... | 5-6 |
| 55 | 5-04.3(3) | Paving and Related Equipment..... | 5-7 |
| 56 | 5-04.3(3)A | Hauling Equipment..... | 5-7 |
| 57 | 5-04.3(3)B | Paving Equipment | 5-7 |
| 58 | 5-04.3(3)B1 | General | 5-7 |
| 59 | 5-04.3(3)B2 | HMA Pavers..... | 5-7 |
| 60 | 5-04.3(3)B3 | Material Transfer Vehicles (MTV)..... | 5-7 |
| 61 | 5-04.3(3)C | Rollers..... | 5-7 |
| 62 | 5-04.3(3)D | Planing Bituminous Pavement and Required Pre-Planing Metal Detection | 5-8 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|---|------|
| 1 | 5-04.3(3)D1 | General | 5-8 |
| 2 | 5-04.3(3)D2 | Planing Bituminous Pavement | 5-8 |
| 3 | 5-04.3(3)D3 | Required Pre-Planing Metal Detection | 5-8 |
| 4 | 5-04.3(4) | Preparation of Street Surfaces | 5-8 |
| 5 | 5-04.3(4)A | Preparation Classification Descriptions | 5-8 |
| 6 | 5-04.3(4)B | Surface Preparation – Treated Surfaces | 5-8 |
| 7 | 5-04.3(4)B1 | General | 5-8 |
| 8 | 5-04.3(4)B2 | Preleveling | 5-9 |
| 9 | 5-04.3(4)B3 | Planing Bituminous Pavement | 5-9 |
| 10 | 5-04.3(4)B3A | Pre-Planing Metal Detection Check | 5-9 |
| 11 | 5-04.3(4)B3B | Planing | 5-9 |
| 12 | 5-04.3(4)B4 | Tack Coat and Distributor Equipment Requirements | 5-10 |
| 13 | 5-04.3(4)B4A | Tack Coat Requirement | 5-10 |
| 14 | 5-04.3(4)B4B | Distributor Equipment Requirement | 5-10 |
| 15 | 5-04.3(4)C | Surface Preparation of Untreated Surfaces | 5-10 |
| 16 | 5-04.3(4)C1 | General | 5-10 |
| 17 | 5-04.3(4)C2 | Prime Coat Treatment | 5-11 |
| 18 | 5-04.3(4)D | Crack Sealing | 5-11 |
| 19 | 5-04.3(5) | Heating of Asphalt Binder | 5-11 |
| 20 | 5-04.3(6) | HMA Mix Design and Submittal Requirements | 5-12 |
| 21 | 5-04.3(6)A | Preparation of Aggregates | 5-12 |
| 22 | 5-04.3(6)B | Mix Design | 5-12 |
| 23 | 5-04.3(6)B1 | General | 5-12 |
| 24 | 5-04.3(6)B2 | Application Definitions | 5-12 |
| 25 | 5-04.3(6)C | Submittal – Structural Application – Major Quantity | 5-12 |
| 26 | 5-04.3(6)C1 | General | 5-12 |
| 27 | 5-04.3(6)C2 | Mix Design and Sample Submittal Requirements | 5-12 |
| 28 | 5-04.3(6)C3 | Accelerated Submittal | 5-14 |
| 29 | 5-04.3(6)C4 | Certification to Accompany HMA Delivery | 5-14 |
| 30 | 5-04.3(6)D | Structural Application - Minor Quantity | 5-14 |
| 31 | 5-04.3(6)E | Non-Structural Applications | 5-14 |
| 32 | 5-04.3(7) | HMA Mixing Process | 5-15 |
| 33 | 5-04.3(7)A | General | 5-15 |
| 34 | 5-04.3(7)B | Acceptance Sampling and Testing – HMA Mixture | 5-15 |
| 35 | 5-04.3(8) | Spreading and Finishing | 5-16 |
| 36 | 5-04.3(8)A | Utility Adjustments | 5-17 |
| 37 | 5-04.3(9) | Compaction | 5-17 |
| 38 | 5-04.3(9)A | General | 5-17 |
| 39 | 5-04.3(9)B | Control | 5-17 |
| 40 | 5-04.3(9)B1 | Compaction Requirement | 5-17 |
| 41 | 5-04.3(9)B2 | Test Results | 5-18 |
| 42 | 5-04.3(10) | Joints | 5-18 |
| 43 | 5-04.3(10)A | Longitudinal and Transverse Joints | 5-18 |
| 44 | 5-04.3(10)B | New Pavement Connections with Existing Pavements | 5-18 |
| 45 | 5-04.3(11) | Surface Smoothness | 5-18 |
| 46 | 5-04.3(11)A | General | 5-18 |
| 47 | 5-04.3(11)B | Concrete Overlaying Asphalt | 5-19 |
| 48 | 5-04.3(12) | Weather Limitations | 5-19 |
| 49 | 5-04.3(13) | Paving and Planing Under Traffic | 5-19 |
| 50 | 5-04.3(13)A | General | 5-19 |
| 51 | 5-04.3(13)B | Submittals - Planing Plan and HMA Paving Plan | 5-20 |
| 52 | 5-04.3(13)C | Pre-Paving and Pre-Planing Briefing | 5-20 |
| 53 | 5-04.3(14) | Sealing of Pavement Surfaces | 5-21 |
| 54 | 5-04.3(15) | Anti-Stripping Additive | 5-21 |
| 55 | 5-04.3(16) | Shoulder Paving | 5-21 |
| 56 | 5-04.3(17) | Non-Structural HMA Applications | 5-21 |
| 57 | 5-04.3(17)A | HMA Sidewalks | 5-21 |
| 58 | 5-04.3(17)B | HMA Driveways | 5-21 |
| 59 | 5-04.3(18) | Temporary Pavement Patching | 5-21 |
| 60 | 5-04.4 | Measurement | 5-22 |
| 61 | 5-04.5 | Payment | 5-22 |
| 62 | SECTION 5-05 CEMENT CONCRETE FOR ROADWAY AND RELATED WORK | | 5-23 |
| 63 | 5-05.1 | Description | 5-23 |
| 64 | 5-05.2 | Materials | 5-24 |
| 65 | 5-05.3 | Construction Requirements | 5-24 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|-------------|--|------|
| 1 | 5-05.3(1) | Concrete Mix Design | 5-24 |
| 2 | 5-05.3(1)A | Materials | 5-26 |
| 3 | 5-05.3(1)B | Roadway Cement Concrete | 5-26 |
| 4 | 5-05.3(1)C | Non-Roadway Cement Concrete | 5-26 |
| 5 | 5-05.3(1)D | Pozzolans | 5-26 |
| 6 | 5-05.3(1)E | Submittals | 5-26 |
| 7 | 5-05.3(1)F | Quality Level Calculation..... | 5-27 |
| 8 | 5-05.3(2) | Consistency..... | 5-27 |
| 9 | 5-05.3(3) | Equipment | 5-27 |
| 10 | 5-05.3(3)A | Batch Plant and Equipment..... | 5-27 |
| 11 | 5-05.3(3)B | Mixing Equipment..... | 5-28 |
| 12 | 5-05.3(3)C | Finishing Equipment – Roadway..... | 5-28 |
| 13 | 5-05.3(3)D | Joint Sawing Equipment - Roadway..... | 5-28 |
| 14 | 5-05.3(3)E | Smoothness Testing Equipment – Roadway | 5-28 |
| 15 | 5-05.3(4) | Cement Concrete Batching and Acceptance..... | 5-28 |
| 16 | 5-05.3(4)A | Measuring, and Batching Materials | 5-28 |
| 17 | 5-05.3(4)B | Acceptance of Portland Cement or Blended Hydraulic Cement Concrete | 5-28 |
| 18 | 5-05.3(4)B1 | Acceptance Parameters for Roadway Cement Concrete | 5-29 |
| 19 | 5-05.3(4)B2 | Acceptance Parameters - Non-Roadway Cement Concrete | 5-29 |
| 20 | 5-05.3(4)B3 | Representative Area Method | 5-29 |
| 21 | 5-05.3(4)B4 | Re-Testing by Coring | 5-29 |
| 22 | 5-05.3(4)C | Rejection of Concrete..... | 5-30 |
| 23 | 5-05.3(5) | Mixing Concrete | 5-30 |
| 24 | 5-05.3(5)A | Limitations of Mixing..... | 5-30 |
| 25 | 5-05.3(6) | Subgrade..... | 5-31 |
| 26 | 5-05.3(7) | Placing, Spreading, and Compacting Concrete..... | 5-31 |
| 27 | 5-05.3(7)A | Slip Form Construction for Continuous Paving | 5-31 |
| 28 | 5-05.3(7)B | Stationary Side Form Construction | 5-31 |
| 29 | 5-05.3(8) | Joints - Roadway..... | 5-32 |
| 30 | 5-05.3(8)A | Contraction Joints | 5-32 |
| 31 | 5-05.3(8)A1 | Sawed Contraction Joints | 5-32 |
| 32 | 5-05.3(8)A2 | Sealing Sawed Contraction Joints (Non-Base Only) | 5-32 |
| 33 | 5-05.3(8)A3 | Formed Contraction Joints (Non-Base Only) | 5-33 |
| 34 | 5-05.3(8)A4 | Weakened Plane Contraction Joints (Base Only) | 5-33 |
| 35 | 5-05.3(8)B | Construction Joints..... | 5-33 |
| 36 | 5-05.3(8)C | Through Joints | 5-33 |
| 37 | 5-05.3(8)D | Isolation Joints | 5-34 |
| 38 | 5-05.3(8)E | Joint Location | 5-34 |
| 39 | 5-05.3(8)E1 | Transverse Joints..... | 5-34 |
| 40 | 5-05.3(8)E2 | Longitudinal Joints | 5-34 |
| 41 | 5-05.3(9) | Castings and Steel Reinforcing In Concrete Pavement..... | 5-34 |
| 42 | 5-05.3(10) | Tie Bars and Dowel Bars..... | 5-35 |
| 43 | 5-05.3(10)A | “New To Existing” Joints – Tie-Bars and Dowels | 5-35 |
| 44 | 5-05.3(11) | Roadway Finishing | 5-35 |
| 45 | 5-05.3(11)A | Edging (Non-Base Only) | 5-36 |
| 46 | 5-05.3(11)B | Roadway Surface Finishing (Non-Base Only) | 5-36 |
| 47 | 5-05.3(11)C | Roadway Base Finishing (Base Only) | 5-36 |
| 48 | 5-05.3(11)D | Utility Adjustments..... | 5-36 |
| 49 | 5-05.3(12) | Roadway Surface Smoothness | 5-36 |
| 50 | 5-05.3(13) | Curing..... | 5-37 |
| 51 | 5-05.3(13)A | Curing Compound | 5-37 |
| 52 | 5-05.3(13)B | White Polyethylene Sheeting | 5-38 |
| 53 | 5-05.3(13)C | Wet Curing | 5-38 |
| 54 | 5-05.3(14) | Cold Weather Work | 5-38 |
| 55 | 5-05.3(15) | Concrete Pavement Construction in Adjacent Roadway Lanes | 5-38 |
| 56 | 5-05.3(16) | Protection of Roadway Cement Concrete. | 5-38 |
| 57 | 5-05.3(17) | Opening to Vehicle Traffic | 5-39 |
| 58 | 5-05.3(18) | Pre-Paving Meeting..... | 5-39 |
| 59 | 5-05.3(19) | Repair of Defective Roadway Pavement Slabs | 5-39 |
| 60 | 5-05.3(20) | Patterned and Colored Cement Concrete Treatment | 5-40 |
| 61 | 5-05.3(21) | Exposed Aggregate Cement Concrete Treatment..... | 5-41 |
| 62 | 5-05.4 | Measurement..... | 5-42 |
| 63 | 5-05.5 | Payment | 5-42 |
| 64 | 5-05.5(1) | Miscellaneous items | 5-43 |
| 65 | 5-05.5(2) | Pavement Thickness | 5-43 |
| 66 | 5-05.5(2)A | Thickness Deficiency Adjustment..... | 5-43 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---------------------|--|-------------|
| 1 | 5-05.5(2)B | Thickness Deficiency Rejection..... | 5-44 |
| 2 | SECTION 5-06 | PERVIOUS CEMENT CONCRETE SIDEWALK..... | 5-44 |
| 3 | 5-06.1 | Description..... | 5-44 |
| 4 | 5-06.2 | Materials..... | 5-44 |
| 5 | 5-06.3 | Construction Requirements..... | 5-45 |
| 6 | 5-06.3(1) | Pervious Concrete Mix Design..... | 5-45 |
| 7 | 5-06.3(1)A | Mix Design Criteria..... | 5-45 |
| 8 | 5-06.3(1)B | Job Mix Formula (JMF)..... | 5-45 |
| 9 | 5-06.3(2) | Submittals..... | 5-46 |
| 10 | 5-06.3(3) | Equipment..... | 5-46 |
| 11 | 5-06.3(3)A | Batching Plant..... | 5-46 |
| 12 | 5-06.3(3)B | Mixer Trucks..... | 5-46 |
| 13 | 5-06.3(3)C | Side Forms..... | 5-46 |
| 14 | 5-06.3(3)D | Finishing Equipment..... | 5-47 |
| 15 | 5-06.3(3)E | Joint Sawing Equipment..... | 5-47 |
| 16 | 5-06.3(3)F | Smoothness Testing Equipment..... | 5-47 |
| 17 | 5-06.3(4) | Measuring and Batching Materials..... | 5-47 |
| 18 | 5-06.3(4)A | Acceptance..... | 5-47 |
| 19 | 5-06.3(4)A1 | Void Content of the Mix; Lab Test..... | 5-48 |
| 20 | 5-06.3(4)A2 | Infiltration Rate of the Mix; Field Test..... | 5-48 |
| 21 | 5-06.3(4)B | Rejection..... | 5-49 |
| 22 | 5-06.3(5) | Mixing Pervious Concrete..... | 5-49 |
| 23 | 5-06.3(5)A | Limitations of Mixing Pervious Concrete..... | 5-49 |
| 24 | 5-06.3(6) | Aggregate Discharge Subbase..... | 5-49 |
| 25 | 5-06.3(6)A | Subgrade Preparation..... | 5-50 |
| 26 | 5-06.3(7) | Placing, Spreading, and Compacting Pervious Concrete..... | 5-50 |
| 27 | 5-06.3(7)A | Contractor's Qualifications..... | 5-50 |
| 28 | 5-06.3(7)B | Test Panels..... | 5-50 |
| 29 | 5-06.3(7)C | Placing, Spreading and Compacting..... | 5-51 |
| 30 | 5-06.3(8) | Joints..... | 5-51 |
| 31 | 5-06.3(8)A | Construction Joints..... | 5-51 |
| 32 | 5-06.3(8)B | Contraction Joints..... | 5-51 |
| 33 | 5-06.3(8)C | Isolation Joints..... | 5-51 |
| 34 | 5-06.3(9) | Surface Smoothness..... | 5-52 |
| 35 | 5-06.3(10) | Curing..... | 5-52 |
| 36 | 5-06.3(11) | Cold Weather Work..... | 5-52 |
| 37 | 5-06.3(12) | Protection of Pervious Concrete Sidewalk..... | 5-52 |
| 38 | 5-06.4 | Measurement..... | 5-52 |
| 39 | 5-06.5 | Payment..... | 5-53 |
| 40 | DIVISION 6 | STRUCTURES..... | 6-1 |
| 41 | SECTION 6-01 | GENERAL REQUIREMENTS - STRUCTURES..... | 6-1 |
| 42 | 6-01.1 | Description..... | 6-1 |
| 43 | 6-01.2 | Foundation Data..... | 6-1 |
| 44 | 6-01.3 | Clearing the Site..... | 6-1 |
| 45 | 6-01.4 | Appearance of Structures..... | 6-1 |
| 46 | 6-01.5 | Load Restrictions on Bridges Under Construction..... | 6-1 |
| 47 | 6-01.6 | Navigable Streams..... | 6-1 |
| 48 | 6-01.7 | Approaches to Movable Spans..... | 6-1 |
| 49 | 6-01.8 | Working Drawings..... | 6-1 |
| 50 | 6-01.9 | Name Plates..... | 6-2 |
| 51 | 6-01.10 | Final Cleanup - Structure..... | 6-2 |
| 52 | 6-01.11 | Architectural Features..... | 6-2 |
| 53 | 6-01.12 | Premolded Joint Filler..... | 6-2 |
| 54 | 6-01.13 | Normal Temperature..... | 6-2 |
| 55 | 6-01.14 | Maintenance of Bridge Drains..... | 6-2 |
| 56 | SECTION 6-02 | CEMENT CONCRETE STRUCTURES AND CEMENT CONCRETE FOR MISC WORK..... | 6-2 |
| 57 | 6-02.1 | Description..... | 6-2 |
| 58 | 6-02.2 | Materials..... | 6-2 |
| 59 | 6-02.3 | Construction Requirements..... | 6-3 |
| 60 | 6-02.3(1) | Classification of Structural Concrete..... | 6-3 |
| 61 | 6-02.3(2) | Proportioning Materials..... | 6-3 |
| 62 | 6-02.3(2)A | Contractor Mix Design..... | 6-4 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|--|------|
| 1 | 6-02.3(2)B | Commercial Concrete | 6-5 |
| 2 | 6-02.3(2)C | Lean Concrete..... | 6-5 |
| 3 | 6-02.3(3) | Admixtures | 6-5 |
| 4 | 6-02.3(4) | Ready-Mix Concrete..... | 6-5 |
| 5 | 6-02.3(4)A | Qualification of Concrete Suppliers | 6-5 |
| 6 | 6-02.3(4)B | Job Site Mixing..... | 6-6 |
| 7 | 6-02.3(4)C | Consistency | 6-7 |
| 8 | 6-02.3(4)D | Temperature and Time for Placement..... | 6-7 |
| 9 | 6-02.3(5) | Acceptance of Concrete | 6-7 |
| 10 | 6-02.3(5)A | General | 6-7 |
| 11 | 6-02.3(5)B | Certification of Compliance | 6-8 |
| 12 | 6-02.3(5)C | Conformance to Mix Design..... | 6-8 |
| 13 | 6-02.3(5)D | Test Methods | 6-9 |
| 14 | 6-02.3(5)E | Point of Acceptance | 6-9 |
| 15 | 6-02.3(5)F | Water-Cement Ratio Conformance | 6-9 |
| 16 | 6-02.3(5)G | Sampling and Testing Frequency for Temperature, Consistency, and Air Content..... | 6-9 |
| 17 | 6-02.3(5)H | Sampling and Testing for Compressive Strength and Initial Curing | 6-10 |
| 18 | 6-02.3(5)I | Rejecting Concrete..... | 6-10 |
| 19 | 6-02.3(5)J | Concrete with Non-Conforming Strength | 6-10 |
| 20 | 6-02.3(6) | Placing Concrete | 6-10 |
| 21 | 6-02.3(6)A | Weather and Temperature Limits to Protect Concrete | 6-12 |
| 22 | 6-02.3(6)A1 | Hot Weather Protection..... | 6-12 |
| 23 | 6-02.3(6)A2 | Cold Weather Protection | 6-12 |
| 24 | 6-02.3(6)B | Placing Concrete in Foundation Seals | 6-14 |
| 25 | 6-02.3(6)C | Dewatering Concrete Seals and Foundations..... | 6-15 |
| 26 | 6-02.3(6)D | Protection Against Vibration..... | 6-15 |
| 27 | 6-02.3(6)D1 | Prescriptive Safe Distance Method | 6-15 |
| 28 | 6-02.3(6)D2 | Monitoring Safe Distance Method | 6-16 |
| 29 | 6-02.3(7) | Concrete Exposed to Sea Water..... | 6-16 |
| 30 | 6-02.3(8) | Concrete Exposed to Alkaline Soils or Water | 6-16 |
| 31 | 6-02.3(9) | Vibration of Concrete..... | 6-16 |
| 32 | 6-02.3(10) | Bridge Decks and Bridge Approach Slabs..... | 6-17 |
| 33 | 6-02.3(10)A | Preoperational Meeting | 6-17 |
| 34 | 6-02.3(10)B | Screed Rail Supports | 6-17 |
| 35 | 6-02.3(10)C | Finishing Equipment..... | 6-17 |
| 36 | 6-02.3(10)D | Concrete Placement, Finishing, and Texturing | 6-17 |
| 37 | 6-02.3(10)E | Sidewalk on Structures | 6-19 |
| 38 | 6-02.3(10)F | Bridge Approach Slab Orientation and Anchors..... | 6-19 |
| 39 | 6-02.3(11) | Curing Concrete | 6-19 |
| 40 | 6-02.3(11)A | Curing and Finishing Concrete Traffic and Pedestrian Barrier | 6-20 |
| 41 | 6-02.3(11)A1 | Fixed Form Barrier | 6-20 |
| 42 | 6-02.3(11)A2 | Slip Form Barrier..... | 6-20 |
| 43 | 6-02.3(12) | Construction Joints..... | 6-21 |
| 44 | 6-02.3(12)A | Construction Joints in New Construction..... | 6-21 |
| 45 | 6-02.3(12)B | Construction Joints Between Existing and New Construction | 6-21 |
| 46 | 6-02.3(13) | Expansion Joints | 6-21 |
| 47 | 6-02.3(14) | Finishing Concrete Surfaces | 6-22 |
| 48 | 6-02.3(14)A | Class 1 Surface Finish | 6-22 |
| 49 | 6-02.3(14)B | Class 2 Surface Finish | 6-22 |
| 50 | 6-02.3(14)C | Pigmented Sealer for Concrete Surfaces..... | 6-22 |
| 51 | 6-02.3(15) | Date Numerals | 6-22 |
| 52 | 6-02.3(16) | Plans for Falsework and Formwork | 6-23 |
| 53 | 6-02.3(16)A | Nonpreapproved Falsework and Formwork Plans | 6-23 |
| 54 | 6-02.3(17) | Falsework and Formwork | 6-24 |
| 55 | 6-02.3(17)A | Design Loads | 6-24 |
| 56 | 6-02.3(17)B | Allowable Design Stresses and Deflections | 6-25 |
| 57 | 6-02.3(17)B1 | Deflection | 6-25 |
| 58 | 6-02.3(17)B2 | Timber..... | 6-26 |
| 59 | 6-02.3(17)B3 | Steel..... | 6-26 |
| 60 | 6-02.3(17)C | Falsework and Formwork at Special Locations | 6-27 |
| 61 | 6-02.3(17)D | Falsework Support Systems: Piling, Temporary Concrete Footings, Timber Mudsills, Manufactured Shoring Towers, Caps, and Posts | 6-28 |
| 62 | 6-02.3(17)D1 | Piling | 6-28 |
| 63 | 6-02.3(17)D2 | Temporary Concrete Footings and Timber Mudsills..... | 6-28 |
| 64 | 6-02.3(17)D3 | Bents, Shoring Towers, Piling, Posts, and Caps..... | 6-29 |
| 65 | 6-02.3(17)D4 | Manufactured Shoring Tower Systems and Devices..... | 6-30 |
| 66 | | | |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|--|------|
| 1 | 6-02.3(17)D5 | Cross-Braced Type Base Frames | 6-31 |
| 2 | 6-02.3(17)D6 | Ladder Type Base Frames | 6-32 |
| 3 | 6-02.3(17)D7 | Intermediate Strength Shoring | 6-32 |
| 4 | 6-02.3(17)D8 | Heavy-Duty Shoring Systems | 6-32 |
| 5 | 6-02.3(17)E | Stringers, Beams, Joists, Bridge Deck Support, and Deck Overhangs | 6-33 |
| 6 | 6-02.3(17)F | Bracing | 6-34 |
| 7 | 6-02.3(17)F1 | Cable or Tension Bracing Systems | 6-34 |
| 8 | 6-02.3(17)F2 | Applying Wire Rope Clips | 6-36 |
| 9 | 6-02.3(17)F3 | Anchor Blocks | 6-36 |
| 10 | 6-02.3(17)F4 | Temporary Bracing for Bridge Girders During Erection | 6-37 |
| 11 | 6-02.3(17)F5 | Temporary Bracing for Bridge Girders During Diaphragm And Bridge Deck Concrete Placement | 6-37 |
| 12 | | Testing Falsework Devices | 6-37 |
| 13 | 6-02.3(17)G | Formwork Accessories | 6-38 |
| 14 | 6-02.3(17)H | Timber Connections | 6-38 |
| 15 | 6-02.3(17)I | Bolted Connections | 6-39 |
| 16 | 6-02.3(17)I1 | Lag Screw Connections | 6-39 |
| 17 | 6-02.3(17)I2 | Drift Pin and Drift Bolt Connections | 6-40 |
| 18 | 6-02.3(17)I3 | Nailed and Spiked Joints | 6-40 |
| 19 | 6-02.3(17)I4 | Timber Connection Adjustment for Duration Of Load | 6-40 |
| 20 | 6-02.3(17)I5 | Face Lumber, Studs, Wales, and Metal Forms | 6-41 |
| 21 | 6-02.3(17)J | Concrete Forms on Steel Spans | 6-42 |
| 22 | 6-02.3(17)K | Finishing Machine Support System | 6-43 |
| 23 | 6-02.3(17)L | Restricted Overhead Clearance Sign | 6-43 |
| 24 | 6-02.3(17)M | Removal of Falsework and Forms | 6-43 |
| 25 | 6-02.3(17)N | Early Concrete Test Cylinder Breaks | 6-44 |
| 26 | 6-02.3(17)O | Placing Anchor Bolts | 6-44 |
| 27 | 6-02.3(18) | Bridge Bearings | 6-45 |
| 28 | 6-02.3(19) | Bridge Bearing Assemblies | 6-45 |
| 29 | 6-02.3(19)A | Grout for Anchor Bolts and Bridge Bearings | 6-45 |
| 30 | 6-02.3(20) | Drainage of Box Girder Cells | 6-45 |
| 31 | 6-02.3(21) | Drainage of Substructure | 6-45 |
| 32 | 6-02.3(22) | Opening to Traffic | 6-46 |
| 33 | 6-02.3(23) | Reinforcement | 6-46 |
| 34 | 6-02.3(24) | Field Bending | 6-46 |
| 35 | 6-02.3(24)A | Protection of Materials | 6-47 |
| 36 | 6-02.3(24)B | Placing and Fastening | 6-47 |
| 37 | 6-02.3(24)C | Splicing | 6-49 |
| 38 | 6-02.3(24)D | Welding Reinforcing Steel | 6-49 |
| 39 | 6-02.3(24)E | Mechanical Splices | 6-50 |
| 40 | 6-02.3(24)F | Job Control Tests | 6-51 |
| 41 | 6-02.3(24)G | Epoxy-Coated Steel Reinforcing Bar | 6-51 |
| 42 | 6-02.3(24)H | Prestressed Concrete Girders | 6-51 |
| 43 | 6-02.3(25) | Shop Drawings | 6-52 |
| 44 | 6-02.3(25)A | Casting | 6-52 |
| 45 | 6-02.3(25)B | Prestressing | 6-53 |
| 46 | 6-02.3(25)C | Curing | 6-53 |
| 47 | 6-02.3(25)D | Contractors Control Strength | 6-54 |
| 48 | 6-02.3(25)E | Prestress Release | 6-55 |
| 49 | 6-02.3(25)F | Protection of Exposed Reinforcement | 6-55 |
| 50 | 6-02.3(25)G | Finishing | 6-55 |
| 51 | 6-02.3(25)H | Fabrication Tolerances | 6-55 |
| 52 | 6-02.3(25)I | Horizontal Alignment | 6-56 |
| 53 | 6-02.3(25)J | Girder Deflection | 6-57 |
| 54 | 6-02.3(25)K | Handling And Storage | 6-57 |
| 55 | 6-02.3(25)L | Shipping | 6-58 |
| 56 | 6-02.3(25)M | Prestressed Concrete Girder Erection | 6-59 |
| 57 | 6-02.3(25)N | Deck Bulb Tee Girder Flange Connection | 6-60 |
| 58 | 6-02.3(25)O | Cast-In-Place Prestressed Concrete | 6-60 |
| 59 | 6-02.3(26) | Shop Drawings | 6-60 |
| 60 | 6-02.3(26)A | General Requirements for Anchorages | 6-61 |
| 61 | 6-02.3(26)B | Normal Anchorage Devices | 6-61 |
| 62 | 6-02.3(26)C | Special Anchorage Devices | 6-62 |
| 63 | 6-02.3(26)D | Test Block Requirements | 6-62 |
| 64 | 6-02.3(26)D1 | Test Block Dimensions | 6-62 |
| 65 | 6-02.3(26)D2 | Local Zone Reinforcement For Confinement | 6-62 |
| 66 | 6-02.3(26)D3 | | |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|---|-------------|
| 1 | 6-02.3(26)D4 | Supplementary Skin Reinforcement..... | 6-62 |
| 2 | 6-02.3(26)D5 | Test Block Concrete Strength | 6-63 |
| 3 | 6-02.3(26)D6 | Special Anchorage Device Acceptance Testing..... | 6-63 |
| 4 | 6-02.3(26)D7 | Cyclic Loading Test..... | 6-63 |
| 5 | 6-02.3(26)D8 | Sustained Loading Test | 6-63 |
| 6 | 6-02.3(26)D9 | Monotonic Loading Test..... | 6-63 |
| 7 | 6-02.3(26)D10 | Special Anchorage Device Test Performance Requirements | 6-63 |
| 8 | 6-02.3(26)D11 | Test Series Requirements..... | 6-63 |
| 9 | 6-02.3(26)D12 | Special Anchorage Device Acceptance Testing Results Report | 6-63 |
| 10 | 6-02.3(26)E | Ducts..... | 6-64 |
| 11 | 6-02.3(26)E1 | Ducts for Internal Embedded Installation | 6-64 |
| 12 | 6-02.3(26)E2 | Ducts for External Exposed Installation..... | 6-65 |
| 13 | 6-02.3(26)E3 | Transitions | 6-65 |
| 14 | 6-02.3(26)E4 | Vents, Grout Injection Ports, Drains, and Caps..... | 6-65 |
| 15 | 6-02.3(26)E5 | Leak Tightness Testing..... | 6-66 |
| 16 | 6-02.3(26)F | Prestressing Reinforcement..... | 6-66 |
| 17 | 6-02.3(26)G | Tensioning | 6-66 |
| 18 | 6-02.3(26)H | Grouting | 6-68 |
| 19 | 6-02.3(27) | Concrete for Precast Units | 6-69 |
| 20 | 6-02.3(27)A | Of Self-Consolidating Concrete for Precast Units | 6-69 |
| 21 | 6-02.3(27)B | Submittals for Self-Consolidating Concrete for Precast Units | 6-69 |
| 22 | 6-02.3(27)C | Acceptance Testing Of Self-Consolidating Concrete for Precast Units | 6-69 |
| 23 | 6-02.3(28) | Precast Concrete Panels..... | 6-70 |
| 24 | 6-02.3(28)A | Shop Drawings..... | 6-70 |
| 25 | 6-02.3(28)B | Casting..... | 6-70 |
| 26 | 6-02.3(28)C | Curing | 6-70 |
| 27 | 6-02.3(28)D | Contractors Control Strength | 6-71 |
| 28 | 6-02.3(28)E | Finishing..... | 6-71 |
| 29 | 6-02.3(28)F | Tolerances | 6-71 |
| 30 | 6-02.3(28)G | Handling and Storage | 6-71 |
| 31 | 6-02.3(28)H | Shipping..... | 6-71 |
| 32 | 6-02.3(28)I | Erection..... | 6-72 |
| 33 | 6-02.3(29) | Patterned, Colored, and Exposed Aggregate Treatments..... | 6-72 |
| 34 | 6-02.4 | Measurement..... | 6-72 |
| 35 | 6-02.5 | Payment | 6-73 |
| 36 | SECTION 6-03 STEEL STRUCTURES..... | | 6-74 |
| 37 | 6-03.1 | Description..... | 6-74 |
| 38 | 6-03.2 | Materials..... | 6-74 |
| 39 | 6-03.3 | Construction Requirements | 6-75 |
| 40 | 6-03.3(1) | Notice of Rolling | 6-75 |
| 41 | 6-03.3(2) | Facilities for Inspection | 6-75 |
| 42 | 6-03.3(3) | Inspector's Authority..... | 6-75 |
| 43 | 6-03.3(4) | Rejections..... | 6-75 |
| 44 | 6-03.3(5) | Mill Orders and Shipping Statements | 6-75 |
| 45 | 6-03.3(6) | Weighing | 6-75 |
| 46 | 6-03.3(7) | Shop Drawings and As-Built Records | 6-75 |
| 47 | 6-03.3(7)A | Erection Methods | 6-75 |
| 48 | 6-03.3(8) | Substitutions..... | 6-76 |
| 49 | 6-03.3(9) | Handling, Storing, and Shipping of Materials..... | 6-76 |
| 50 | 6-03.3(10) | Straightening Bent Material | 6-76 |
| 51 | 6-03.3(11) | Workmanship and Finish..... | 6-77 |
| 52 | 6-03.3(12) | Falsework..... | 6-77 |
| 53 | 6-03.3(13) | Fabricating Tension Members..... | 6-77 |
| 54 | 6-03.3(14) | Edge Finishing..... | 6-77 |
| 55 | 6-03.3(15) | Planing of Bearing Surfaces | 6-77 |
| 56 | 6-03.3(16) | Abutting Joints..... | 6-77 |
| 57 | 6-03.3(17) | End Connection Angles..... | 6-77 |
| 58 | 6-03.3(18) | Built Up Members..... | 6-77 |
| 59 | 6-03.3(19) | Hand Holes..... | 6-78 |
| 60 | 6-03.3(20) | Lacing Bars | 6-78 |
| 61 | 6-03.3(21) | Plate Girders | 6-78 |
| 62 | 6-03.3(21)A | Web Plates..... | 6-78 |
| 63 | 6-03.3(21)B | Web Splices and Fillers..... | 6-78 |
| 64 | 6-03.3(22) | Eyebars | 6-78 |
| 65 | 6-03.3(23) | Annealing | 6-78 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------------------------------|---|------|
| 1 | 6-03.3(24) | Pins and Rollers | 6-78 |
| 2 | 6-03.3(24)A | Boring Pin Holes | 6-78 |
| 3 | 6-03.3(24)B | Pin Clearances | 6-78 |
| 4 | 6-03.3(25) | Welding and Repair Welding | 6-78 |
| 5 | 6-03.3(25)A | Welding Inspection | 6-79 |
| 6 | 6-03.3(25)A1 | Visual Inspection | 6-79 |
| 7 | 6-03.3(25)A2 | Radiographic Inspection | 6-79 |
| 8 | 6-03.3(25)A3 | Ultrasonic Inspection | 6-79 |
| 9 | 6-03.3(25)A4 | Magnetic Particle Inspection | 6-80 |
| 10 | 6-03.3(26) | Screw Threads | 6-80 |
| 11 | 6-03.3(27) | High Strength Bolt Holes | 6-80 |
| 12 | 6-03.3(27)A | Punched Holes | 6-81 |
| 13 | 6-03.3(27)B | Reamed and Drilled Holes | 6-81 |
| 14 | 6-03.3(27)C | Numerically Controlled (N/C) Drilled Connections | 6-81 |
| 15 | 6-03.3(27)D | Accuracy of Punched, Subpunched and Subdrilled Holes | 6-81 |
| 16 | 6-03.3(27)E | Accuracy of Reamed and Drilled Holes | 6-81 |
| 17 | 6-03.3(27)F | Fitting for Bolting | 6-81 |
| 18 | 6-03.3(28) | Shop Assembly | 6-82 |
| 19 | 6-03.3(28)A | Method of Shop Assembly | 6-82 |
| 20 | 6-03.3(28)B | Check of Shop Assembly | 6-82 |
| 21 | 6-03.3(29) | Welded Shear Connectors | 6-82 |
| 22 | 6-03.3(30) | Painting | 6-82 |
| 23 | 6-03.3(30)A | Erection Marks | 6-82 |
| 24 | 6-03.3(30)B | Machine Finished Surfaces | 6-82 |
| 25 | 6-03.3(31) | Alignment and Camber | 6-83 |
| 26 | 6-03.3(31)A | Measuring Camber | 6-83 |
| 27 | 6-03.3(32) | Assembling and Bolting | 6-83 |
| 28 | 6-03.3(33) | Bolted Connections | 6-84 |
| 29 | 6-03.3(33)A | Pre-Erection Testing | 6-86 |
| 30 | 6-03.3(33)B | Bolting Inspection | 6-87 |
| 31 | 6-03.3(34) | Adjusting Pin Nuts | 6-88 |
| 32 | 6-03.3(35) | Setting Anchor Bolts | 6-88 |
| 33 | 6-03.3(36) | Setting and Grouting Masonry Plates | 6-88 |
| 34 | 6-03.3(37) | Setting Steel Bridge Bearings | 6-88 |
| 35 | 6-03.3(38) | Placing Superstructure | 6-88 |
| 36 | 6-03.3(39) | Swinging the Span | 6-88 |
| 37 | 6-03.3(40) | Draining Pockets | 6-89 |
| 38 | 6-03.3(41) | Floorbeam Protection | 6-89 |
| 39 | 6-03.3(42) | Surface Condition | 6-89 |
| 40 | 6-03.3(43) | Castings, Steel Forgings, and Miscellaneous Metals | 6-89 |
| 41 | 6-03.3(43)A | Shop Construction, Castings, Steel Forgings, and Miscellaneous Metals | 6-89 |
| 42 | 6-03.4 | Measurement | 6-89 |
| 43 | 6-03.5 | Payment | 6-89 |
| 44 | SECTION 6-04 TIMBER STRUCTURES | | 6-90 |
| 45 | 6-04.1 | Description | 6-90 |
| 46 | 6-04.2 | Materials | 6-90 |
| 47 | 6-04.3 | Construction Requirements | 6-90 |
| 48 | 6-04.3(1) | Storing and Handling Material | 6-90 |
| 49 | 6-04.3(2) | Workmanship | 6-90 |
| 50 | 6-04.3(3) | Shop Drawings | 6-90 |
| 51 | 6-04.3(4) | Field Treatment of Cut Surfaces, Bolt Holes, and Contact Surfaces | 6-91 |
| 52 | 6-04.3(5) | Holes for Bolts, Dowels, Rods, and Lag Screws | 6-91 |
| 53 | 6-04.3(6) | Bolts, Washers, and Other Hardware | 6-91 |
| 54 | 6-04.3(7) | Countersinking | 6-91 |
| 55 | 6-04.3(8) | Framing | 6-91 |
| 56 | 6-04.3(9) | Framed Bents | 6-91 |
| 57 | 6-04.3(10) | Caps | 6-91 |
| 58 | 6-04.3(11) | Bracing | 6-91 |
| 59 | 6-04.3(12) | Stringers | 6-92 |
| 60 | 6-04.3(13) | Wheel Guards and Railings | 6-92 |
| 61 | 6-04.3(14) | Single Plank Floors | 6-92 |
| 62 | 6-04.3(15) | Laminated Floors | 6-92 |
| 63 | 6-04.3(16) | Plank Subfloors for Concrete Decks | 6-92 |
| 64 | 6-04.3(17) | Trusses | 6-92 |
| 65 | 6-04.3(18) | Painting | 6-92 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|--|-------|
| 1 | 6-04.4 | Measurement..... | 6-92 |
| 2 | 6-04.5 | Payment | 6-93 |
| 3 | SECTION 6-05 PILES..... | | 6-93 |
| 4 | 6-05.1 | Description..... | 6-93 |
| 5 | 6-05.2 | Materials | 6-93 |
| 6 | 6-05.3 | Construction Requirements | 6-93 |
| 7 | 6-05.3(1) | Pile Terms | 6-93 |
| 8 | 6-05.3(2) | Ordering Piles..... | 6-94 |
| 9 | 6-05.3(3) | Manufacture of Precast Concrete Piles | 6-94 |
| 10 | 6-05.3(3)A | Casting and Stressing | 6-95 |
| 11 | 6-05.3(3)B | Finishing..... | 6-95 |
| 12 | 6-05.3(3)C | Curing | 6-95 |
| 13 | 6-05.3(4) | Manufacture of Steel Casings for Cast in Place Concrete Piles | 6-95 |
| 14 | 6-05.3(5) | Manufacture of Steel Piles..... | 6-95 |
| 15 | 6-05.3(6) | Splicing Steel Casings and Steel Piles | 6-96 |
| 16 | 6-05.3(7) | Storage and Handling..... | 6-96 |
| 17 | 6-05.3(7)A | Timber Piles | 6-96 |
| 18 | 6-05.3(7)B | Precast Concrete Piles..... | 6-96 |
| 19 | 6-05.3(7)C | Steel Casings and Steel Piles | 6-96 |
| 20 | 6-05.3(8) | Pile Tips and Shoes | 6-96 |
| 21 | 6-05.3(9) | Pile Driving Equipment | 6-97 |
| 22 | 6-05.3(9)A | Pile Driving Equipment Approval..... | 6-97 |
| 23 | 6-05.3(9)B | Pile Driving Equipment Minimum Requirements | 6-97 |
| 24 | 6-05.3(9)C | Pile Driving Leads | 6-98 |
| 25 | 6-05.3(10) | Test Piles..... | 6-99 |
| 26 | 6-05.3(11) | Driving Piles | 6-99 |
| 27 | 6-05.3(11)A | Tolerances | 6-99 |
| 28 | 6-05.3(11)B | Foundation Pit Preparation | 6-99 |
| 29 | 6-05.3(11)C | Preparation for Driving | 6-99 |
| 30 | 6-05.3(11)D | Achieving Minimum Tip Elevation and Bearing | 6-100 |
| 31 | 6-05.3(11)E | Of Followers or Driving..... | 6-100 |
| 32 | 6-05.3(11)F | Pile Damage | 6-101 |
| 33 | 6-05.3(11)G | Pile Cutoff | 6-101 |
| 34 | 6-05.3(11)H | Pile Driving From or Near Adjacent Structures | 6-101 |
| 35 | 6-05.3(12) | Determination of Bearing Values..... | 6-101 |
| 36 | 6-05.3(13) | Treatment of Timber Pile Heads..... | 6-102 |
| 37 | 6-05.3(14) | Extensions and Build Ups of Precast Concrete Piles | 6-102 |
| 38 | 6-05.3(15) | Completion of Cast in Place Concrete Piles | 6-103 |
| 39 | 6-05.3(15)A | Reinforcement..... | 6-103 |
| 40 | 6-05.3(15)B | Placing Concrete..... | 6-103 |
| 41 | 6-05.4 | Measurement..... | 6-103 |
| 42 | 6-05.5 | Payment | 6-103 |
| 43 | SECTION 6-06 BRIDGE AND PEDESTRIAN RAILINGS | | 6-104 |
| 44 | 6-06.1 | Description..... | 6-104 |
| 45 | 6-06.2 | Materials | 6-105 |
| 46 | 6-06.3 | Construction Requirements | 6-105 |
| 47 | 6-06.3(1) | Timber Wheel Guards and Railings..... | 6-105 |
| 48 | 6-06.3(2) | Metal Railings..... | 6-105 |
| 49 | 6-06.4 | Measurement..... | 6-105 |
| 50 | 6-06.5 | Payment | 6-105 |
| 51 | SECTION 6-07 PAINTING..... | | 6-105 |
| 52 | 6-07.1 | Description..... | 6-105 |
| 53 | 6-07.2 | Materials | 6-106 |
| 54 | 6-07.3 | Construction Requirements | 6-106 |
| 55 | 6-07.3(1) | Work Force Qualifications | 6-106 |
| 56 | 6-07.3(1)A | Work Force Qualifications for Shop Application of Paint | 6-106 |
| 57 | 6-07.3(1)B | Work Force Qualifications for Field Application of Paint..... | 6-106 |
| 58 | 6-07.3(2) | Painting Plan Submittals..... | 6-106 |
| 59 | 6-07.3(2)A | Work Force Qualifications Submittal Component..... | 6-106 |
| 60 | 6-07.3(2)B | Contractor's Quality Control Program Submittal Component | 6-106 |
| 61 | 6-07.3(2)C | Paint System Manufacturer and Paint System Information Submittal Component..... | 6-107 |
| 62 | 6-07.3(2)D | Hazardous Waste Containment, Collection, Testing, and Disposal Submittal Component | 6-107 |
| 63 | | | 6-107 |
| 64 | 6-07.3(2)E | Cleaning and Surface Preparation Equipment Submittal Component..... | 6-107 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---------------------------------|---|-------|
| 1 | 6-07.3(2)F | Paint Application Equipment and Operations Submittal Component..... | 6-107 |
| 2 | 6-07.3(2)G | Painting Plan Meeting | 6-108 |
| 3 | 6-07.3(3) | Quality Control and Quality Assurance..... | 6-108 |
| 4 | 6-07.3(3)A | Quality Control and Quality Assurance for Shop Application of Paint | 6-108 |
| 5 | 6-07.3(3)B | Quality Control and Quality Assurance for Field Application of Paint..... | 6-108 |
| 6 | 6-07.3(4) | Paint System Manufacturer's Technical Representative | 6-108 |
| 7 | 6-07.3(5) | Pre-Painting Conference | 6-109 |
| 8 | 6-07.3(6) | Paint Containers, Storage, and Handling | 6-109 |
| 9 | 6-07.3(6)A | Paint Containers..... | 6-109 |
| 10 | 6-07.3(6)B | Paint Storage | 6-109 |
| 11 | 6-07.3(7) | Paint Sampling and Testing..... | 6-109 |
| 12 | 6-07.3(8) | Equipment | 6-109 |
| 13 | 6-07.3(8)A | Paint Film Thickness Measurement Gages..... | 6-109 |
| 14 | 6-07.3(9) | Painting New Steel Structures..... | 6-109 |
| 15 | 6-07.3(9)A | Paint System..... | 6-110 |
| 16 | 6-07.3(9)B | Paint Color | 6-110 |
| 17 | 6-07.3(9)C | Mixing and Thinning Paint..... | 6-110 |
| 18 | 6-07.3(9)D | Coating Thickness..... | 6-110 |
| 19 | 6-07.3(9)E | Surface Temperature Requirements Before Application of Paint..... | 6-110 |
| 20 | 6-07.3(9)F | Shop Surface Cleaning and Preparation..... | 6-110 |
| 21 | 6-07.3(9)G | Application of Shop Primer Coat | 6-110 |
| 22 | 6-07.3(9)H | Containment for Field Coating..... | 6-110 |
| 23 | 6-07.3(9)I | Application of Field Coatings..... | 6-111 |
| 24 | 6-07.3(10) | Painting Existing Steel Structures | 6-111 |
| 25 | 6-07.3(10)A | Containment..... | 6-111 |
| 26 | 6-07.3(10)B | Bird Guano, Fungus, and Vegetation Removal | 6-111 |
| 27 | 6-07.3(10)C | Dry Cleaning | 6-112 |
| 28 | 6-07.3(10)D | Surface Preparation Before Overcoat Painting | 6-112 |
| 29 | 6-07.3(10)E | Surface Preparation – Full Paint Removal | 6-112 |
| 30 | 6-07.3(10)F | Collecting, Testing, and Disposal of Containment Waste..... | 6-112 |
| 31 | 6-07.3(10)G | Treatment of Pack Rust and Gaps | 6-113 |
| 32 | 6-07.3(10)H | Paint System..... | 6-113 |
| 33 | 6-07.3(10)I | Paint Color | 6-113 |
| 34 | 6-07.3(10)J | Mixing and Thinning Paint..... | 6-113 |
| 35 | 6-07.3(10)K | Coating Thickness..... | 6-114 |
| 36 | 6-07.3(10)L | Environmental Condition Requirements Before Application of Paint..... | 6-114 |
| 37 | 6-07.3(10)M | Steel Surface Condition Requirements Before Application of Paint | 6-114 |
| 38 | 6-07.3(10)N | Field Coating Application Methods..... | 6-114 |
| 39 | 6-07.3(10)O | Applying Field Coatings | 6-115 |
| 40 | 6-07.3(10)P | Field Coating Repair | 6-116 |
| 41 | 6-07.3(10)Q | Cleanup..... | 6-116 |
| 42 | 6-07.3(11) | Painting or Powder Coating of Galvanized Surfaces | 6-116 |
| 43 | 6-07.3(11)A | Painting of Galvanized Surfaces | 6-116 |
| 44 | 6-07.3(11)A1 | Environmental Conditions | 6-116 |
| 45 | 6-07.3(11)A2 | Paint Coat Materials..... | 6-116 |
| 46 | 6-07.3(11)B | Powder Coating of Galvanized Surfaces..... | 6-116 |
| 47 | 6-07.3(11)B1 | Submittals | 6-116 |
| 48 | 6-07.3(11)B2 | Galvanizing | 6-116 |
| 49 | 6-07.3(11)B3 | Galvanized Surface Cleaning and Preparation | 6-117 |
| 50 | 6-07.3(11)B4 | Powder Coating Application and Curing..... | 6-117 |
| 51 | 6-07.3(11)B5 | Testing | 6-117 |
| 52 | 6-07.3(11)B6 | Coating Protection for Shipping, Storage, and Field Erection | 6-117 |
| 53 | 6-07.3(12) | Painting Timber Structures | 6-118 |
| 54 | 6-07.3(12)A | Number of Coats and Color | 6-118 |
| 55 | 6-07.3(12)B | Application | 6-118 |
| 56 | 6-07.3(12)C | Painting Treated Timber..... | 6-118 |
| 57 | 6-07.4 | Measurement..... | 6-118 |
| 58 | 6-07.5 | Payment | 6-118 |
| 59 | SECTION 6-08 WATERPROOFING..... | | 6-119 |
| 60 | 6-08.1 | Description..... | 6-119 |
| 61 | 6-08.2 | Materials..... | 6-119 |
| 62 | 6-08.3 | Construction Requirements | 6-119 |
| 63 | 6-08.3(1) | Storage of Fabric..... | 6-119 |
| 64 | 6-08.3(2) | Preparation of Surface | 6-119 |
| 65 | 6-08.3(3) | Application of Waterproofing | 6-119 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|--|--------------|
| 1 | 6-08.3(4) | Protection Course..... | 6-120 |
| 2 | 6-08.4 | Measurement..... | 6-120 |
| 3 | 6-08.5 | Payment | 6-120 |
| 4 | SECTION 6-09 MODIFIED CONCRETE OVERLAYS..... | | 6-120 |
| 5 | 6-09.1 | Description..... | 6-120 |
| 6 | 6-09.2 | Materials..... | 6-120 |
| 7 | 6-09.3 | Construction Requirements | 6-121 |
| 8 | 6-09.3(1) | Equipment..... | 6-121 |
| 9 | 6-09.3(1)A | Power Driven Hand Tools | 6-121 |
| 10 | 6-09.3(1)B | Rotary Milling Machines..... | 6-122 |
| 11 | 6-09.3(1)C | Hydro-Demolition Machines | 6-122 |
| 12 | 6-09.3(1)D | Shot Blasting Machines..... | 6-122 |
| 13 | 6-09.3(1)E | Air Compressor..... | 6-122 |
| 14 | 6-09.3(1)F | Vacuum Machine | 6-122 |
| 15 | 6-09.3(1)G | Water Spraying System | 6-122 |
| 16 | 6-09.3(1)H | Mobile Mixer for Latex Modified Concrete..... | 6-122 |
| 17 | 6-09.3(1)I | Ready-Mix Trucks for Fly Ash Modified and Microsilica Modified Concrete | 6-124 |
| 18 | 6-09.3(1)J | Finishing Machine | 6-124 |
| 19 | 6-09.3(2) | Submittals..... | 6-124 |
| 20 | 6-09.3(3) | Concrete Overlay Mixes | 6-124 |
| 21 | 6-09.3(3)A | General | 6-124 |
| 22 | 6-09.3(3)B | Concrete Class M..... | 6-124 |
| 23 | 6-09.3(3)C | Fly Ash Modified Concrete | 6-125 |
| 24 | 6-09.3(3)D | Microsilica Modified Concrete | 6-125 |
| 25 | 6-09.3(3)E | Latex Modified Concrete | 6-125 |
| 26 | 6-09.3(4) | Storing and Handling..... | 6-126 |
| 27 | 6-09.3(4)A | Aggregate | 6-126 |
| 28 | 6-09.3(4)B | Latex Admixture | 6-126 |
| 29 | 6-09.3(4)C | High Molecular Weight Methacrylate Resin (HMWM) | 6-126 |
| 30 | 6-09.3(5) | Scarifying Concrete Surface..... | 6-126 |
| 31 | 6-09.3(5)A | General..... | 6-126 |
| 32 | 6-09.3(5)B | Testing Of Hydro-Demolition and Shot Blasting Machines..... | 6-127 |
| 33 | 6-09.3(5)C | Hydro-Demolishing..... | 6-127 |
| 34 | 6-09.3(5)D | Shot Blasting..... | 6-127 |
| 35 | 6-09.3(5)E | Rotomilling | 6-127 |
| 36 | 6-09.3(5)F | Repair of Steel Reinforcing Bars Damaged by Scarifying Operations..... | 6-127 |
| 37 | 6-09.3(5)G | Cleanup Following Scarification | 6-127 |
| 38 | 6-09.3(6) | Further Deck Preparation | 6-127 |
| 39 | 6-09.3(6)A | Equipment for Further Deck Preparation..... | 6-128 |
| 40 | 6-09.3(6)B | Deck Repair Preparation..... | 6-128 |
| 41 | 6-09.3(6)C | Placing Deck Repair Concrete | 6-128 |
| 42 | 6-09.3(7) | Surface Preparation for Concrete Overlay..... | 6-128 |
| 43 | 6-09.3(8) | Quality Assurance | 6-129 |
| 44 | 6-09.3(8)A | Quality Assurance for Microsilica Modified and Fly Ash Modified Concrete Overlays..... | 6-129 |
| 45 | 6-09.3(8)B | Quality Assurance for Latex Modified Concrete Overlays | 6-129 |
| 46 | 6-09.3(9) | Mixing Concrete for Concrete Overlay | 6-130 |
| 47 | 6-09.3(9)A | Mixing Microsilica Modified or Fly Ash Modified Concrete | 6-130 |
| 48 | 6-09.3(9)B | Mixing Latex Modified Concrete | 6-130 |
| 49 | 6-09.3(10) | Overlay Profile and Screed Rails..... | 6-130 |
| 50 | 6-09.3(10)A | Survey of Existing Bridge Deck Before Scarification | 6-130 |
| 51 | 6-09.3(10)B | Establishing Finish Overlay Profile..... | 6-130 |
| 52 | 6-09.3(11) | Placing Concrete Overlay..... | 6-131 |
| 53 | 6-09.3(12) | Finishing Concrete Overlay | 6-132 |
| 54 | 6-09.3(13) | Curing Concrete Overlay..... | 6-132 |
| 55 | 6-09.3(14) | Checking for Bond..... | 6-132 |
| 56 | 6-09.4 | Measurement..... | 6-132 |
| 57 | 6-09.5 | Payment | 6-133 |
| 58 | SECTION 6-10 CONCRETE BARRIER..... | | 6-133 |
| 59 | 6-10.1 | Description..... | 6-133 |
| 60 | 6-10.2 | Materials..... | 6-133 |
| 61 | 6-10.3 | Construction Requirements | 6-134 |
| 62 | 6-10.3(1) | Precast Concrete Barrier..... | 6-134 |
| 63 | 6-10.3(2) | Cast in Place Concrete Barrier | 6-134 |
| 64 | 6-10.3(3) | Removing and Resetting Concrete Barrier | 6-134 |
| 65 | 6-10.3(4) | Joining Precast Concrete Barrier to Cast In-Place Barrier..... | 6-135 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--|--|--------------|
| 1 | 6-10.3(5) | Temporary Concrete Barrier..... | 6-135 |
| 2 | 6-10.3(6) | Placing Concrete Barrier | 6-135 |
| 3 | 6-10.4 | Measurement..... | 6-135 |
| 4 | 6-10.5 | Payment | 6-135 |
| 5 | SECTION 6-11 REINFORCED CONCRETE WALLS..... | | 6-136 |
| 6 | 6-11.1 | Description..... | 6-136 |
| 7 | 6-11.2 | Materials | 6-136 |
| 8 | 6-11.3 | Construction Requirements | 6-136 |
| 9 | 6-11.3(1) | Submittals..... | 6-136 |
| 10 | 6-11.3(2) | Excavation and Foundation Preparation..... | 6-136 |
| 11 | 6-11.3(3) | Precast Concrete Wall Stem Panels | 6-136 |
| 12 | 6-11.3(4) | Cast-In-Place Concrete Construction | 6-137 |
| 13 | 6-11.3(5) | Backfill, Weepholes, and Gutters | 6-137 |
| 14 | 6-11.3(6) | Traffic Barrier and Pedestrian Barrier..... | 6-138 |
| 15 | 6-11.4 | Measurement..... | 6-138 |
| 16 | 6-11.5 | Payment | 6-138 |
| 17 | DIVISION 7 STORM DRAIN, SANITARY AND COMBINED SEWERS, WATER MAINS AND RELATED | | |
| 18 | STRUCTURES 7-1 | | |
| 19 | SECTION 7-01 SUBSURFACE DRAINS..... | | 7-1 |
| 20 | 7-01.1 | Description..... | 7-1 |
| 21 | 7-01.2 | Materials | 7-1 |
| 22 | 7-01.3 | Construction Requirements | 7-1 |
| 23 | 7-01.3(1) | Excavation..... | 7-1 |
| 24 | 7-01.3(2) | Placing Pipe And Filter Material | 7-1 |
| 25 | 7-01.3(3) | Joints..... | 7-1 |
| 26 | 7-01.4 | Measurement..... | 7-1 |
| 27 | 7-01.5 | Payment | 7-2 |
| 28 | SECTION 7-02 RESERVED..... | | 7-2 |
| 29 | SECTION 7-03 RESERVED..... | | 7-2 |
| 30 | SECTION 7-04 RESERVED..... | | 7-2 |
| 31 | SECTION 7-05 MAINTENANCE HOLES, CATCH BASINS, INLETS, JUNCTION BOXES AND BRIDGE DRAINS..... | | 7-2 |
| 32 | 7-05.1 | Description..... | 7-2 |
| 33 | 7-05.2 | Materials | 7-2 |
| 34 | 7-05.3 | Construction Requirements | 7-3 |
| 35 | 7-05.3(1) | Maintenance Hole | 7-3 |
| 36 | 7-05.3(1)A | Foundation Preparation..... | 7-3 |
| 37 | 7-05.3(1)A1 | Dewatering..... | 7-3 |
| 38 | 7-05.3(1)A2 | Foundation Preparation..... | 7-3 |
| 39 | 7-05.3(1)B | Bedding And Foundation Support | 7-3 |
| 40 | 7-05.3(1)C | Reinforced Concrete | 7-3 |
| 41 | 7-05.3(1)C1 | Concrete Mixture..... | 7-3 |
| 42 | 7-05.3(1)C2 | Curing | 7-3 |
| 43 | 7-05.3(1)D | Base Slab..... | 7-3 |
| 44 | 7-05.3(1)D1 | General | 7-3 |
| 45 | 7-05.3(1)D2 | Precast Base..... | 7-3 |
| 46 | 7-05.3(1)D3 | Cast In Place Base..... | 7-3 |
| 47 | 7-05.3(1)E | Precast Wall Sections | 7-3 |
| 48 | 7-05.3(1)F | Precast Cones..... | 7-4 |
| 49 | 7-05.3(1)G | Top Slab..... | 7-4 |
| 50 | 7-05.3(1)H | T Top Pipe Maintenance Holes..... | 7-4 |
| 51 | 7-05.3(1)I | Joints..... | 7-4 |
| 52 | 7-05.3(1)J | Maintenance Hole Channels | 7-4 |
| 53 | 7-05.3(1)K | Maintenance Hole Pipe Connections | 7-4 |
| 54 | 7-05.3(1)L | Maintenance Hole Grade Adjustment | 7-4 |
| 55 | 7-05.3(1)M | Ladder, Steps and Handholds..... | 7-4 |
| 56 | 7-05.3(1)N | Frame and Cover | 7-5 |
| 57 | 7-05.3(1)O | Connections To Existing Maintenance Holes..... | 7-5 |
| 58 | 7-05.3(1)P | Rechannel Existing Maintenance Hole..... | 7-5 |
| 59 | 7-05.3(1)Q | Rebuild Existing Brick Maintenance Hole..... | 7-5 |
| 60 | 7-05.3(2) | Catch Basins And Inlets | 7-5 |
| 61 | 7-05.3(2)A | General | 7-5 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|--|------|
| 1 | 7-05.3(2)B | Pipe Connections for Catch Basins and Inlets | 7-6 |
| 2 | 7-05.3(2)C | Catch Basin Grade Adjustment..... | 7-6 |
| 3 | 7-05.3(2)D | Inlet Grade Adjustment | 7-6 |
| 4 | 7-05.3(2)E | Relocate Existing Catch Basin or Inlet | 7-6 |
| 5 | 7-05.3(2)F | Rebuild Existing Catch Basin | 7-6 |
| 6 | 7-05.3(3) | Junction Box..... | 7-6 |
| 7 | 7-05.3(4) | Bridge Drain | 7-6 |
| 8 | 7-05.4 | Measurement..... | 7-7 |
| 9 | 7-05.5 | Payment | 7-7 |
| 10 | SECTION 7-06 RESERVED | | 7-8 |
| 11 | SECTION 7-07 CLEANING EXISTING DRAINAGE STRUCTURES..... | | 7-8 |
| 12 | 7-07.1 | Description..... | 7-8 |
| 13 | 7-07.2 | Reserved | 7-8 |
| 14 | 7-07.3 | Construction Requirements | 7-8 |
| 15 | 7-07.4 | Measurement..... | 7-8 |
| 16 | 7-07.5 | Payment | 7-8 |
| 17 | SECTION 7-08 MISCELLANEOUS PIPE CONNECTIONS..... | | 7-8 |
| 18 | 7-08.1 | Description..... | 7-8 |
| 19 | 7-08.2 | Materials | 7-8 |
| 20 | 7-08.3 | Construction Requirements | 7-8 |
| 21 | 7-08.3(1) | Excavation, Foundation Preparation, Bedding, and Backfill | 7-8 |
| 22 | 7-08.3(2) | Connections to Existing Sanitary Sewers | 7-8 |
| 23 | 7-08.3(3) | Pipe Installing, Jointing, And Testing..... | 7-8 |
| 24 | 7-08.3(4) | Catch Basin Connections | 7-8 |
| 25 | 7-08.3(5) | Inlet Connections..... | 7-9 |
| 26 | 7-08.3(6) | Drop Connections..... | 7-9 |
| 27 | 7-08.3(7) | Vertical Connections | 7-9 |
| 28 | 7-08.3(8) | Detention Pipe Outlet Connections | 7-9 |
| 29 | 7-08.3(9) | Bridge Downspouts | 7-9 |
| 30 | 7-08.4 | Measurement..... | 7-10 |
| 31 | 7-08.5 | Payment | 7-10 |
| 32 | SECTION 7-09 RESERVED | | 7-11 |
| 33 | SECTION 7-10 RESERVED | | 7-11 |
| 34 | SECTION 7-11 PIPE INSTALLATION FOR WATER MAINS | | 7-11 |
| 35 | 7-11.1 | Description..... | 7-11 |
| 36 | 7-11.2 | Materials | 7-11 |
| 37 | 7-11.2(1) | General..... | 7-11 |
| 38 | 7-11.2(2) | Pre-Installation Taste and Odor Rating Test | 7-11 |
| 39 | 7-11.2(3) | Post Installation Taste and Odor Rating Tests | 7-12 |
| 40 | 7-11.3 | Construction Requirements | 7-12 |
| 41 | 7-11.3(1) | Trench Dewatering, Embankment Fill and Pipe Bedding | 7-12 |
| 42 | 7-11.3(1)A | Dewatering of Trench..... | 7-12 |
| 43 | 7-11.3(1)B | Installing Pipe in Embankment Fill | 7-12 |
| 44 | 7-11.3(1)C | Bedding Rigid Pipe..... | 7-12 |
| 45 | 7-11.3(1)C1 | General | 7-12 |
| 46 | 7-11.3(1)C2 | Bedding For Polyethylene Encased, Multi-Layered Polyethylene Tape Coating, Thermoplastic Powder Coated, Or Special Coated Pipe..... | 7-12 |
| 47 | | | |
| 48 | 7-11.3(1)C3 | Sand bedding at trench crossings | 7-13 |
| 49 | 7-11.3(1)D | Bedding flexible pipe | 7-13 |
| 50 | 7-11.3(2) | Handling of pipe | 7-13 |
| 51 | 7-11.3(2)A | General | 7-13 |
| 52 | 7-11.3(2)B | Handling special coated pipe | 7-13 |
| 53 | 7-11.3(3) | Cutting pipe | 7-14 |
| 54 | 7-11.3(4) | Grade and alignment..... | 7-14 |
| 55 | 7-11.3(4)A | General | 7-14 |
| 56 | 7-11.3(4)B | Verification of location | 7-14 |
| 57 | 7-11.3(4)C | Minimum depth of cover..... | 7-14 |
| 58 | 7-11.3(4)D | Installing pipe on curves..... | 7-14 |
| 59 | 7-11.3(5) | Cleaning and assembling joints..... | 7-14 |
| 60 | 7-11.3(6) | Installing and jointing pipe | 7-14 |
| 61 | 7-11.3(6)A | Installing and jointing ductile iron pipe and appurtenances | 7-14 |
| 62 | 7-11.3(6)B | Installing and jointing polyethylene encased (film wrapped) pipe..... | 7-15 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|---|------|
| 1 | 7-11.3(6)C | Installing and jointing multi layered polyethylene tape coated pipe | 7-15 |
| 2 | 7-11.3(6)D | Installing restrained joint pipe..... | 7-15 |
| 3 | 7-11.3(7) | Installing steel pipe..... | 7-15 |
| 4 | 7-11.3(7)A | Threaded steel pipe less than 4 inches in diameter | 7-15 |
| 5 | 7-11.3(7)B | Coupled pipe 4 inches in diameter and larger | 7-15 |
| 6 | 7-11.3(7)C | Steel casing pipe..... | 7-16 |
| 7 | 7-11.3(7)C1 | General | 7-16 |
| 8 | 7-11.3(7)C2 | Seals and spacers between casing and water main | 7-16 |
| 9 | 7-11.3(8) | Field applied coatings..... | 7-16 |
| 10 | 7-11.3(8)A | Wax tape coating | 7-16 |
| 11 | 7-11.3(9) | Connections | 7-16 |
| 12 | 7-11.3(9)A | Connections to existing water mains | 7-16 |
| 13 | 7-11.3(9)B | Maintaining service | 7-18 |
| 14 | 7-11.3(9)C | Water service connections | 7-18 |
| 15 | 7-11.3(9)C1 | Insulated couplings and flange kits | 7-18 |
| 16 | 7-11.3(9)D | Temporary water mains and services | 7-18 |
| 17 | 7-11.3(9)E | Temporary private water service laterals | 7-18 |
| 18 | 7-11.3(10) | Locating wire | 7-18 |
| 19 | 7-11.3(11) | Hydrostatic Pressure Test | 7-18 |
| 20 | 7-11.3(11)A | Test pressure for field testing water main pipe..... | 7-19 |
| 21 | 7-11.3(11)B | Testing extensions from existing water mains..... | 7-19 |
| 22 | 7-11.3(11)C | Testing section with hydrants installed..... | 7-19 |
| 23 | 7-11.3(11)D | Testing hydrants installed on existing water mains | 7-20 |
| 24 | 7-11.3(12) | Flushing and disinfection of water mains..... | 7-20 |
| 25 | 7-11.3(12)A | General | 7-20 |
| 26 | 7-11.3(12)B | Predisinfection flushing | 7-20 |
| 27 | 7-11.3(12)C | Required contact time | 7-21 |
| 28 | 7-11.3(12)D | Form of applied chlorine..... | 7-21 |
| 29 | 7-11.3(12)E | Chlorine dosage | 7-21 |
| 30 | 7-11.3(12)F | Point of application for liquid/gas disinfection..... | 7-22 |
| 31 | 7-11.3(12)G | Backflow prevention requirement..... | 7-22 |
| 32 | 7-11.3(12)H | Rate of application | 7-22 |
| 33 | 7-11.3(12)I | Disinfection of connections to existing water systems..... | 7-22 |
| 34 | 7-11.3(12)J | Final flushing and testing | 7-22 |
| 35 | 7-11.3(12)K | Repetition of flushing and testing | 7-22 |
| 36 | 7-11.3(12)L | Preflushing and disinfection of water mains by spu (special case) | 7-22 |
| 37 | 7-11.3(13) | Concrete thrust blocking..... | 7-23 |
| 38 | 7-11.3(14) | Blowoff assemblies..... | 7-23 |
| 39 | 7-11.3(15) | Electrolysis monitoring system | 7-23 |
| 40 | 7-11.3(15)A | General | 7-23 |
| 41 | 7-11.3(15)B | Electrical joints for pipe and fittings | 7-23 |
| 42 | 7-11.3(15)B1 | General | 7-23 |
| 43 | 7-11.3(15)B2 | Joint bond cable connections for pipe | 7-23 |
| 44 | 7-11.3(15)B3 | Testing electrolysis test station | 7-23 |
| 45 | 7-11.3(15)C | Electrolysis test station..... | 7-23 |
| 46 | 7-11.3(15)C1 | General | 7-23 |
| 47 | 7-11.3(15)C2 | Zinc reference electrodes..... | 7-24 |
| 48 | 7-11.3(15)C3 | Test station | 7-24 |
| 49 | 7-11.3(15)C4 | Test wires..... | 7-24 |
| 50 | 7-11.3(15)D | Testing and capping exothermic weld connections | 7-24 |
| 51 | 7-11.3(15)D1 | General | 7-24 |
| 52 | 7-11.3(15)D2 | Capping exothermic weld connections | 7-24 |
| 53 | 7-11.3(15)D3 | Testing exothermic weld connections | 7-24 |
| 54 | 7-11.3(15)E | Sacrificial Anode Bonded to Pipe Installation Details | 7-25 |
| 55 | 7-11.3(16) | Electrical insulation of water main | 7-25 |
| 56 | 7-11.3(16)A | General | 7-25 |
| 57 | 7-11.3(16)B | Testing of insulating couplings or insulating flange kits..... | 7-25 |
| 58 | 7-11.4 | Measurement..... | 7-25 |
| 59 | 7-11.5 | Payment | 7-25 |
| 60 | SECTION 7-12 VALVES FOR WATER MAINS | | 7-27 |
| 61 | 7-12.1 | Description..... | 7-27 |
| 62 | 7-12.2 | Materials | 7-27 |
| 63 | 7-12.3 | Construction Requirements | 7-27 |
| 64 | 7-12.3(1) | General..... | 7-27 |
| 65 | 7-12.3(2) | Valve Chambers..... | 7-27 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|---|------|
| 1 | 7-12.3(2)A | General | 7-27 |
| 2 | 7-12.3(2)B | Precast Valve Chambers | 7-27 |
| 3 | 7-12.3(2)C | Chambers Made With Precast Concrete Blocks | 7-27 |
| 4 | 7-12.3(2)D | Cast In Place Chambers | 7-28 |
| 5 | 7-12.3(3) | Setting Frame and Cover | 7-28 |
| 6 | 7-12.3(4) | Setting Valve Box | 7-28 |
| 7 | 7-12.3(5) | Valves Installed On Specially Coated Pipe..... | 7-28 |
| 8 | 7-12.3(6) | Ladders | 7-28 |
| 9 | 7-12.3(7) | Painting of Valves..... | 7-28 |
| 10 | 7-12.3(7)A | Painting at Factory | 7-28 |
| 11 | 7-12.3(7)B | Painting in the Field..... | 7-28 |
| 12 | 7-12.3(8) | Thermoplastic Powder Coating | 7-28 |
| 13 | 7-12.4 | Measurement..... | 7-28 |
| 14 | 7-12.5 | Payment | 7-28 |
| 15 | SECTION 7-13 RESERVED | | 7-29 |
| 16 | SECTION 7-14 HYDRANTS..... | | 7-29 |
| 17 | 7-14.1 | Description..... | 7-29 |
| 18 | 7-14.2 | Material..... | 7-29 |
| 19 | 7-14.3 | Construction Requirements | 7-29 |
| 20 | 7-14.3(1) | Setting Hydrants..... | 7-29 |
| 21 | 7-14.3(2) | Hydrant Connections..... | 7-29 |
| 22 | 7-14.3(2)A | General | 7-29 |
| 23 | 7-14.3(2)B | Hydrant Restraint | 7-29 |
| 24 | 7-14.3(2)C | Auxiliary Gate Valve And Valve Box | 7-30 |
| 25 | 7-14.3(3) | Resetting Existing Hydrants | 7-30 |
| 26 | 7-14.3(4) | Relocating Existing Hydrants..... | 7-30 |
| 27 | 7-14.3(5) | Hydrant Barrel Extensions..... | 7-30 |
| 28 | 7-14.3(6) | Retaining Walls For Hydrants..... | 7-30 |
| 29 | 7-14.3(7) | Hydrants On Water Mains That Are Polyethylene Encased, Multi-Layered Polyethylene Encased, Or Specially Coated | 7-30 |
| 30 | 7-14.3(8) | Hydrant Field Painting..... | 7-30 |
| 31 | 7-14.3(8)A | Below Ground Coating | 7-30 |
| 32 | 7-14.3(8)B | Above Ground Coating..... | 7-30 |
| 33 | 7-14.4 | Measurement..... | 7-30 |
| 34 | 7-14.5 | Payment | 7-31 |
| 35 | SECTION 7-15 WATER SERVICE CONNECTION TRANSFERS | | 7-31 |
| 36 | 7-15.1 | Reserved | 7-31 |
| 37 | 7-15.2 | Reserved | 7-31 |
| 38 | 7-15.3 | Construction Requirements | 7-31 |
| 39 | 7-15.4 | Reserved | 7-31 |
| 40 | 7-15.5 | Payment | 7-31 |
| 41 | SECTION 7-16 FLOW CONTROL STRUCTURE AND DETENTION PIPE..... | | 7-31 |
| 42 | 7-16.1 | Description..... | 7-31 |
| 43 | 7-16.2 | Materials..... | 7-32 |
| 44 | 7-16.3 | Construction Requirements | 7-32 |
| 45 | 7-16.3(1) | General..... | 7-32 |
| 46 | 7-16.3(2) | Flow Control Devices | 7-32 |
| 47 | 7-16.3(2)A | Flow Control Device Assembly..... | 7-32 |
| 48 | 7-16.3(2)B | PVC Shear Gate | 7-32 |
| 49 | 7-16.3(3) | Corrugated Metal Detention Pipe | 7-32 |
| 50 | 7-16.3(4) | Tee Connection to Corrugated Pipe | 7-33 |
| 51 | 7-16.3(5) | Testing..... | 7-33 |
| 52 | 7-16.3(6) | Tee Connection to Steel Reinforced Polyethylene | 7-33 |
| 53 | 7-16.4 | Measurement..... | 7-33 |
| 54 | 7-16.5 | Payment | 7-33 |
| 55 | SECTION 7-17 STORM DRAINS AND SANITARY SEWERS | | 7-33 |
| 56 | 7-17.1 | Description..... | 7-33 |
| 57 | 7-17.2 | Materials..... | 7-33 |
| 58 | 7-17.2(1) | General..... | 7-33 |
| 59 | 7-17.2(2) | Proof Tests (Prequalification) | 7-34 |
| 60 | 7-17.2(3) | Material Certification..... | 7-34 |
| 61 | 7-17.3 | Construction Requirements | 7-34 |
| 62 | 7-17.3(1) | Pipe Bedding | 7-34 |
| 63 | | | |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|--|------|
| 1 | 7-17.3(1)A | Bedding for Concrete Pipe | 7-34 |
| 2 | 7-17.3(1)B | Bedding for Flexible Pipe | 7-35 |
| 3 | 7-17.3(1)C | Bedding for Vitrified Clay Pipe | 7-35 |
| 4 | 7-17.3(1)D | Bedding for Ductile Iron Pipe | 7-35 |
| 5 | 7-17.3(2) | Installing Sewer Pipe | 7-35 |
| 6 | 7-17.3(2)A | Survey Line and Grade | 7-35 |
| 7 | 7-17.3(2)B | Pipe Installation and Jointing | 7-35 |
| 8 | 7-17.3(2)B1 | Pipe Installation..... | 7-35 |
| 9 | 7-17.3(2)B2 | Joints on Curves | 7-35 |
| 10 | 7-17.3(2)C | Plugs and Connections | 7-36 |
| 11 | 7-17.3(2)C1 | General | 7-36 |
| 12 | 7-17.3(2)C2 | Tee Fittings | 7-36 |
| 13 | 7-17.3(2)C3 | Cut In Tee on Existing Or New Pipe..... | 7-36 |
| 14 | 7-17.3(2)D | Gasketed and Compression Sealed Joints | 7-37 |
| 15 | 7-17.3(2)E | Jointing – Break-Out and Reconnect & Mismatched Wall Thickness..... | 7-37 |
| 16 | 7-17.3(2)F | Storm Drain and Sewer Connections | 7-37 |
| 17 | 7-17.3(2)G | Protection of Existing Sewer Facilities | 7-37 |
| 18 | 7-17.3(2)H | Trenchless Construction and Casing Pipe | 7-38 |
| 19 | 7-17.3(2)H1 | General | 7-38 |
| 20 | 7-17.3(2)H2 | Casing Pipe, Spacers and End Sealing | 7-38 |
| 21 | 7-17.3(2)H3 | Trenchless Construction | 7-38 |
| 22 | 7-17.3(2)I | Temporary Sewer Bypass | 7-38 |
| 23 | 7-17.3(3) | Cleaning And Testing | 7-39 |
| 24 | 7-17.3(3)A | General | 7-39 |
| 25 | 7-17.3(3)A1 | Pipe Not Passing Testing..... | 7-39 |
| 26 | 7-17.3(3)B | Exfiltration Test | 7-39 |
| 27 | 7-17.3(3)C | Infiltration Test..... | 7-39 |
| 28 | 7-17.3(3)D | Air Pressure Test | 7-40 |
| 29 | 7-17.3(3)D1 | Test Time | 7-40 |
| 30 | 7-17.3(3)D2 | General Procedure for Conducting Acceptance Test By Pressure Drop Method | 7-41 |
| 31 | 7-17.3(3)E | Hydrostatic Test for Sewer Force Mains | 7-41 |
| 32 | 7-17.3(3)E1 | General | 7-41 |
| 33 | 7-17.3(3)E2 | Equipment | 7-41 |
| 34 | 7-17.3(3)E3 | Procedure | 7-41 |
| 35 | 7-17.3(3)E4 | Duration | 7-41 |
| 36 | 7-17.3(3)E5 | Expelling Air and Filling Pipe..... | 7-41 |
| 37 | 7-17.3(3)E6 | Pressure Test..... | 7-41 |
| 38 | 7-17.3(3)E7 | Leakage Test | 7-41 |
| 39 | 7-17.3(3)E8 | Correction of Excessive Leakage..... | 7-42 |
| 40 | 7-17.3(3)F | Deflection Test for Flexible Pipe..... | 7-42 |
| 41 | 7-17.3(3)G | Television Inspection with Audio Assessment..... | 7-43 |
| 42 | 7-17.4 | Measurement..... | 7-44 |
| 43 | 7-17.5 | Payment | 7-45 |
| 44 | SECTION 7-18 | SIDE SEWERS..... | 7-47 |
| 45 | 7-18.1 | Description..... | 7-47 |
| 46 | 7-18.2 | Materials | 7-47 |
| 47 | 7-18.3 | Construction Requirements | 7-47 |
| 48 | 7-18.3(1) | Side Sewer Construction | 7-47 |
| 49 | 7-18.3(1)A | General | 7-47 |
| 50 | 7-18.3(1)B | Side Sewers Shown On The Drawings | 7-47 |
| 51 | 7-18.3(1)B1 | Protection of Existing Side Sewer | 7-47 |
| 52 | 7-18.3(1)B2 | Remove and Replace Existing Side Sewer | 7-48 |
| 53 | 7-18.3(2) | Excavation, Foundation Preparation, Bedding, And Backfill..... | 7-48 |
| 54 | 7-18.3(3) | Pipe Installation And Jointing | 7-48 |
| 55 | 7-18.3(3)A | General | 7-48 |
| 56 | 7-18.3(3)B | Line and Grade | 7-48 |
| 57 | 7-18.3(3)C | Pipe Installation..... | 7-48 |
| 58 | 7-18.3(3)D | Jointing – New Pipe to Existing Pipe..... | 7-48 |
| 59 | 7-18.3(4) | Fittings..... | 7-48 |
| 60 | 7-18.3(5) | Cleanouts | 7-48 |
| 61 | 7-18.3(6) | Inspection And Testing..... | 7-49 |
| 62 | 7-18.3(6)A | Inspection..... | 7-49 |
| 63 | 7-18.3(6)B | Testing | 7-49 |
| 64 | 7-18.3(7) | Miscellaneous Requirements | 7-49 |
| 65 | 7-18.3(7)A | Pipe and Connections – Private Property | 7-49 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--|--|-------------|
| 1 | 7-18.3(7)B | Proximity to Other Underground Facilities..... | 7-49 |
| 2 | 7-18.3(7)C | Plugs..... | 7-49 |
| 3 | 7-18.3(7)D | Septic Tanks and Cesspools – Private Property..... | 7-49 |
| 4 | 7-18.3(8) | Restoration, Finishing, And Cleanup – Private Construction..... | 7-49 |
| 5 | 7-18.3(9) | Extending Side Sewer Into Private Property..... | 7-49 |
| 6 | 7-18.3(10) | End Pipe Marker..... | 7-50 |
| 7 | 7-18.4 | Measurement..... | 7-50 |
| 8 | 7-18.5 | Payment..... | 7-50 |
| 9 | SECTION 7-19 SEWER CLEANOUT..... | | 7-50 |
| 10 | 7-19.1 | Description..... | 7-50 |
| 11 | 7-19.2 | Materials..... | 7-50 |
| 12 | 7-19.3 | Construction Requirements..... | 7-50 |
| 13 | 7-19.4 | Measurement..... | 7-51 |
| 14 | 7-19.5 | Payment..... | 7-51 |
| 15 | SECTION 7-20 ADJUSTMENT OF NEW AND EXISTING UTILITY STRUCTURES TO FINISH GRADE..... | | 7-51 |
| 16 | 7-20.1 | Description..... | 7-51 |
| 17 | 7-20.2 | Materials..... | 7-51 |
| 18 | 7-20.3 | Construction Requirements..... | 7-51 |
| 19 | 7-20.3(1) | Adjustment of Maintenance Holes, Catch Basins, and Similar Structures..... | 7-51 |
| 20 | 7-20.3(1)A | General..... | 7-51 |
| 21 | 7-20.3(1)B | Cement Concrete Paving Projects..... | 7-52 |
| 22 | 7-20.3(1)C | Asphalt Concrete Paving Projects..... | 7-52 |
| 23 | 7-20.3(1)D | Asphalt Resurfacing Projects..... | 7-52 |
| 24 | 7-20.3(2) | Adjustment of Inlets..... | 7-52 |
| 25 | 7-20.3(3) | Adjustment of Monuments, and Frame and Cover..... | 7-52 |
| 26 | 7-20.3(4) | Adjustment of Valve Box Castings..... | 7-52 |
| 27 | 7-20.3(5) | Furnishing Castings..... | 7-52 |
| 28 | 7-20.3(6) | Replacement of Inlet Grate..... | 7-52 |
| 29 | 7-20.4 | Measurement..... | 7-52 |
| 30 | 7-20.5 | Payment..... | 7-52 |
| 31 | SECTION 7-21 BIORETENTION..... | | 7-53 |
| 32 | 7-21.1 | Description..... | 7-53 |
| 33 | 7-21.2 | Materials..... | 7-53 |
| 34 | 7-21.3 | Construction Requirements..... | 7-54 |
| 35 | 7-21.3(1) | General..... | 7-54 |
| 36 | 7-21.3(1)A | Submittals for Bioretention Soil Mix Design..... | 7-54 |
| 37 | 7-21.3(2) | Bioretention Cells and Earth Berms Construction..... | 7-54 |
| 38 | 7-21.3(2)A | Grading and Placement for Bioretention Cells..... | 7-54 |
| 39 | 7-21.3(2)A1 | General..... | 7-54 |
| 40 | 7-21.3(2)A2 | Excavation..... | 7-55 |
| 41 | 7-21.3(2)A3 | Subgrade..... | 7-55 |
| 42 | 7-21.3(2)A4 | Placement of Bioretention Soil..... | 7-55 |
| 43 | 7-21.3(2)A5 | Final Mulching and Planting..... | 7-56 |
| 44 | 7-21.3(2)B | Grading for Earth Berm..... | 7-56 |
| 45 | 7-21.4 | Measurement..... | 7-56 |
| 46 | 7-21.5 | Payment..... | 7-56 |
| 47 | DIVISION 8 MISCELLANEOUS CONSTRUCTION..... | | 8-1 |
| 48 | SECTION 8-01 CONSTRUCTION STORMWATER POLLUTION PREVENTION..... | | 8-1 |
| 49 | 8-01.1 | Description..... | 8-1 |
| 50 | 8-01.2 | Materials..... | 8-1 |
| 51 | 8-01.3 | Construction Requirements..... | 8-1 |
| 52 | 8-01.3(1) | General..... | 8-1 |
| 53 | 8-01.3(2) | Construction Stormwater Pollution Prevention Submittals..... | 8-2 |
| 54 | 8-01.3(2)A | Construction Stormwater and Erosion Control Plan (CSECP)..... | 8-2 |
| 55 | 8-01.3(2)B | Tree, Vegetation and Soil Protection Plan (TVSPP)..... | 8-3 |
| 56 | 8-01.3(2)C | Spill Plan..... | 8-4 |
| 57 | 8-01.3(2)D | Temporary Discharge Plan..... | 8-6 |
| 58 | 8-01.3(2)E | Dewatering Plan..... | 8-7 |
| 59 | 8-01.3(3) | Maintaining CSECP and TVSPP Current..... | 8-7 |
| 60 | 8-01.3(4) | Authority of Construction Stormwater Pollution Prevention Coordinator..... | 8-7 |
| 61 | 8-01.3(5) | Erosion Control Seeding..... | 8-7 |
| 62 | 8-01.3(5)A | General..... | 8-7 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|--|------|
| 1 | 8-01.3(5)B | Cultivation | 8-7 |
| 2 | 8-01.3(5)C | Compaction | 8-7 |
| 3 | 8-01.3(5)D | Seeding | 8-8 |
| 4 | 8-01.3(5)E | Hydroseeding | 8-8 |
| 5 | 8-01.3(5)F | Seeding With Blower-Applied Compost | 8-8 |
| 6 | 8-01.3(5)G | Establishment Period and Maintenance | 8-8 |
| 7 | 8-01.3(6) | Erosion Control Mulching | 8-9 |
| 8 | 8-01.3(6)A | General | 8-9 |
| 9 | 8-01.3(6)B | Straw Mulch | 8-9 |
| 10 | 8-01.3(6)C | Arborist Wood Chip Mulch | 8-9 |
| 11 | 8-01.3(6)D | Bark Mulch | 8-9 |
| 12 | 8-01.3(6)E | Wood Cellulose Fiber Mulch | 8-9 |
| 13 | 8-01.3(6)F | Compost Blanket (Compost Mulch)..... | 8-10 |
| 14 | 8-01.3(7) | Erosion Control Matting | 8-10 |
| 15 | 8-01.3(7)A | General | 8-10 |
| 16 | 8-01.3(7)B | Non-Ditch and Non-Channel Matting Installation | 8-10 |
| 17 | 8-01.3(7)C | Ditch and Channel Matting Installation | 8-10 |
| 18 | 8-01.3(8) | Plastic Covering | 8-10 |
| 19 | 8-01.3(9) | Structural and Biomechanical Erosion Controls | 8-11 |
| 20 | 8-01.3(9)A | Equipment Wash Area | 8-11 |
| 21 | 8-01.3(9)B | Road Stabilization and Stabilized Construction Entrance | 8-11 |
| 22 | 8-01.3(10) | Temporary Sediment Controls..... | 8-12 |
| 23 | 8-01.3(10)A | Silt Fence (Sediment Fence or Filter Fence)..... | 8-12 |
| 24 | 8-01.3(10)B | Sediment Removal..... | 8-12 |
| 25 | 8-01.3(10)C | Damaged Fence Repair | 8-12 |
| 26 | 8-01.3(11) | Shear Boards | 8-13 |
| 27 | 8-01.3(12) | Protection of the Drainage and Sewer System..... | 8-13 |
| 28 | 8-01.3(12)A | Prevent Blockage of Surface Flow Path..... | 8-13 |
| 29 | 8-01.3(12)B | Inlet and Catch Basin Protection..... | 8-13 |
| 30 | 8-01.3(12)C | Cleaning Inlets and Catch Basins | 8-13 |
| 31 | 8-01.3(12)D | Temporary Discharge of Groundwater, Process Water and Stormwater | 8-13 |
| 32 | 8-01.3(13) | Compost Socks, Compost Berms, and Straw Wattles..... | 8-14 |
| 33 | 8-01.3(13)A | Compost Socks..... | 8-14 |
| 34 | 8-01.3(13)B | Compost Berms | 8-14 |
| 35 | 8-01.3(13)C | Straw Wattles | 8-15 |
| 36 | 8-01.3(14) | Erosion and Sediment Control Maintenance | 8-15 |
| 37 | 8-01.3(15) | Removal and Reuse of Temporary Erosion and Sediment Controls | 8-15 |
| 38 | 8-01.3(16) | Sweeping and Washing..... | 8-15 |
| 39 | 8-01.4 | Measurement..... | 8-15 |
| 40 | 8-01.5 | Payment | 8-15 |
| 41 | SECTION 8-02 LANDSCAPE CONSTRUCTION | | 8-16 |
| 42 | 8-02.1 | Description..... | 8-16 |
| 43 | 8-02.2 | Materials | 8-16 |
| 44 | 8-02.3 | Construction Requirements | 8-16 |
| 45 | 8-02.3(1) | Responsibility During Construction..... | 8-16 |
| 46 | 8-02.3(1)A | General | 8-16 |
| 47 | 8-02.3(1)B | Landscape Contractor Qualifications | 8-16 |
| 48 | 8-02.3(2) | Topsoil, Planting Soil, and Turf Area Soil | 8-16 |
| 49 | 8-02.3(2)A | General | 8-16 |
| 50 | 8-02.3(2)B | Topsoil Type A – (Imported)..... | 8-17 |
| 51 | 8-02.3(2)C | Reused and Amended Site Soil | 8-17 |
| 52 | 8-02.3(2)D | Turf Area Soil | 8-17 |
| 53 | 8-02.3(2)E | Planting Soil..... | 8-17 |
| 54 | 8-02.3(2)F | High Performance Turf Soil..... | 8-17 |
| 55 | 8-02.3(3) | Pesticides..... | 8-17 |
| 56 | 8-02.3(4) | Planting Area Preparation | 8-18 |
| 57 | 8-02.3(5) | Layout of Planting..... | 8-18 |
| 58 | 8-02.3(6) | Planting | 8-19 |
| 59 | 8-02.3(6)A | General | 8-19 |
| 60 | 8-02.3(6)B | Trees..... | 8-19 |
| 61 | 8-02.3(6)C | Shrubs and Groundcovers | 8-19 |
| 62 | 8-02.3(7) | Pruning and Staking..... | 8-20 |
| 63 | 8-02.3(7)A | Pruning..... | 8-20 |
| 64 | 8-02.3(7)B | Staking..... | 8-20 |
| 65 | 8-02.3(8) | Fertilizers..... | 8-20 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|--|------|
| 1 | 8-02.3(9) | Mulch..... | 8-20 |
| 2 | 8-02.3(9)A | Rock Mulch..... | 8-21 |
| 3 | 8-02.3(10) | Soil Amendments..... | 8-21 |
| 4 | 8-02.3(11) | Cleanup..... | 8-21 |
| 5 | 8-02.3(12) | Landscape Establishment..... | 8-21 |
| 6 | 8-02.3(13) | Plant Replacement..... | 8-22 |
| 7 | 8-02.3(14) | Lawn Installation..... | 8-22 |
| 8 | 8-02.3(14)A | General..... | 8-22 |
| 9 | 8-02.3(14)B | Seeded Lawns..... | 8-23 |
| 10 | 8-02.3(14)C | Sodded Lawns..... | 8-23 |
| 11 | 8-02.3(15) | Lawn Establishment..... | 8-24 |
| 12 | 8-02.3(16) | Removable Paver Blocks in Tree Pits..... | 8-24 |
| 13 | 8-02.3(17) | Turf Reinforcing Grid Blocks..... | 8-24 |
| 14 | 8-02.3(18) | Edging..... | 8-25 |
| 15 | 8-02.3(18)A | Edging, Cedar..... | 8-25 |
| 16 | 8-02.3(18)B | Edging, Paver Restraint System..... | 8-25 |
| 17 | 8-02.3(18)C | Edging, Landscape Timbers..... | 8-25 |
| 18 | 8-02.3(19) | Bollards..... | 8-25 |
| 19 | 8-02.3(19)A | General..... | 8-25 |
| 20 | 8-02.3(19)B | Wood Bollards..... | 8-25 |
| 21 | 8-02.3(19)C | Concrete Bollards..... | 8-25 |
| 22 | 8-02.3(19)D | Steel Bollards..... | 8-25 |
| 23 | 8-02.3(20) | Benches..... | 8-25 |
| 24 | 8-02.3(21) | Tree Grates..... | 8-25 |
| 25 | 8-02.3(22) | Relocate Tree..... | 8-26 |
| 26 | 8-02.3(23) | Tree Root Pruning Procedure..... | 8-26 |
| 27 | 8-02.3(24) | Tunneling or Trenching, and Tree Roots..... | 8-26 |
| 28 | 8-02.3(25) | Mowing..... | 8-26 |
| 29 | 8-02.3(26) | Tree Root Barriers..... | 8-27 |
| 30 | 8-02.4 | Measurement..... | 8-27 |
| 31 | 8-02.5 | Payment..... | 8-27 |
| 32 | SECTION 8-03 IRRIGATION SYSTEM..... | | 8-29 |
| 33 | 8-03.1 | Description..... | 8-29 |
| 34 | 8-03.2 | Materials..... | 8-29 |
| 35 | 8-03.2(1) | Applicable Electrical Codes..... | 8-29 |
| 36 | 8-03.3 | Construction Requirements..... | 8-29 |
| 37 | 8-03.3(1) | General..... | 8-29 |
| 38 | 8-03.3(2) | Layout of Irrigation System..... | 8-30 |
| 39 | 8-03.3(3) | Excavation..... | 8-30 |
| 40 | 8-03.3(4) | Piping..... | 8-30 |
| 41 | 8-03.3(5) | Jointing..... | 8-31 |
| 42 | 8-03.3(6) | Installation..... | 8-31 |
| 43 | 8-03.3(7) | Electrical Wire and Controller Installation..... | 8-31 |
| 44 | 8-03.3(8) | Backflow Prevention Assembly (BPA)..... | 8-32 |
| 45 | 8-03.3(9) | Flushing and Testing..... | 8-32 |
| 46 | 8-03.3(10) | Adjusting System..... | 8-33 |
| 47 | 8-03.3(11) | Backfill..... | 8-33 |
| 48 | 8-03.3(12) | As Built Drawings, O&M Manual, and System Orientation..... | 8-33 |
| 49 | 8-03.3(13) | System Operation Inspection..... | 8-34 |
| 50 | 8-03.4 | Measurement..... | 8-34 |
| 51 | 8-03.5 | Payment..... | 8-34 |
| 52 | SECTION 8-04 CEMENT CONCRETE CURB, CURB AND GUTTER..... | | 8-35 |
| 53 | 8-04.1 | Description..... | 8-35 |
| 54 | 8-04.2 | Materials..... | 8-35 |
| 55 | 8-04.3 | Construction Requirements..... | 8-35 |
| 56 | 8-04.3(1) | General..... | 8-35 |
| 57 | 8-04.3(1)A | Erecting Forms..... | 8-35 |
| 58 | 8-04.3(1)B | Placing Concrete..... | 8-35 |
| 59 | 8-04.3(1)C | Dowels..... | 8-36 |
| 60 | 8-04.3(1)D | Stripping Forms and Finishing..... | 8-36 |
| 61 | 8-04.3(1)E | Curing..... | 8-36 |
| 62 | 8-04.3(1)F | Expansion and Dummy Joints..... | 8-36 |
| 63 | 8-04.3(1)G | Finished Work..... | 8-36 |
| 64 | 8-04.3(2) | Curb Block Outs at Curb Ramps..... | 8-36 |
| 65 | 8-04.3(3) | Type 410B Curb and Gutter..... | 8-36 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | |
|----|---|------|
| 1 | 8-04.3(4) Type 410C Curb | 8-36 |
| 2 | 8-04.3(4)A Cement Concrete Curb on Existing Pavement..... | 8-36 |
| 3 | 8-04.3(4)B Cement Concrete Curb on New Pavement | 8-37 |
| 4 | 8-04.3(5) Mountable Curb..... | 8-37 |
| 5 | 8-04.4 Measurement..... | 8-37 |
| 6 | 8-04.5 Payment | 8-37 |
| 7 | SECTION 8-05 RESERVED | 8-37 |
| 8 | SECTION 8-06 EXTRUDED CURB..... | 8-37 |
| 9 | 8-06.1 Description..... | 8-37 |
| 10 | 8-06.2 Materials | 8-37 |
| 11 | 8-06.3 Construction Requirements | 8-38 |
| 12 | 8-06.3(1) Preparation of Pavement Surface | 8-38 |
| 13 | 8-06.3(1)A Extruded Asphalt Concrete Curb..... | 8-38 |
| 14 | 8-06.3(1)B Extruded Cement Concrete Curb..... | 8-38 |
| 15 | 8-06.3(2) Equipment for Laying Curb..... | 8-38 |
| 16 | 8-06.3(2)A Extruded Asphalt Concrete Curb..... | 8-38 |
| 17 | 8-06.3(2)B Extruded Cement Concrete Curb | 8-38 |
| 18 | 8-06.3(3) Mixing and Placing | 8-38 |
| 19 | 8-06.3(3)A Extruded Asphalt Concrete Curb..... | 8-38 |
| 20 | 8-06.3(3)B Extruded Cement Concrete Curb | 8-38 |
| 21 | 8-06.3(4) Joints..... | 8-38 |
| 22 | 8-06.3(4)A Extruded Asphalt Concrete Curb..... | 8-38 |
| 23 | 8-06.3(4)B Extruded Cement Concrete Curb | 8-38 |
| 24 | 8-06.3(5) Curing Extruded Cement Concrete Curb..... | 8-38 |
| 25 | 8-06.3(6) Protection from Traffic | 8-38 |
| 26 | 8-06.3(7) Substitutions..... | 8-39 |
| 27 | 8-06.4 Measurement..... | 8-39 |
| 28 | 8-06.5 Payment | 8-39 |
| 29 | SECTION 8-07 PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB..... | 8-39 |
| 30 | 8-07.1 Description..... | 8-39 |
| 31 | 8-07.2 Materials | 8-39 |
| 32 | 8-07.3 Construction Requirements | 8-39 |
| 33 | 8-07.3(1) Installing Curbs..... | 8-39 |
| 34 | 8-07.3(2) Painting of Curbs..... | 8-40 |
| 35 | 8-07.4 Measurement..... | 8-40 |
| 36 | 8-07.5 Payment | 8-40 |
| 37 | SECTION 8-08 PLASTIC LANE MARKERS AND TRAFFIC BUTTONS | 8-40 |
| 38 | 8-08.1 Description..... | 8-40 |
| 39 | 8-08.2 Materials | 8-40 |
| 40 | 8-08.3 Construction Requirements | 8-40 |
| 41 | 8-08.3(1) General..... | 8-40 |
| 42 | 8-08.3(2) Surface Preparation | 8-40 |
| 43 | 8-08.3(3) Adhesive Preparation | 8-41 |
| 44 | 8-08.3(4) Application Procedure | 8-41 |
| 45 | 8-08.4 Measurement..... | 8-41 |
| 46 | 8-08.5 Payment | 8-41 |
| 47 | SECTION 8-09 RESERVED | 8-41 |
| 48 | SECTION 8-10 FLEXIBLE DELINEATOR POSTS | 8-41 |
| 49 | 8-10.1 Description..... | 8-41 |
| 50 | 8-10.2 Materials | 8-41 |
| 51 | 8-10.3 Construction Requirements | 8-42 |
| 52 | 8-10.4 Measurement..... | 8-42 |
| 53 | 8-10.5 Payment | 8-42 |
| 54 | SECTION 8-11 GUARDRAIL..... | 8-42 |
| 55 | 8-11.1 Description..... | 8-42 |
| 56 | 8-11.2 Materials | 8-42 |
| 57 | 8-11.3 Construction Requirements | 8-42 |
| 58 | 8-11.3(1) Beam Guardrail | 8-42 |
| 59 | 8-11.3(1)A Erection of Posts..... | 8-42 |
| 60 | 8-11.3(1)B Erection of Rail..... | 8-42 |
| 61 | 8-11.3(1)C Anchor Installation..... | 8-43 |
| 62 | 8-11.3(1)D Guardrail Shop Drawings | 8-43 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|---|------|
| 1 | 8-11.3(2) | Guardrail Construction Exposed to Traffic..... | 8-43 |
| 2 | 8-11.3(3) | Access Control Gates..... | 8-43 |
| 3 | 8-11.3(4) | Raising Guardrail..... | 8-43 |
| 4 | 8-11.4 | Measurement..... | 8-43 |
| 5 | 8-11.5 | Payment..... | 8-43 |
| 6 | SECTION 8-12 CHAIN LINK FENCE AND WIRE FENCE..... | | 8-44 |
| 7 | 8-12.1 | Description..... | 8-44 |
| 8 | 8-12.2 | Materials..... | 8-44 |
| 9 | 8-12.3 | Construction Requirements..... | 8-44 |
| 10 | 8-12.3(1) | General..... | 8-44 |
| 11 | 8-12.3(2) | Chain Link Fence and Gates..... | 8-44 |
| 12 | 8-12.3(2)A | Posts..... | 8-44 |
| 13 | 8-12.3(2)B | Top Rail..... | 8-45 |
| 14 | 8-12.3(2)C | Tension Wire..... | 8-45 |
| 15 | 8-12.3(2)D | Chain Link Fabric..... | 8-45 |
| 16 | 8-12.3(2)E | Chain Link Gates..... | 8-45 |
| 17 | 8-12.3(3) | Wire Fence and Gates..... | 8-46 |
| 18 | 8-12.3(3)A | Posts..... | 8-46 |
| 19 | 8-12.3(3)B | Barbed Wire and Wire Mesh..... | 8-46 |
| 20 | 8-12.3(3)C | Vertical Cinch Stays..... | 8-47 |
| 21 | 8-12.3(3)D | Wire Gates..... | 8-47 |
| 22 | 8-12.4 | Measurement..... | 8-47 |
| 23 | 8-12.5 | Payment..... | 8-47 |
| 24 | SECTION 8-13 MONUMENT CASES..... | | 8-47 |
| 25 | 8-13.1 | Description..... | 8-47 |
| 26 | 8-13.2 | Materials..... | 8-47 |
| 27 | 8-13.3 | Construction Requirements..... | 8-47 |
| 28 | 8-13.3(1) | Reference Points – General..... | 8-47 |
| 29 | 8-13.3(2) | Furnish and Place Monument Castings..... | 8-48 |
| 30 | 8-13.3(3) | Adjust Existing Monument Castings to Grade..... | 8-48 |
| 31 | 8-13.3(4) | Reset or Relocate Monument Castings..... | 8-48 |
| 32 | 8-13.3(5) | Missing and Broken Castings, and Extra Work..... | 8-48 |
| 33 | 8-13.4 | Measurement..... | 8-48 |
| 34 | 8-13.5 | Payment..... | 8-48 |
| 35 | SECTION 8-14 CEMENT CONCRETE SIDEWALK..... | | 8-49 |
| 36 | 8-14.1 | Description..... | 8-49 |
| 37 | 8-14.2 | Materials..... | 8-49 |
| 38 | 8-14.3 | Construction Requirements..... | 8-49 |
| 39 | 8-14.3(1) | General..... | 8-49 |
| 40 | 8-14.3(2) | Excavation and Subgrade..... | 8-49 |
| 41 | 8-14.3(3) | Forms and Fine Grading..... | 8-49 |
| 42 | 8-14.3(4) | Placing and Finishing Concrete..... | 8-50 |
| 43 | 8-14.3(4)A | Placing Concrete..... | 8-50 |
| 44 | 8-14.3(4)B | Finishing Concrete..... | 8-50 |
| 45 | 8-14.3(5) | Curing and Protection..... | 8-50 |
| 46 | 8-14.3(6) | Through and Contraction Joints..... | 8-50 |
| 47 | 8-14.3(7) | Curb Ramp..... | 8-51 |
| 48 | 8-14.3(7)A | Submittal..... | 8-51 |
| 49 | 8-14.3(7)B | Curb Ramp..... | 8-51 |
| 50 | 8-14.3(7)C | Reserved..... | 8-52 |
| 51 | 8-14.3(7)D | Detectable Warning Plate Retrofit..... | 8-52 |
| 52 | 8-14.3(8) | Patterned, Colored, and Exposed Aggregate Treatments..... | 8-52 |
| 53 | 8-14.3(9) | Bus Shelter Footing..... | 8-52 |
| 54 | 8-14.3(10) | Stripping Forms and Finishing – Monolithic Curb and Sidewalk..... | 8-52 |
| 55 | 8-14.4 | Measurement..... | 8-53 |
| 56 | 8-14.5 | Payment..... | 8-53 |
| 57 | SECTION 8-15 RIPRAP..... | | 8-54 |
| 58 | 8-15.1 | Description..... | 8-54 |
| 59 | 8-15.2 | Materials..... | 8-54 |
| 60 | 8-15.3 | Construction Requirements..... | 8-55 |
| 61 | 8-15.3(1) | General..... | 8-55 |
| 62 | 8-15.3(2) | Loose Riprap..... | 8-55 |
| 63 | 8-15.3(3) | Hand Placed Riprap..... | 8-55 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--|--|------|
| 1 | 8-15.3(4) | Sack Riprap..... | 8-55 |
| 2 | 8-15.3(5) | Concrete Slab Riprap..... | 8-55 |
| 3 | 8-15.3(5)A | Concrete Slab for Hydrant Wall Requirements..... | 8-55 |
| 4 | 8-15.3(6) | Quarry Spalls..... | 8-56 |
| 5 | 8-15.3(7) | Filter Blanket..... | 8-56 |
| 6 | 8-15.4 | Measurement..... | 8-56 |
| 7 | 8-15.5 | Payment..... | 8-56 |
| 8 | SECTION 8-16 CONCRETE SLOPE PROTECTION..... | | 8-56 |
| 9 | 8-16.1 | Description..... | 8-56 |
| 10 | 8-16.2 | Materials..... | 8-56 |
| 11 | 8-16.3 | Construction Requirements..... | 8-57 |
| 12 | 8-16.3(1) | Footing and Preparation Of Slope..... | 8-57 |
| 13 | 8-16.3(2) | Placing Semi Open Concrete Masonry Units..... | 8-57 |
| 14 | 8-16.3(3) | Cast in Place Cement Concrete..... | 8-57 |
| 15 | 8-16.3(4) | Pneumatically Placed Concrete..... | 8-57 |
| 16 | 8-16.4 | Measurement..... | 8-58 |
| 17 | 8-16.5 | Payment..... | 8-58 |
| 18 | SECTION 8-17 CURB WALL AND SUPPORT WALL..... | | 8-58 |
| 19 | 8-17.1 | Description..... | 8-58 |
| 20 | 8-17.2 | Materials..... | 8-58 |
| 21 | 8-17.3 | Construction Requirements..... | 8-58 |
| 22 | 8-17.3(1) | General..... | 8-58 |
| 23 | 8-17.3(2) | Curb Wall..... | 8-58 |
| 24 | 8-17.3(3) | Support Wall..... | 8-58 |
| 25 | 8-17.4 | Measurement..... | 8-58 |
| 26 | 8-17.5 | Payment..... | 8-58 |
| 27 | SECTION 8-18 CEMENT CONCRETE STAIRWAYS, LANDINGS, AND STEPS..... | | 8-59 |
| 28 | 8-18.1 | Description..... | 8-59 |
| 29 | 8-18.2 | Materials..... | 8-59 |
| 30 | 8-18.3 | Construction Requirements..... | 8-59 |
| 31 | 8-18.3(1) | Site Preparation and Grading..... | 8-59 |
| 32 | 8-18.3(2) | Subgrade Preparation and Forms..... | 8-59 |
| 33 | 8-18.3(3) | Reinforcing Steel..... | 8-59 |
| 34 | 8-18.3(4) | Handrail..... | 8-59 |
| 35 | 8-18.3(5) | Placing, Finishing, and Curing Concrete..... | 8-60 |
| 36 | 8-18.3(6) | Gutter..... | 8-60 |
| 37 | 8-18.3(7) | Steps..... | 8-60 |
| 38 | 8-18.3(8) | Bike Runnels..... | 8-60 |
| 39 | 8-18.4 | Measurement..... | 8-60 |
| 40 | 8-18.5 | Payment..... | 8-60 |
| 41 | SECTION 8-19 CEMENT CONCRETE DRIVEWAY AND ALLEY..... | | 8-61 |
| 42 | 8-19.1 | Description..... | 8-61 |
| 43 | 8-19.2 | Materials..... | 8-61 |
| 44 | 8-19.3 | Construction Requirements..... | 8-61 |
| 45 | 8-19.3(1) | Excavation and Subgrade..... | 8-61 |
| 46 | 8-19.3(2) | Forms and Fine Grading..... | 8-62 |
| 47 | 8-19.3(3) | Placing and Finishing Cement Concrete Driveway and Alley..... | 8-62 |
| 48 | 8-19.3(4) | Curing and Protection..... | 8-62 |
| 49 | 8-19.4 | Measurement..... | 8-62 |
| 50 | 8-19.5 | Payment..... | 8-62 |
| 51 | SECTION 8-20 RESERVED..... | | 8-63 |
| 52 | SECTION 8-21 PERMANENT SIGNING AND POSTS..... | | 8-63 |
| 53 | 8-21.1 | Description..... | 8-63 |
| 54 | 8-21.2 | Materials..... | 8-63 |
| 55 | 8-21.3 | Construction Requirements..... | 8-63 |
| 56 | 8-21.3(1) | General..... | 8-63 |
| 57 | 8-21.3(1)A | Signs..... | 8-64 |
| 58 | 8-21.3(1)A1 | Traffic Sign..... | 8-64 |
| 59 | 8-21.3(1)A2 | Street Designation Signs..... | 8-64 |
| 60 | 8-21.3(1)A3 | Street Name Signs..... | 8-64 |
| 61 | 8-21.3(1)A4 | Bus Zone Signs, Numbered Base Plates and Signs Associated with Parking Pay Stations, and Other Signs..... | 8-64 |
| 62 | | | |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|---|------|
| 1 | 8-21.3(1)B | Mounting Signs | 8-64 |
| 2 | 8-21.3(1)B1 | General | 8-64 |
| 3 | 8-21.3(1)B2 | Mounted to Wood Post..... | 8-64 |
| 4 | 8-21.3(1)B3 | Mounted to Steel, Aluminum, or Concrete Pole | 8-64 |
| 5 | 8-21.3(1)B4 | Mounted to Parking Meter Post..... | 8-64 |
| 6 | 8-21.3(1)B5 | Mounted to Span Wire or Mast Arms | 8-64 |
| 7 | 8-21.3(1)B6 | Mounted to Telespar Qwik-Punch Sign Post..... | 8-65 |
| 8 | 8-21.3(1)B7 | Mounting Street Name Sign to Post..... | 8-65 |
| 9 | 8-21.3(2) | Post Installation | 8-65 |
| 10 | 8-21.3(2)A | Sign Post Installation..... | 8-65 |
| 11 | 8-21.3(2)A1 | General | 8-65 |
| 12 | 8-21.3(2)A2 | Street Name, and Steel Pipe Sign Post Installation | 8-65 |
| 13 | 8-21.3(2)A3 | Telespar Qwik-Punch and Wood Sign Post Installation | 8-65 |
| 14 | 8-21.3(3) | Sign Covering..... | 8-65 |
| 15 | 8-21.3(4) | Sign Relocation | 8-65 |
| 16 | 8-21.3(5) | Sign Cleaning | 8-65 |
| 17 | 8-21.4 | Measurement..... | 8-65 |
| 18 | 8-21.5 | Payment | 8-66 |
| 19 | SECTION 8-22 PAVEMENT MARKING | | 8-66 |
| 20 | 8-22.1 | Description..... | 8-66 |
| 21 | 8-22.1(1) | General..... | 8-66 |
| 22 | 8-22.1(2) | Pavement Marking Designations..... | 8-66 |
| 23 | 8-22.2 | Materials | 8-68 |
| 24 | 8-22.3 | Construction Requirements | 8-68 |
| 25 | 8-22.3(1) | Preliminary Spotting | 8-68 |
| 26 | 8-22.3(2) | Preparation of Surfaces..... | 8-69 |
| 27 | 8-22.3(3) | Marking Application | 8-69 |
| 28 | 8-22.3(3)A | Marking Colors | 8-69 |
| 29 | 8-22.3(3)B | Line Patterns | 8-69 |
| 30 | 8-22.3(3)C | Line Surfaces | 8-69 |
| 31 | 8-22.3(3)D | Line Applications..... | 8-69 |
| 32 | 8-22.3(3)E | Installation | 8-69 |
| 33 | 8-22.3(3)F | Application Thickness | 8-70 |
| 34 | 8-22.3(3)G | Glass Beads..... | 8-72 |
| 35 | 8-22.3(4) | Tolerances for Lines..... | 8-72 |
| 36 | 8-22.3(5) | Installation Instructions | 8-72 |
| 37 | 8-22.3(5)A | Plastic Markings..... | 8-72 |
| 38 | 8-22.3(5)B | Pressure Sensitive Tape Pavement Marking | 8-72 |
| 39 | 8-22.3(6) | Removal of Pavement Marking | 8-72 |
| 40 | 8-22.3(7) | Temporary Pavement Marking | 8-72 |
| 41 | 8-22.3(8) | Locating Bicycle Detector Loop Symbol | 8-72 |
| 42 | 8-22.4 | Measurement..... | 8-72 |
| 43 | 8-22.5 | Payment | 8-73 |
| 44 | SECTION 8-23 RESERVED | | 8-73 |
| 45 | SECTION 8-24 RESERVED | | 8-73 |
| 46 | SECTION 8-25 GLARE SCREEN..... | | 8-73 |
| 47 | 8-25.1 | Description..... | 8-73 |
| 48 | 8-25.2 | Materials | 8-73 |
| 49 | 8-25.3 | Construction Requirements | 8-73 |
| 50 | 8-25.3(1) | Glare Screen Fabric | 8-73 |
| 51 | 8-25.3(2) | Slats | 8-74 |
| 52 | 8-25.3(3) | Posts | 8-74 |
| 53 | 8-25.3(4) | Tension Wire | 8-74 |
| 54 | 8-25.3(5) | Tension Cables | 8-74 |
| 55 | 8-25.3(6) | Fittings, Attachments, and Hardware | 8-74 |
| 56 | 8-25.4 | Measurement..... | 8-74 |
| 57 | 8-25.5 | Payment | 8-74 |
| 58 | SECTION 8-26 RESERVED | | 8-74 |
| 59 | SECTION 8-27 PROJECT IDENTIFICATION SIGN..... | | 8-74 |
| 60 | 8-27.1 | Description..... | 8-74 |
| 61 | 8-27.2 | Materials and Fabrication | 8-75 |
| 62 | 8-27.2(1) | General..... | 8-75 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|--|------|
| 1 | 8-27.2(2) | Plywood..... | 8-75 |
| 2 | 8-27.2(3) | Sign Borders..... | 8-75 |
| 3 | 8-27.2(4) | Lettering and Spacing Formula | 8-75 |
| 4 | 8-27.2(5) | Sign Supports..... | 8-75 |
| 5 | 8-27.3 | Construction Requirements | 8-75 |
| 6 | 8-27.3(1) | Location of Signs..... | 8-75 |
| 7 | 8-27.3(2) | Sign Removal..... | 8-75 |
| 8 | 8-27.4 | Measurement..... | 8-75 |
| 9 | 8-27.5 | Payment | 8-76 |
| 10 | SECTION 8-28 | RESERVED..... | 8-76 |
| 11 | SECTION 8-29 | WIRE MESH SLOPE PROTECTION..... | 8-76 |
| 12 | 8-29.1 | Description..... | 8-76 |
| 13 | 8-29.2 | Materials..... | 8-76 |
| 14 | 8-29.3 | Construction Requirements | 8-76 |
| 15 | 8-29.3(1) | Anchors..... | 8-76 |
| 16 | 8-29.3(2) | Cable Assembly | 8-76 |
| 17 | 8-29.3(3) | Wire Mesh | 8-76 |
| 18 | 8-29.4 | Measurement..... | 8-77 |
| 19 | 8-29.5 | Payment | 8-77 |
| 20 | SECTION 8-30 | ILLUMINATION AND ELECTRICAL SYSTEMS..... | 8-77 |
| 21 | 8-30.1 | Description..... | 8-77 |
| 22 | 8-30.1(1) | General..... | 8-77 |
| 23 | 8-30.1(2) | Applicable Electrical Codes And Standards | 8-77 |
| 24 | 8-30.1(3) | Electrical Shop Drawings..... | 8-77 |
| 25 | 8-30.1(4) | Electrical and Electronic Words and Phrases..... | 8-78 |
| 26 | 8-30.2 | Materials..... | 8-78 |
| 27 | 8-30.3 | Construction Requirements | 8-78 |
| 28 | 8-30.3(1) | General..... | 8-78 |
| 29 | 8-30.3(2) | Luminaires..... | 8-78 |
| 30 | 8-30.3(3) | Handhole, Maintenance Hole and Vault Access Requirements | 8-78 |
| 31 | 8-30.3(4) | Relocating Equipment | 8-78 |
| 32 | 8-30.3(5) | Wiring, Fusing, and Splicing..... | 8-78 |
| 33 | 8-30.3(6) | Luminaires Relamping..... | 8-79 |
| 34 | 8-30.3(7) | Grounding and Bonding..... | 8-79 |
| 35 | 8-30.3(8) | Removal and Salvage Of Existing Equipment..... | 8-80 |
| 36 | 8-30.3(9) | Field Testing..... | 8-80 |
| 37 | 8-30.3(10) | As-Built Drawings..... | 8-80 |
| 38 | 8-30.3(11) | Final Inspection | 8-80 |
| 39 | 8-30.3(12) | Commissioning..... | 8-80 |
| 40 | 8-30.3(13) | Acceptance..... | 8-80 |
| 41 | 8-30.4 | Measurement..... | 8-81 |
| 42 | 8-30.5 | Payment | 8-81 |
| 43 | SECTION 8-31 | TRAFFIC SIGNAL SYSTEM..... | 8-81 |
| 44 | 8-31.1 | Description..... | 8-81 |
| 45 | 8-31.1(1) | General..... | 8-81 |
| 46 | 8-31.1(2) | Electrical and Electronic Words and Phrases..... | 8-82 |
| 47 | 8-31.1(3) | Applicable Electrical Codes | 8-82 |
| 48 | 8-31.1(4) | Submittals and Reference Materials..... | 8-82 |
| 49 | 8-31.1(4)A | Signal Shop Drawings..... | 8-82 |
| 50 | 8-31.1(4)B | Samples | 8-82 |
| 51 | 8-31.1(5) | Controller Assembly Testing Requirements | 8-82 |
| 52 | 8-31.1(5)A | Field Testing | 8-82 |
| 53 | 8-31.1(6) | Guarantee | 8-83 |
| 54 | 8-31.2 | Materials..... | 8-83 |
| 55 | 8-31.3 | Construction Requirements | 8-83 |
| 56 | 8-31.3(1) | Clearance Requirements and Intersection Check Out and Turn On Procedures | 8-83 |
| 57 | 8-31.3(1)A | Traffic Control..... | 8-83 |
| 58 | 8-31.3(1)B | Traffic Signal Controller Cabinet and Handhole Access Requirements | 8-83 |
| 59 | 8-31.3(1)C | Traffic Signal Controller Assembly Replacement | 8-83 |
| 60 | 8-31.3(2) | Traffic Signal Controller Assembly | 8-84 |
| 61 | 8-31.3(2)A | General | 8-84 |
| 62 | 8-31.3(2)B | Temporary Controller Cabinet Framing Apparatus..... | 8-84 |
| 63 | 8-31.3(2)C | Auxiliary Cabinets | 8-84 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--|---|-------|
| 1 | 8-31.3(2)D | Terminal Cabinet..... | 8-84 |
| 2 | 8-31.3(3) | Signal Heads, Vehicle and Pedestrian | 8-85 |
| 3 | 8-31.3(3)A | General | 8-85 |
| 4 | 8-31.3(3)B | Vehicle Signal Heads..... | 8-85 |
| 5 | 8-31.3(3)C | Pedestrian Signal Heads..... | 8-85 |
| 6 | 8-31.3(4) | Pedestrian Pushbutton Assembly..... | 8-86 |
| 7 | 8-31.3(5) | Vehicle Detection | 8-86 |
| 8 | 8-31.3(5)A | Inductive Detector Loops | 8-86 |
| 9 | 8-31.3(5)B | Preformed Detector Loop..... | 8-87 |
| 10 | 8-31.3(5)C | Video Detection Camera | 8-87 |
| 11 | 8-31.3(5)D | Wireless Sensor Detection..... | 8-88 |
| 12 | 8-31.3(5)E | Detector Loop Lead-In Cable | 8-89 |
| 13 | 8-31.3(6) | Overhead Illuminated Sign | 8-89 |
| 14 | 8-31.3(7) | Preemption Detectors and Cameras | 8-89 |
| 15 | 8-31.3(7)A | Emergency Vehicle Preemption Detectors..... | 8-89 |
| 16 | 8-31.3(8) | Signal Interconnect..... | 8-89 |
| 17 | 8-31.3(8)A | General | 8-89 |
| 18 | 8-31.3(9) | Signal Wiring | 8-90 |
| 19 | 8-31.3(9)A | Conductor Installation | 8-90 |
| 20 | 8-31.3(9)B | Splices | 8-90 |
| 21 | 8-31.3(9)C | Terminations | 8-91 |
| 22 | 8-31.3(9)D | Pedestrian Pushbutton Cable | 8-91 |
| 23 | 8-31.3(9)E | CAT5-E Cable | 8-91 |
| 24 | 8-31.3(9)F | Electrical Service Connections..... | 8-91 |
| 25 | 8-31.3(9)G | Service Cabinets..... | 8-91 |
| 26 | 8-31.3(10) | Grounding and Bonding..... | 8-91 |
| 27 | 8-31.3(11) | Pole Line Hardware Installation..... | 8-92 |
| 28 | 8-31.3(12) | Relocating Equipment | 8-92 |
| 29 | 8-31.3(13) | Removal and Salvage of Existing Electrical Equipment | 8-92 |
| 30 | 8-31.3(14) | Owner Furnished Equipment and Materials | 8-92 |
| 31 | 8-31.3(15) | Check Out Procedure..... | 8-92 |
| 32 | 8-31.3(16) | Turn On/Cut Over Procedure | 8-92 |
| 33 | 8-31.3(17) | Final Inspection and As-Built Drawings | 8-93 |
| 34 | 8-31.3(18) | License Plate Reader (LPR)..... | 8-93 |
| 35 | 8-31.3(19) | CCTV Camera..... | 8-93 |
| 36 | 8-31.3(20) | Dynamic Message Sign (DMS) | 8-94 |
| 37 | 8-31.4 | Measurement..... | 8-94 |
| 38 | 8-31.5 | Payment | 8-94 |
| 39 | SECTION 8-32 POLES, PEDESTALS, AND FOUNDATIONS | | 8-96 |
| 40 | 8-32.1 | Description..... | 8-96 |
| 41 | 8-32.1(1) | General..... | 8-96 |
| 42 | 8-32.1(2) | Applicable Electrical Codes | 8-96 |
| 43 | 8-32.1(3) | Pole and Pedestal Shop Drawings | 8-96 |
| 44 | 8-32.1(4) | Electrical and Electronic Words and Phrases..... | 8-96 |
| 45 | 8-32.2 | Materials | 8-96 |
| 46 | 8-32.3 | Construction Requirements | 8-96 |
| 47 | 8-32.3(1) | Poles | 8-96 |
| 48 | 8-32.3(1)A | General | 8-96 |
| 49 | 8-32.3(1)B | Metal Poles and Pedestals..... | 8-98 |
| 50 | 8-32.3(1)C | Wood Poles..... | 8-98 |
| 51 | 8-32.3(2) | Foundations..... | 8-98 |
| 52 | 8-32.3(2)A | General | 8-98 |
| 53 | 8-32.3(2)B | Traffic Signal Controller Foundations | 8-99 |
| 54 | 8-32.3(2)C | Pole, Pedestal and Pedestrian Pushbutton Post Foundations | 8-99 |
| 55 | 8-32.3(2)D | Existing Pole Foundations..... | 8-99 |
| 56 | 8-32.3(3) | Back Guy Assemblies | 8-100 |
| 57 | 8-32.3(4) | Relocating Equipment | 8-100 |
| 58 | 8-32.3(5) | Bracket Arms..... | 8-100 |
| 59 | 8-32.4 | Measurement..... | 8-100 |
| 60 | 8-32.5 | Payment | 8-100 |
| 61 | SECTION 8-33 ELECTRICAL CONDUIT AND TRENCHING..... | | 8-101 |
| 62 | 8-33.1 | Description..... | 8-101 |
| 63 | 8-33.1(1) | General..... | 8-101 |
| 64 | 8-33.1(2) | Applicable Electrical Codes | 8-101 |
| 65 | 8-33.1(3) | Electrical Conduit Shop Drawings | 8-101 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|-------------------|--|------------|
| 1 | 8-33.1(4) | Electrical and Electronic Words and Phrases..... | 8-101 |
| 2 | 8-33.2 | Material..... | 8-101 |
| 3 | 8-33.3 | Construction Requirements..... | 8-102 |
| 4 | 8-33.3(1) | Trenching..... | 8-102 |
| 5 | 8-33.3(2) | Conduit Installation..... | 8-102 |
| 6 | 8-33.3(2)A | General..... | 8-102 |
| 7 | 8-33.3(2)B | Rigid Steel Conduit and PVC Coated Rigid Steel Conduit..... | 8-103 |
| 8 | 8-33.3(2)C | PVC Conduit..... | 8-104 |
| 9 | 8-33.3(3) | Conduit Risers..... | 8-104 |
| 10 | 8-33.3(4) | Handholes..... | 8-104 |
| 11 | 8-33.3(5) | Jacking or Boring or Tunneling, Rigid Steel and Other Conduit..... | 8-104 |
| 12 | 8-33.4 | Measurement..... | 8-104 |
| 13 | 8-33.5 | Payment..... | 8-105 |
| 14 | DIVISION 9 | MATERIALS..... | 9-1 |
| 15 | SECTION 9-00 | DEFINITIONS AND TESTS..... | 9-1 |
| 16 | 9-00.1 | Fracture..... | 9-1 |
| 17 | 9-00.2 | Wood Waste..... | 9-1 |
| 18 | 9-00.3 | Test For Weight of Galvanizing..... | 9-1 |
| 19 | 9-00.4 | Sieve Analysis of Aggregates..... | 9-1 |
| 20 | 9-00.5 | Dust Ratio..... | 9-1 |
| 21 | 9-00.6 | Sand/Silt Ratio..... | 9-1 |
| 22 | 9-00.7 | Galvanized Hardware, AASHTO M 232..... | 9-1 |
| 23 | SECTION 9-01 | PORTLAND CEMENT AND BLENDED HYDRAULIC CEMENT..... | 9-1 |
| 24 | 9-01.1 | Types Of Cement..... | 9-1 |
| 25 | 9-01.2 | Specifications..... | 9-1 |
| 26 | 9-01.2(1) | Portland Cement..... | 9-1 |
| 27 | 9-01.2(2) | Low Alkali Cement..... | 9-1 |
| 28 | 9-01.2(3) | Blended Hydraulic Cement..... | 9-1 |
| 29 | SECTION 9-02 | BITUMINOUS MATERIALS..... | 9-2 |
| 30 | 9-02.1 | Asphalt Material..... | 9-2 |
| 31 | 9-02.1(1) | Reserved..... | 9-2 |
| 32 | 9-02.1(2) | Medium Curing (MC) Liquid Asphalt..... | 9-2 |
| 33 | 9-02.1(3) | RESERVED..... | 9-3 |
| 34 | 9-02.1(4) | Asphalt Cement..... | 9-3 |
| 35 | 9-02.1(4)A | Paving Asphalt..... | 9-3 |
| 36 | 9-02.1(4)B | Performance Grade (PG) Asphalt Cement..... | 9-3 |
| 37 | 9-02.1(5) | RESERVED..... | 9-3 |
| 38 | 9-02.1(6) | Cationic Emulsified Asphalts..... | 9-4 |
| 39 | 9-02.1(6)A | Polymerized Cationic Emulsified Asphalt – CRS-2P..... | 9-5 |
| 40 | 9-02.1(7) | Asphalt for Sub Sealing..... | 9-5 |
| 41 | 9-02.1(8) | Hot Melt Traffic Button Adhesive..... | 9-5 |
| 42 | 9-02.2 | Sampling and Acceptance..... | 9-6 |
| 43 | 9-02.2(1) | Certification of Shipment..... | 9-6 |
| 44 | 9-02.2(2) | Samples..... | 9-6 |
| 45 | 9-02.3 | Temperature of Asphalt..... | 9-6 |
| 46 | 9-02.4 | Anti Stripping Additive..... | 9-6 |
| 47 | 9-02.5 | Temporary Pavement Patch Material..... | 9-6 |
| 48 | SECTION 9-03 | AGGREGATES..... | 9-7 |
| 49 | 9-03.0 | General..... | 9-7 |
| 50 | 9-03.1 | Aggregates for Portland Cement Concrete..... | 9-7 |
| 51 | 9-03.1(1) | General Requirements..... | 9-7 |
| 52 | 9-03.1(2) | Fine Aggregate for Portland Cement Concrete..... | 9-7 |
| 53 | 9-03.1(2)A | General..... | 9-7 |
| 54 | 9-03.1(2)B | Deleterious Substances..... | 9-7 |
| 55 | 9-03.1(2)C | Grading..... | 9-8 |
| 56 | 9-03.1(2)D | Use of Substandard Gradings..... | 9-8 |
| 57 | 9-03.1(2)E | Use of Crushed Recycled Portland Cement Concrete..... | 9-8 |
| 58 | 9-03.1(3) | Coarse Aggregate for Portland Cement Concrete..... | 9-8 |
| 59 | 9-03.1(3)A | General..... | 9-8 |
| 60 | 9-03.1(3)B | Deleterious Substances..... | 9-9 |
| 61 | 9-03.1(3)C | Durability..... | 9-9 |
| 62 | 9-03.1(3)D | Grading..... | 9-9 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|---|------|
| 1 | 9-03.1(3)E | Use of Crushed Recycled Portland Cement Concrete | 9-9 |
| 2 | 9-03.1(4) | Combined Aggregate Gradation for Portland Cement Concrete | 9-10 |
| 3 | 9-03.1(4)A | Deleterious Substances | 9-10 |
| 4 | 9-03.1(4)B | Grading | 9-10 |
| 5 | 9-03.1(5) | Coarse Aggregates for Pervious Concrete | 9-11 |
| 6 | 9-03.1(5)A | General | 9-11 |
| 7 | 9-03.1(5)B | Grading | 9-11 |
| 8 | 9-03.2 | Aggregate for Bioretention Soil | 9-11 |
| 9 | 9-03.2(1) | General | 9-11 |
| 10 | 9-03.2(2) | Mineral Aggregate for Bioretention Soil | 9-11 |
| 11 | 9-03.3 | Streambed Aggregate | 9-12 |
| 12 | 9-03.3(1) | Quality | 9-12 |
| 13 | 9-03.3(2) | Gradations | 9-12 |
| 14 | 9-03.4 | Aggregate for Bituminous Surface Treatment | 9-13 |
| 15 | 9-03.4(1) | General Requirements | 9-13 |
| 16 | 9-03.4(2) | Grading and Quality | 9-13 |
| 17 | 9-03.5 | Aggregates for Asphalt Treated Base (ATB) | 9-14 |
| 18 | 9-03.5(1) | General Requirements | 9-14 |
| 19 | 9-03.5(2) | Grading | 9-14 |
| 20 | 9-03.5(3) | Test Requirements | 9-14 |
| 21 | 9-03.6 | Aggregates for Hot Mix Asphalt (HMA) | 9-15 |
| 22 | 9-03.6(1) | General Requirements | 9-15 |
| 23 | 9-03.6(2) | HMA Test Requirements | 9-15 |
| 24 | 9-03.6(3) | Grading | 9-16 |
| 25 | 9-03.6(3)A | Gradation | 9-16 |
| 26 | 9-03.6(3)B | Recycled Asphalt Pavement (RAP) | 9-16 |
| 27 | 9-03.6(3)C | Recycled Portland Cement Concrete Rubble and Steel Furnace Slag | 9-16 |
| 28 | 9-03.6(4) | Blending Sand | 9-16 |
| 29 | 9-03.6(5) | Mineral Filler | 9-16 |
| 30 | 9-03.6(6) | HMA Proportions of Materials | 9-16 |
| 31 | 9-03.6(7) | HMA Tolerances and Adjustments | 9-17 |
| 32 | 9-03.7 | Aggregates for Ballast and Crushed Surfacing | 9-17 |
| 33 | 9-03.7(1) | Ballast | 9-17 |
| 34 | 9-03.7(2) | Shoulder Ballast | 9-18 |
| 35 | 9-03.7(3) | Crushed Rock | 9-18 |
| 36 | 9-03.7(4) | Maintenance Rock | 9-18 |
| 37 | 9-03.7(5) | Sand Filler | 9-18 |
| 38 | 9-03.8 | Aggregate for Gravel Base | 9-18 |
| 39 | 9-03.9 | Crushed Gravel | 9-18 |
| 40 | 9-03.10 | Pit Run Sand, Washed Sand, And Gravel Backfill | 9-19 |
| 41 | 9-03.10(1) | Gravel Backfill for Foundations | 9-19 |
| 42 | 9-03.10(1)A | Class A Backfill | 9-19 |
| 43 | 9-03.10(1)B | Class B Backfill | 9-19 |
| 44 | 9-03.10(2) | Gravel Backfill for Walls | 9-19 |
| 45 | 9-03.10(3) | Gravel and Sand Backfill for Pipe Bedding | 9-19 |
| 46 | 9-03.10(4) | Gravel Backfill for Drains | 9-19 |
| 47 | 9-03.10(5) | Pit Run Sand and Gravel | 9-19 |
| 48 | 9-03.10(6) | Washed Sand and Gravel | 9-19 |
| 49 | 9-03.10(7) | Quarry Run Crushed Rock | 9-19 |
| 50 | 9-03.11 | Backfill for Sand Drain | 9-20 |
| 51 | 9-03.11(1) | Sand Drain Backfill | 9-20 |
| 52 | 9-03.11(2) | Sand Drainage Blanket | 9-20 |
| 53 | 9-03.12 | Gravel Borrow | 9-20 |
| 54 | 9-03.13 | Test Methods for Aggregates | 9-20 |
| 55 | 9-03.14 | Mineral Aggregate Chart | 9-21 |
| 56 | 9-03.15 | Rock Facing Material | 9-23 |
| 57 | 9-03.16 | Recycled Material | 9-23 |
| 58 | 9-03.16(1) | General Requirements | 9-23 |
| 59 | 9-03.16(1)A | Recycled Hot Mix Asphalt | 9-23 |
| 60 | 9-03.16(1)B | Recycled Portland Cement Concrete Rubble | 9-23 |
| 61 | 9-03.16(1)C | Recycled Glass Cullet | 9-24 |
| 62 | 9-03.16(1)D | Recycled Steel Furnace Slag | 9-24 |
| 63 | 9-03.16(1)E | Allowable Recycled Material Content | 9-24 |
| 64 | SECTION 9-04 | JOINT AND CRACK SEALING MATERIALS | 9-26 |
| 65 | 9-04.1 | Premolded Joint Fillers | 9-26 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|---|------|
| 1 | 9-04.1(1) | Filler for Contraction Joints in Cement Concrete Pavement | 9-26 |
| 2 | 9-04.1(2) | Filler for Through (Expansion) Joints in Cement Concrete Pavement | 9-26 |
| 3 | 9-04.1(3) | Elastomeric Expansion Joint Seals | 9-26 |
| 4 | 9-04.2 | Joint Sealants | 9-26 |
| 5 | 9-04.2(1) | Hot Poured Joint Sealants | 9-26 |
| 6 | 9-04.2(2) | Poured Rubber Joint Sealer | 9-26 |
| 7 | 9-04.2(3) | Poured Joint Sealer for Walkways | 9-27 |
| 8 | 9-04.3 | Mortar and Non Shrink Cement Sand Grout | 9-27 |
| 9 | 9-04.3(1) | Joint Mortar | 9-27 |
| 10 | 9-04.3(2) | Non Shrink Cement Sand Grout | 9-27 |
| 11 | 9-04.3(2)A | General | 9-27 |
| 12 | 9-04.3(2)B | Grout for Anchor Bolts, Bridge Bearings, and Drainage Structure | 9-27 |
| 13 | 9-04.3(2)C | Grout for Pipe Connections | 9-27 |
| 14 | 9-04.3(2)D | Grout Type 1 for Post-Tensioning Applications | 9-27 |
| 15 | 9-04.3(2)E | Grout for Poles and Pedestals | 9-27 |
| 16 | 9-04.4 | Rubber Gaskets | 9-27 |
| 17 | 9-04.4(1) | Rubber Gaskets for Concrete Pipes and Precast Maintenance Holes | 9-27 |
| 18 | 9-04.4(2) | Seals for Vitrified Clay Pipe (Compression) | 9-27 |
| 19 | 9-04.4(3) | Seals for Vitrified Clay Pipe (Flexible Couplings) | 9-27 |
| 20 | 9-04.4(4) | Rubber Gaskets for Aluminum or Steel Culvert or Storm Sewer Pipe | 9-27 |
| 21 | 9-04.4(5) | Rubber Gaskets for Aluminum or Steel Drain Pipe | 9-27 |
| 22 | 9-04.4(6) | Protection and Storage | 9-28 |
| 23 | 9-04.5 | Flexible Plastic Gaskets | 9-28 |
| 24 | 9-04.6 | Expanded Polystyrene | 9-28 |
| 25 | 9-04.7 | Expanded Rubber | 9-28 |
| 26 | 9-04.8 | Solvent Cements | 9-28 |
| 27 | 9-04.9 | Crack Sealing Rubberized Asphalt | 9-28 |
| 28 | SECTION 9-05 | STORM DRAIN AND SANITARY SEWER STRUCTURES, CULVERTS, AND CONDUITS | 9-28 |
| 29 | 9-05.1 | Acceptance by Manufacturer's Certification | 9-28 |
| 30 | 9-05.2 | Concrete Pipe | 9-29 |
| 31 | 9-05.2(1) | General | 9-29 |
| 32 | 9-05.2(2) | Basis for Acceptance of Concrete Pipe | 9-29 |
| 33 | 9-05.2(2)A | General | 9-29 |
| 34 | 9-05.2(2)B | Pipe Acceptance Report (PAR) | 9-29 |
| 35 | 9-05.2(3) | Age at Shipment | 9-29 |
| 36 | 9-05.2(4) | Beveled Concrete End Sections | 9-30 |
| 37 | 9-05.2(5) | Concrete Pipe Joints and Testing | 9-30 |
| 38 | 9-05.2(5)A | General | 9-30 |
| 39 | 9-05.2(5)B | Testing Concrete Pipe Joints | 9-30 |
| 40 | 9-05.2(5)B1 | General | 9-30 |
| 41 | 9-05.2(5)B2 | Hydrostatic Pressure on Pipes in Straight Alignment | 9-30 |
| 42 | 9-05.2(5)B3 | Hydrostatic Pressure Tests on Pipes in Maximum Deflected Position | 9-30 |
| 43 | 9-05.2(5)B4 | Hydrostatic Pressure Test on 15-Inch Diameter and Larger Pipe Under Differential Load ... | 9-30 |
| 44 | | | 9-30 |
| 45 | 9-05.2(6) | Perforated Concrete Subsurface Drain Pipe | 9-31 |
| 46 | 9-05.3 | Ductile Iron Pipe | 9-31 |
| 47 | 9-05.4 | Polyvinyl Chloride (PVC) Pipe | 9-31 |
| 48 | 9-05.4(1) | Slotted PVC Subsurface Drain Pipe | 9-31 |
| 49 | 9-05.5 | Vitrified Clay Pipe (VCP) | 9-31 |
| 50 | 9-05.5(1) | Pipe Acceptance Report (PAR) | 9-32 |
| 51 | 9-05.6 | Polyethylene Pipe | 9-32 |
| 52 | 9-05.6(1) | Corrugated Polyethylene Drainage Tubing Pipe | 9-32 |
| 53 | 9-05.6(1)A | Corrugated Polyethylene Drainage Tubing Drain Pipe | 9-32 |
| 54 | 9-05.6(1)B | Perforated Corrugated Polyethylene Drainage Tubing Subsurface Drain Pipe | 9-32 |
| 55 | 9-05.6(2) | Corrugated Polyethylene Drain Pipe | 9-32 |
| 56 | 9-05.6(2)A | General | 9-32 |
| 57 | 9-05.6(2)B | Coupling Bands | 9-32 |
| 58 | 9-05.6(3) | Steel Reinforced Polyethylene Pipe for Detention | 9-32 |
| 59 | 9-05.6(4) | Perforated Corrugated Polyethylene Subsurface Drain Pipe | 9-32 |
| 60 | 9-05.6(4)A | General | 9-32 |
| 61 | 9-05.6(4)B | Coupling Bands | 9-32 |
| 62 | 9-05.6(5) | Polyethylene End Sections | 9-32 |
| 63 | 9-05.7 | Aluminum Pipe | 9-33 |
| 64 | 9-05.7(1) | General | 9-33 |
| 65 | 9-05.7(1)A | Basis for Acceptance for Aluminum Pipe | 9-33 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|--|------|
| 1 | 9-05.7(1)B | Coupling Bands..... | 9-33 |
| 2 | 9-05.7(1)B1 | Coupling Bands for Drain Pipe..... | 9-33 |
| 3 | 9-05.7(1)B2 | Coupling Bands for Culvert Pipe..... | 9-33 |
| 4 | 9-05.7(1)B3 | Coupling Bands for Aluminum Pipe..... | 9-33 |
| 5 | 9-05.7(1)C | Mitered Ends..... | 9-33 |
| 6 | 9-05.7(1)D | Aluminum End Sections..... | 9-33 |
| 7 | 9-05.7(2) | Perforated Corrugated Aluminum Subsurface Drain Pipe..... | 9-34 |
| 8 | 9-05.7(2)A | General..... | 9-34 |
| 9 | 9-05.7(2)B | Coupling Bands..... | 9-34 |
| 10 | 9-05.7(3) | Aluminum Spiral Rib Pipe..... | 9-34 |
| 11 | 9-05.7(3)A | General..... | 9-34 |
| 12 | 9-05.7(3)B | Continuous Lock Seam Pipe..... | 9-34 |
| 13 | 9-05.7(3)C | Basis for Acceptance for Aluminum Spiral Rib Pipe..... | 9-34 |
| 14 | 9-05.7(3)D | Coupling Bands..... | 9-34 |
| 15 | 9-05.7(4) | Aluminum Pipe for Detention..... | 9-34 |
| 16 | 9-05.8 | Steel Pipe..... | 9-35 |
| 17 | 9-05.8(1) | Galvanized Steel Drain Pipe..... | 9-35 |
| 18 | 9-05.8(2) | Steel Culvert Pipe and Pipe Arch..... | 9-35 |
| 19 | 9-05.8(2)A | General..... | 9-35 |
| 20 | 9-05.8(2)B | Elliptical Fabrication..... | 9-35 |
| 21 | 9-05.8(2)C | Coupling Bands..... | 9-35 |
| 22 | 9-05.8(2)D | Steel Culvert Pipe Arch..... | 9-35 |
| 23 | 9-05.8(2)E | Steel End Sections..... | 9-36 |
| 24 | 9-05.8(2)E1 | General..... | 9-36 |
| 25 | 9-05.8(2)E2 | Fabrication..... | 9-36 |
| 26 | 9-05.8(2)E3 | Galvanized Hardware..... | 9-36 |
| 27 | 9-05.8(2)E4 | Toe Plate Extensions..... | 9-36 |
| 28 | 9-05.8(3) | Steel Spiral Rib Drain Pipe..... | 9-36 |
| 29 | 9-05.8(3)A | General..... | 9-36 |
| 30 | 9-05.8(3)B | Continuous Lock Seam Pipe..... | 9-36 |
| 31 | 9-05.8(3)B1 | General..... | 9-36 |
| 32 | 9-05.8(3)B2 | Basis for Acceptance..... | 9-36 |
| 33 | 9-05.8(3)C | Continuous Welded Seam Pipe..... | 9-37 |
| 34 | 9-05.8(3)D | Coupling Bands..... | 9-37 |
| 35 | 9-05.8(4) | Steel Pipe For Detention..... | 9-37 |
| 36 | 9-05.9 | Pipe Coatings..... | 9-37 |
| 37 | 9-05.9(1) | Aluminum Coated (Aluminized) Corrugated Iron or Steel Drain Pipe..... | 9-37 |
| 38 | 9-05.9(1)A | General..... | 9-37 |
| 39 | 9-05.9(1)B | Coupling Bands..... | 9-37 |
| 40 | 9-05.9(2) | Aluminum Coated (Aluminized) Corrugated Iron or Steel Subsurface Drain Pipe..... | 9-37 |
| 41 | 9-05.9(2)A | General..... | 9-37 |
| 42 | 9-05.9(2)B | Coupling Bands..... | 9-37 |
| 43 | 9-05.10 | Plastic Foam (Ethafom)..... | 9-38 |
| 44 | 9-05.11 | ABS Composite Pipe..... | 9-38 |
| 45 | 9-05.12 | Safety Bars for Culvert Pipe..... | 9-38 |
| 46 | 9-05.13 | Flow Control Structure..... | 9-38 |
| 47 | 9-05.14 | Galvanized Iron Pipe..... | 9-38 |
| 48 | 9-05.15 | Cement Slurry Abandoning Pipe or Filling Annular Space Between 2 Pipes..... | 9-38 |
| 49 | 9-05.16 | Side Sewer and Service Drain..... | 9-39 |
| 50 | 9-05.17 | Polypropylene Pipe..... | 9-39 |
| 51 | 9-05.18 | Couplings for Pipe Jointing (new Section)..... | 9-39 |
| 52 | SECTION 9-06 | STRUCTURAL STEEL AND RELATED MATERIALS..... | 9-39 |
| 53 | 9-06.1 | Structural Carbon Steel..... | 9-39 |
| 54 | 9-06.2 | Structural Low Alloy Steel..... | 9-39 |
| 55 | 9-06.3 | Structural High Strength Steel..... | 9-39 |
| 56 | 9-06.4 | Bolts 9-40..... | |
| 57 | 9-06.4(1) | Unfinished Bolts..... | 9-40 |
| 58 | 9-06.4(2) | High Strength Bolts..... | 9-40 |
| 59 | 9-06.4(3) | Anchor Bolts..... | 9-41 |
| 60 | 9-06.5 | Steel Castings..... | 9-41 |
| 61 | 9-06.6 | Gray Iron Castings..... | 9-41 |
| 62 | 9-06.7 | Malleable Iron Castings..... | 9-41 |
| 63 | 9-06.8 | Steel Forgings and Steel Shafting..... | 9-41 |
| 64 | 9-06.9 | Bronze Castings..... | 9-41 |
| 65 | 9-06.10 | Copper Seals..... | 9-41 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--|--|------|
| 1 | 9-06.11 | Ductile Iron Castings..... | 9-42 |
| 2 | 9-06.12 | Welded Shear Connectors..... | 9-42 |
| 3 | 9-06.13 | Roadside Sign Structures..... | 9-42 |
| 4 | 9-06.14 | Metal Bridge Railing..... | 9-42 |
| 5 | 9-06.15 | Bolts, Washers, and Other Hardware..... | 9-43 |
| 6 | SECTION 9-07 REINFORCING STEEL..... | | 9-43 |
| 7 | 9-07.1 | General..... | 9-43 |
| 8 | 9-07.1(1) | Acceptance by Manufacturer's Certification..... | 9-43 |
| 9 | 9-07.1(1)A | Acceptance of Materials..... | 9-43 |
| 10 | 9-07.1(2) | Bending..... | 9-43 |
| 11 | 9-07.1(3) | Lengths..... | 9-44 |
| 12 | 9-07.2 | Deformed Steel Bars..... | 9-44 |
| 13 | 9-07.3 | Epoxy Coated Steel Reinforcing Bars..... | 9-44 |
| 14 | 9-07.4 | Plain Steel Bars..... | 9-45 |
| 15 | 9-07.5 | Dowel Bars (for Cement Concrete Pavement)..... | 9-45 |
| 16 | 9-07.6 | Tie Bars (for Cement Concrete Pavement)..... | 9-45 |
| 17 | 9-07.7 | Wire Mesh..... | 9-45 |
| 18 | 9-07.8 | Deformed Wire..... | 9-45 |
| 19 | 9-07.9 | Cold Drawn Wire..... | 9-45 |
| 20 | 9-07.10 | Prestressing Reinforcement Strand..... | 9-45 |
| 21 | 9-07.11 | Prestressing Reinforcement Bar..... | 9-46 |
| 22 | SECTION 9-08 PAINTS AND RELATED MATERIALS..... | | 9-46 |
| 23 | 9-08.1 | Paint 9-46..... | 9-46 |
| 24 | 9-08.1(1) | Description..... | 9-46 |
| 25 | 9-08.1(2) | Paint Types..... | 9-46 |
| 26 | 9-08.1(2)A | Vinyl Pretreatment..... | 9-46 |
| 27 | 9-08.1(2)B | Galvanizing Repair Paint, High Zinc Dust Content..... | 9-46 |
| 28 | 9-08.1(2)C | Inorganic Zinc-Rich Primer..... | 9-46 |
| 29 | 9-08.1(2)D | Organic Zinc-Rich Primer..... | 9-46 |
| 30 | 9-08.1(2)E | Epoxy Polyamide..... | 9-46 |
| 31 | 9-08.1(2)F | Primer, Zinc-Filled, Single-Component, Moisture-Cured Polyurethane..... | 9-46 |
| 32 | 9-08.1(2)G | Intermediate and Stripe Coat, Single Component, Moisture-Cured Polyurethane..... | 9-47 |
| 33 | 9-08.1(2)H | Top Coat, Single-Component, Moisture-Cured Polyurethane..... | 9-47 |
| 34 | 9-08.1(2)I | Rust-Penetrating Sealer..... | 9-47 |
| 35 | 9-08.1(2)J | Black Enamel..... | 9-47 |
| 36 | 9-08.1(2)K | Orange Equipment Enamel..... | 9-47 |
| 37 | 9-08.1(2)L | Exterior Acrylic Latex Paint-White..... | 9-47 |
| 38 | 9-08.1(3) | Working Properties..... | 9-47 |
| 39 | 9-08.1(4) | Storage Properties..... | 9-47 |
| 40 | 9-08.1(5) | Fineness of Grinding..... | 9-48 |
| 41 | 9-08.1(6) | Test Methods..... | 9-48 |
| 42 | 9-08.1(7) | Acceptance..... | 9-48 |
| 43 | 9-08.1(8) | Standard Colors..... | 9-48 |
| 44 | 9-08.2 | Powder Coating Materials for Coating Galvanized Surfaces..... | 9-49 |
| 45 | 9-08.3 | Pigmented Sealer Materials for Coating Of Concrete Surfaces..... | 9-49 |
| 46 | 9-08.4 | Abrasive Blast Materials..... | 9-49 |
| 47 | 9-08.4(1) | Abrasive Blast Media..... | 9-49 |
| 48 | 9-08.4(2) | Lead Abatement Additive..... | 9-50 |
| 49 | 9-08.5 | Surface Cleaning Materials..... | 9-50 |
| 50 | 9-08.5(1) | Bird Guano Treatment..... | 9-50 |
| 51 | 9-08.5(2) | Fungicide Treatment..... | 9-50 |
| 52 | 9-08.5(3) | Water..... | 9-50 |
| 53 | 9-08.6 | Filter Fabric..... | 9-50 |
| 54 | 9-08.7 | Single-Component Urethane Sealant..... | 9-50 |
| 55 | 9-08.8 | Foam Backer Rod..... | 9-50 |
| 56 | SECTION 9-09 TIMBER AND LUMBER..... | | 9-50 |
| 57 | 9-09.1 | General Requirements..... | 9-50 |
| 58 | 9-09.2 | Grade Requirements..... | 9-50 |
| 59 | 9-09.2(1) | Surfacing and Seasoning..... | 9-51 |
| 60 | 9-09.2(2) | Inspection..... | 9-51 |
| 61 | 9-09.3 | Preservative Treatment..... | 9-51 |
| 62 | SECTION 9-10 PILES..... | | 9-52 |
| 63 | 9-10.1 | Timber Piles..... | 9-52 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|---|------|
| 1 | 9-10.1(1) | General..... | 9-52 |
| 2 | 9-10.1(2) | Untreated Piles..... | 9-52 |
| 3 | 9-10.1(3) | Creosote Treated Piles..... | 9-52 |
| 4 | 9-10.1(4) | Timber Composite Piles..... | 9-53 |
| 5 | 9-10.1(5) | Peeling..... | 9-53 |
| 6 | 9-10.2 | Concrete Piles..... | 9-53 |
| 7 | 9-10.2(1) | Concrete..... | 9-53 |
| 8 | 9-10.2(2) | Reinforcement..... | 9-53 |
| 9 | 9-10.3 | Cast in Place Concrete Piles..... | 9-53 |
| 10 | 9-10.3(1) | Reinforcement..... | 9-53 |
| 11 | 9-10.4 | Steel Pile Tips and Shoes..... | 9-53 |
| 12 | 9-10.5 | Steel Piles..... | 9-53 |
| 13 | SECTION 9-11 WATERPROOFING..... | | 9-53 |
| 14 | 9-11.1 | Asphalt for Waterproofing..... | 9-53 |
| 15 | 9-11.2 | Waterproofing Fabric..... | 9-53 |
| 16 | 9-11.3 | Portland Cement Mortar..... | 9-53 |
| 17 | SECTION 9-12 MAINTENANCE HOLES, CATCH BASINS, AND INLETS..... | | 9-54 |
| 18 | 9-12.1 | Reinforced Concrete..... | 9-54 |
| 19 | 9-12.1(1) | General..... | 9-54 |
| 20 | 9-12.1(2) | Cement..... | 9-54 |
| 21 | 9-12.1(3) | Steel Reinforcement..... | 9-54 |
| 22 | 9-12.1(4) | Aggregates..... | 9-54 |
| 23 | 9-12.2 | Steps, Handholds, and Ladders..... | 9-54 |
| 24 | 9-12.2(1) | General..... | 9-54 |
| 25 | 9-12.2(2) | Polypropylene Encapsulated Reinforcing Steel..... | 9-54 |
| 26 | 9-12.3 | Mortar and Grout for Sewer and Drainage Structures..... | 9-54 |
| 27 | 9-12.3(1) | Mortar for Joints..... | 9-54 |
| 28 | 9-12.3(2) | Mortar for Plaster Coating..... | 9-54 |
| 29 | 9-12.3(3) | Grout..... | 9-55 |
| 30 | 9-12.4 | Concrete Masonry Units..... | 9-55 |
| 31 | 9-12.5 | Concrete Brick..... | 9-55 |
| 32 | 9-12.6 | Clay Brick..... | 9-55 |
| 33 | 9-12.7 | Metal Castings..... | 9-55 |
| 34 | 9-12.7(1) | Maintenance Hole Ring and Cover..... | 9-55 |
| 35 | 9-12.7(2) | Metal Frame and Grate and Metal Cover For Catch Basins Or Inlets..... | 9-55 |
| 36 | 9-12.7(3) | Cast Metal Inlets..... | 9-56 |
| 37 | 9-12.8 | Junction Box..... | 9-56 |
| 38 | 9-12.9 | Shop Fabricated Corrugated Metal Maintenance Holes..... | 9-56 |
| 39 | 9-12.10 | Monolithic Concrete Maintenance Holes..... | 9-56 |
| 40 | 9-12.11 | Outlet Traps..... | 9-56 |
| 41 | 9-12.12 | Grate Inlets and Drop Inlets..... | 9-56 |
| 42 | SECTION 9-13 RIPRAP, QUARRY SPALLS, AND SLOPE PROTECTION..... | | 9-56 |
| 43 | 9-13.1 | General..... | 9-56 |
| 44 | 9-13.2 | Loose Riprap..... | 9-56 |
| 45 | 9-13.2(1) | Heavy Loose Riprap..... | 9-56 |
| 46 | 9-13.2(2) | Light Loose Riprap..... | 9-57 |
| 47 | 9-13.3 | Hand Placed Riprap..... | 9-57 |
| 48 | 9-13.4 | Sack Riprap..... | 9-57 |
| 49 | 9-13.5 | Concrete Slope Protection..... | 9-57 |
| 50 | 9-13.5(1) | General..... | 9-57 |
| 51 | 9-13.5(2) | Semi Open Concrete Masonry Units Slope Protection..... | 9-57 |
| 52 | 9-13.5(3) | Poured Portland Cement Concrete Slope Protection..... | 9-57 |
| 53 | 9-13.5(4) | Pneumatically Placed Portland Cement Concrete Slope Protection..... | 9-57 |
| 54 | 9-13.6 | Quarry Spalls..... | 9-57 |
| 55 | SECTION 9-14 EROSION AND LANDSCAPE MATERIALS..... | | 9-58 |
| 56 | 9-14.1 | Soils 9-58 | |
| 57 | 9-14.1(1) | GENERAL TESTING AND SUBMITTAL REQUIREMENTS..... | 9-58 |
| 58 | 9-14.1(2) | Topsoil Type A - Imported..... | 9-59 |
| 59 | 9-14.1(3) | Reused Amended Site Soil..... | 9-59 |
| 60 | 9-14.1(4) | Bioretention Soil..... | 9-60 |
| 61 | 9-14.1(5) | Planting Soil..... | 9-60 |
| 62 | 9-14.1(6) | General Turf Area Soil..... | 9-60 |
| 63 | 9-14.1(7) | High Performance Turf Soil..... | 9-61 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|------------|--|------|
| 1 | 9-14.2 | Seed | 9-62 |
| 2 | 9-14.2(1) | General..... | 9-62 |
| 3 | 9-14.2(2) | Seed Mix #1 (Erosion Mix) | 9-62 |
| 4 | 9-14.2(3) | Seed Mix #2 (Non Irrigated Lawn Seed Mix) | 9-63 |
| 5 | 9-14.2(4) | Seed Mix #3 (Irrigated Lawn or Athletic Turf Area)..... | 9-63 |
| 6 | 9-14.2(5) | Seed Mix #4 (Biofiltration Swale Mix) | 9-63 |
| 7 | 9-14.2(6) | Seed Mix #5 (Low Growing, Drought Tolerant Grass and Herbaceous Mix) | 9-63 |
| 8 | 9-14.3 | Fertilizer..... | 9-64 |
| 9 | 9-14.3(1) | General..... | 9-64 |
| 10 | 9-14.3(2) | Lime | 9-64 |
| 11 | 9-14.4 | Mulches and Amendments | 9-64 |
| 12 | 9-14.4(1) | Straw Mulch..... | 9-65 |
| 13 | 9-14.4(2) | Wood Fiber Mulch | 9-65 |
| 14 | 9-14.4(3) | Bark Mulch | 9-65 |
| 15 | 9-14.4(4) | Arborist Wood Chip Mulch..... | 9-65 |
| 16 | 9-14.4(5) | Peat..... | 9-66 |
| 17 | 9-14.4(6) | Vermiculite / Perlite / Pumice..... | 9-66 |
| 18 | 9-14.4(7) | Tackifier..... | 9-66 |
| 19 | 9-14.4(8) | Compost..... | 9-66 |
| 20 | 9-14.5 | Matting and Stakes | 9-67 |
| 21 | 9-14.5(1) | Jute Matting..... | 9-67 |
| 22 | 9-14.5(1)A | Jute Matting for Non-Stream Applications..... | 9-67 |
| 23 | 9-14.5(1)B | Jute Matting for In-Stream Applications | 9-67 |
| 24 | 9-14.5(2) | Coir Matting for In-Stream Applications | 9-67 |
| 25 | 9-14.5(3) | Excelsior Matting | 9-68 |
| 26 | 9-14.5(4) | Clear and Black Plastic Covering | 9-68 |
| 27 | 9-14.5(5) | Stakes for Erosion Control Matting..... | 9-68 |
| 28 | 9-14.6 | Plant Materials | 9-68 |
| 29 | 9-14.6(1) | Definitions..... | 9-68 |
| 30 | 9-14.6(2) | Quality | 9-68 |
| 31 | 9-14.6(3) | Handling and Shipping | 9-69 |
| 32 | 9-14.6(4) | Records..... | 9-69 |
| 33 | 9-14.6(5) | Inspection..... | 9-70 |
| 34 | 9-14.6(6) | Substitution of Plants..... | 9-70 |
| 35 | 9-14.6(7) | Temporary Storage | 9-70 |
| 36 | 9-14.6(8) | Sod..... | 9-71 |
| 37 | 9-14.7 | Tree Stakes, Guys, and Wrapping..... | 9-71 |
| 38 | 9-14.8 | Shear Boards..... | 9-71 |
| 39 | 9-14.9 | Paver Blocks And Interlocking Concrete Pavers..... | 9-71 |
| 40 | 9-14.9(1) | Paver Blocks | 9-71 |
| 41 | 9-14.9(2) | Interlocking Concrete Pavers | 9-72 |
| 42 | 9-14.9(3) | Cementitious Materials | 9-72 |
| 43 | 9-14.9(4) | Aggregates and Other Constituents | 9-72 |
| 44 | 9-14.9(5) | Physical Requirements..... | 9-72 |
| 45 | 9-14.9(6) | Permissible Tolerance in Dimensions | 9-73 |
| 46 | 9-14.9(7) | Visual Inspection | 9-73 |
| 47 | 9-14.9(8) | Sampling and Testing..... | 9-73 |
| 48 | 9-14.9(9) | Base Course..... | 9-73 |
| 49 | 9-14.9(10) | Top Course or Keystone..... | 9-73 |
| 50 | 9-14.9(11) | Leveling Course | 9-73 |
| 51 | 9-14.9(12) | Bedding Sand..... | 9-73 |
| 52 | 9-14.9(13) | Joint Filling Sand..... | 9-73 |
| 53 | 9-14.9(14) | Edging | 9-74 |
| 54 | 9-14.10 | Turf Reinforcement | 9-74 |
| 55 | 9-14.11 | Cedar Edging..... | 9-74 |
| 56 | 9-14.12 | Bollards..... | 9-74 |
| 57 | 9-14.12(1) | Wood Bollards | 9-74 |
| 58 | 9-14.12(2) | Concrete Bollards..... | 9-74 |
| 59 | 9-14.12(3) | Padlocks for Removable Bollards..... | 9-74 |
| 60 | 9-14.13 | Benches..... | 9-74 |
| 61 | 9-14.14 | Tree Grates | 9-74 |
| 62 | 9-14.15 | In-Stream Logs | 9-74 |
| 63 | 9-14.16 | Wattles or Compost Socks | 9-75 |
| 64 | 9-14.17 | Vertical Root Barrier | 9-75 |
| 65 | 9-14.18 | Slow Release Watering Bags | 9-75 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|--|------|
| 1 | SECTION 9-15 | IRRIGATION SYSTEM | 9-75 |
| 2 | 9-15.1 | Pipe and Fittings | 9-75 |
| 3 | 9-15.1(1) | General | 9-75 |
| 4 | 9-15.1(2) | Galvanized Pipe and Fittings | 9-75 |
| 5 | 9-15.1(3) | Polyvinyl Chloride Pipe and Fittings | 9-75 |
| 6 | 9-15.1(4) | Polyethylene Pipe | 9-75 |
| 7 | 9-15.2 | Control Tubing | 9-75 |
| 8 | 9-15.3 | Sleeve | 9-75 |
| 9 | 9-15.4 | Irrigation Automatic Controllers | 9-76 |
| 10 | 9-15.5 | Sprinkler Heads | 9-76 |
| 11 | 9-15.6 | Electrical Wire | 9-76 |
| 12 | 9-15.7 | Irrigation Valves | 9-76 |
| 13 | 9-15.7(1) | Gate Valves | 9-76 |
| 14 | 9-15.7(2) | Control Valves | 9-76 |
| 15 | 9-15.7(2)A | Manual Control Valves | 9-76 |
| 16 | 9-15.7(2)B | Automatic Control Valves | 9-77 |
| 17 | 9-15.7(2)C | Automatic Control Valves With Pressure Regulator | 9-77 |
| 18 | 9-15.7(3) | Quick Coupler Valves | 9-77 |
| 19 | 9-15.7(4) | Drain Valves | 9-77 |
| 20 | 9-15.7(5) | Check Valves | 9-77 |
| 21 | 9-15.7(6) | Pressure Reducing Valves | 9-77 |
| 22 | 9-15.7(7) | Three Way Valves | 9-77 |
| 23 | 9-15.7(8) | Flow Control Valves | 9-77 |
| 24 | 9-15.7(9) | Air Relief Valve | 9-78 |
| 25 | 9-15.8 | Valve Boxes | 9-78 |
| 26 | 9-15.9 | Backflow Prevention Assemblies | 9-78 |
| 27 | 9-15.10 | Hose Bibs | 9-78 |
| 28 | 9-15.11 | Detectable Marking Tape | 9-78 |
| 29 | SECTION 9-16 | FENCE AND GUARDRAIL | 9-78 |
| 30 | 9-16.1 | Chain Link Fence and Gates | 9-78 |
| 31 | 9-16.1(1) | General | 9-78 |
| 32 | 9-16.1(2) | Posts | 9-79 |
| 33 | 9-16.1(3) | Top Rail, Braces, and Trusses | 9-79 |
| 34 | 9-16.1(4) | Tension Wire and Attachments | 9-79 |
| 35 | 9-16.1(5) | Fittings | 9-79 |
| 36 | 9-16.1(6) | Chain Link Fence Fabric | 9-79 |
| 37 | 9-16.1(7) | Fabric Bands and Stretcher Bars | 9-79 |
| 38 | 9-16.1(8) | Tie Wire | 9-79 |
| 39 | 9-16.1(9) | Chain Link Gates | 9-79 |
| 40 | 9-16.1(10) | Miscellaneous | 9-80 |
| 41 | 9-16.2 | Wire Fence and Gates | 9-80 |
| 42 | 9-16.2(1) | General | 9-80 |
| 43 | 9-16.2(2) | Steel Fence Posts and Braces | 9-80 |
| 44 | 9-16.2(3) | Wood Fence Posts And Braces | 9-80 |
| 45 | 9-16.2(4) | Brace Wire | 9-81 |
| 46 | 9-16.2(5) | Staples and Wire Clamps | 9-81 |
| 47 | 9-16.2(6) | Barbed Wire | 9-81 |
| 48 | 9-16.2(7) | Wire Mesh | 9-81 |
| 49 | 9-16.2(8) | Vertical Cinch Stays | 9-81 |
| 50 | 9-16.2(9) | Wire Gates | 9-81 |
| 51 | 9-16.2(10) | Miscellaneous | 9-81 |
| 52 | 9-16.3 | Non-Weathering Steel Beam Guardrail | 9-81 |
| 53 | 9-16.3(1) | Rail Element | 9-81 |
| 54 | 9-16.3(2) | Posts and Blocks | 9-82 |
| 55 | 9-16.3(3) | Galvanizing | 9-82 |
| 56 | 9-16.3(4) | Hardware | 9-82 |
| 57 | 9-16.3(5) | Anchors | 9-82 |
| 58 | 9-16.3(6) | Inspection and Acceptance | 9-83 |
| 59 | 9-16.4 | Wire Mesh Slope Protection | 9-83 |
| 60 | 9-16.4(1) | General | 9-83 |
| 61 | 9-16.4(2) | Wire Mesh | 9-83 |
| 62 | 9-16.4(3) | Wire Rope | 9-83 |
| 63 | 9-16.4(4) | Hardware | 9-83 |
| 64 | 9-16.4(5) | Hog Rings and Tie Wire | 9-83 |
| 65 | 9-16.4(6) | Grout | 9-83 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|---|------|
| 1 | 9-16.4(7) | Anchor Rods..... | 9-83 |
| 2 | 9-16.5 | Glare Screen | 9-83 |
| 3 | 9-16.5(1) | General..... | 9-83 |
| 4 | 9-16.5(2) | Glare Screen Fabric | 9-84 |
| 5 | 9-16.5(3) | Posts | 9-84 |
| 6 | 9-16.5(4) | Tension Wire | 9-84 |
| 7 | 9-16.5(5) | Cable..... | 9-84 |
| 8 | 9-16.5(6) | Cable and Tension Wire Attachments | 9-84 |
| 9 | 9-16.5(7) | Slats | 9-84 |
| 10 | 9-16.5(7)A | Wood Slats..... | 9-84 |
| 11 | 9-16.5(7)B | Plastic Slats | 9-84 |
| 12 | 9-16.5(8) | Fittings..... | 9-85 |
| 13 | 9-16.5(9) | Fabric Bands and Stretcher Bars | 9-85 |
| 14 | 9-16.5(10) | Tie Wire..... | 9-85 |
| 15 | 9-16.6 | Weathering Steel Beam Guardrail | 9-85 |
| 16 | 9-16.6(1) | Rail and Hardware..... | 9-85 |
| 17 | 9-16.6(2) | Anchors | 9-85 |
| 18 | 9-16.6(3) | Posts And Blocks | 9-85 |
| 19 | SECTION 9-17 | FLEXIBLE GUIDE POSTS..... | 9-85 |
| 20 | 9-17.1 | General..... | 9-85 |
| 21 | 9-17.2 | Laboratory Tests..... | 9-86 |
| 22 | 9-17.3 | Field Tests | 9-86 |
| 23 | 9-17.4 | Approval | 9-87 |
| 24 | SECTION 9-18 | PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB..... | 9-87 |
| 25 | 9-18.1 | Precast Traffic Curb..... | 9-87 |
| 26 | 9-18.1(1) | Aggregates and Proportioning..... | 9-87 |
| 27 | 9-18.1(2) | Mixing..... | 9-87 |
| 28 | 9-18.1(3) | Forms | 9-87 |
| 29 | 9-18.1(4) | Placing Concrete | 9-87 |
| 30 | 9-18.1(5) | Removal of Forms | 9-87 |
| 31 | 9-18.1(6) | Curing Concrete | 9-87 |
| 32 | 9-18.1(7) | Finish..... | 9-87 |
| 33 | 9-18.1(8) | Surface Treatment..... | 9-88 |
| 34 | 9-18.1(9) | Dimensions and Shape | 9-88 |
| 35 | 9-18.1(10) | Curb Lengths and Anchor Holes | 9-88 |
| 36 | 9-18.1(11) | Defective Curb..... | 9-88 |
| 37 | 9-18.1(12) | Repairing Curb | 9-88 |
| 38 | 9-18.1(13) | Identification Marking | 9-88 |
| 39 | 9-18.1(14) | Shipping | 9-88 |
| 40 | 9-18.1(15) | Sampling and Inspection | 9-89 |
| 41 | 9-18.2 | Block Traffic Curb | 9-89 |
| 42 | 9-18.3 | Water Repellent Compound | 9-89 |
| 43 | 9-18.4 | Sodium Metasilicate..... | 9-89 |
| 44 | SECTION 9-19 | PRESTRESSED CONCRETE GIRDERS..... | 9-89 |
| 45 | 9-19.1 | Concrete Aggregates And Proportioning | 9-89 |
| 46 | 9-19.2 | Reinforcement | 9-90 |
| 47 | SECTION 9-20 | CONCRETE PATCHING MATERIAL, GROUT AND MORTAR FOR STRUCTURES | 9-90 |
| 48 | 9-20.1 | Patching Material..... | 9-90 |
| 49 | 9-20.2 | Specifications..... | 9-90 |
| 50 | 9-20.2(1) | Patching Mortar | 9-90 |
| 51 | 9-20.2(2) | Patching Mortar Extended with Aggregate | 9-90 |
| 52 | 9-20.2(3) | Aggregate..... | 9-91 |
| 53 | 9-20.2(4) | Water..... | 9-91 |
| 54 | 9-20.3 | Grout..... | 9-91 |
| 55 | 9-20.3(1) | Grout Type 1 for Post-Tensioning Applications | 9-91 |
| 56 | 9-20.3(2) | Grout Type 2 for Nonshrink Applications..... | 9-91 |
| 57 | 9-20.3(3) | Grout Type 3 for Unconfined Bearing Pad Applications | 9-91 |
| 58 | 9-20.3(4) | Grout Type 4 for Multipurpose Applications..... | 9-91 |
| 59 | 9-20.4 | Mortar | 9-91 |
| 60 | 9-20.4(1) | Fine Aggregate for Mortar | 9-91 |
| 61 | 9-20.4(2) | Mortar Type 1 for Concrete Surface Finish..... | 9-91 |
| 62 | 9-20.4(3) | Mortar Type 2 for Masonry Applications | 9-91 |
| 63 | 9-20.4(4) | Mortar Type 3 for Concrete Repair | 9-91 |

| | | |
|----|---|------|
| 1 | SECTION 9-21 PLASTIC TRAFFIC BUTTONS AND LANE MARKERS | 9-92 |
| 2 | 9-21.1 Plastic Traffic Button and Lane Marker Type 1 | 9-92 |
| 3 | 9-21.1(1) General..... | 9-92 |
| 4 | 9-21.1(2) Physical and Chemical Properties..... | 9-92 |
| 5 | 9-21.1(3) Test Methods..... | 9-92 |
| 6 | 9-21.2 Lane Markers Type 2A and Type 2B | 9-92 |
| 7 | 9-21.2(1) Physical Properties..... | 9-92 |
| 8 | 9-21.2(2) Optical Requirements..... | 9-93 |
| 9 | 9-21.2(3) Strength Requirements | 9-93 |
| 10 | SECTION 9-22 MONUMENT FRAMES AND COVERS | 9-93 |
| 11 | 9-22.1 General..... | 9-93 |
| 12 | SECTION 9-23 CONCRETE CURING MATERIALS, POZZOLANS AND ADMIXTURES..... | 9-93 |
| 13 | 9-23.1 Sheet Materials for Curing Concrete..... | 9-93 |
| 14 | 9-23.2 Liquid Membrane Forming Concrete Curing Compounds..... | 9-93 |
| 15 | 9-23.3 Burlap Cloth..... | 9-94 |
| 16 | 9-23.4 Chemical Admixtures for Concrete | 9-94 |
| 17 | 9-23.4(1) Air-Entraining Admixtures..... | 9-94 |
| 18 | 9-23.4(2) Type A Water-Reducing Admixtures | 9-94 |
| 19 | 9-23.4(3) Type B Retarding Admixtures..... | 9-94 |
| 20 | 9-23.4(4) Type C Accelerating Admixtures | 9-94 |
| 21 | 9-23.4(5) Type D Water-Reducing And Retarding Admixtures | 9-94 |
| 22 | 9-23.4(6) Type E Water-Reducing And Accelerating Admixtures | 9-94 |
| 23 | 9-23.4(7) Type F Water-Reducing, High Range Admixtures..... | 9-94 |
| 24 | 9-23.4(8) Type G Water-Reducing, High Range, And Retarding Admixtures | 9-94 |
| 25 | 9-23.4(9) Type S Specific Performance Admixtures | 9-94 |
| 26 | 9-23.5 Waterproofing..... | 9-94 |
| 27 | 9-23.6 Fly Ash..... | 9-94 |
| 28 | 9-23.7 Ground Granulated Blast Furnace Slag (Ggbfs) | 9-94 |
| 29 | 9-23.8 Microsilica Fume..... | 9-95 |
| 30 | 9-23.9 Metakaolin | 9-95 |
| 31 | 9-23.10 Limestone | 9-95 |
| 32 | SECTION 9-24 PLASTIC WATERSTOP | 9-95 |
| 33 | 9-24.1 Material..... | 9-95 |
| 34 | 9-24.1(1) Tests Of Material..... | 9-95 |
| 35 | SECTION 9-25 WATER..... | 9-95 |
| 36 | 9-25.1 Water For Concrete | 9-95 |
| 37 | 9-25.2 Water For Irrigation..... | 9-96 |
| 38 | SECTION 9-26 EPOXY RESINS..... | 9-96 |
| 39 | 9-26.1 Epoxy Bonding Agents | 9-96 |
| 40 | 9-26.1(1) General..... | 9-96 |
| 41 | 9-26.1(1)A Type I and Type IV..... | 9-96 |
| 42 | 9-26.1(1)B Type II and Type V..... | 9-96 |
| 43 | 9-26.1(1)C Type III..... | 9-96 |
| 44 | 9-26.1(2) Packaging and Marking | 9-96 |
| 45 | 9-26.1(3) Certification | 9-96 |
| 46 | 9-26.1(4) Rejection | 9-96 |
| 47 | 9-26.1(5) Acceptance..... | 9-96 |
| 48 | 9-26.2 Epoxy Adhesive for Lane Markers..... | 9-96 |
| 49 | 9-26.2(1) General..... | 9-96 |
| 50 | 9-26.2(2) Packaging and Marking..... | 9-96 |
| 51 | 9-26.2(3) Certification | 9-96 |
| 52 | 9-26.2(4) Rejection | 9-97 |
| 53 | 9-26.2(5) Acceptance..... | 9-97 |
| 54 | 9-26.3 Epoxy Grout/Mortar/Concrete..... | 9-97 |
| 55 | 9-26.3(1) General..... | 9-97 |
| 56 | 9-26.3(1)A Traffic Bearing Applications | 9-97 |
| 57 | 9-26.3(1)B Non-Traffic Bearing Applications..... | 9-97 |
| 58 | 9-26.3(2) Packaging and Marking..... | 9-97 |
| 59 | 9-26.3(3) Certification | 9-97 |
| 60 | 9-26.3(4) Rejection | 9-97 |
| 61 | 9-26.3(5) Acceptance..... | 9-97 |
| 62 | SECTION 9-27 CRIBBING | 9-97 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | |
|----|---|-------|
| 1 | 9-27.1 Gabion Cribbing..... | 9-97 |
| 2 | 9-27.1(1) Gabion Fabric..... | 9-97 |
| 3 | 9-27.1(2) Gabion Baskets..... | 9-97 |
| 4 | 9-27.1(3) Gabion Mattresses..... | 9-98 |
| 5 | 9-27.1(4) Fasteners for Basket Assembly..... | 9-98 |
| 6 | 9-27.1(5) Nonraveling Construction..... | 9-99 |
| 7 | 9-27.1(6) Stone..... | 9-99 |
| 8 | SECTION 9-28 SIGNING MATERIALS AND FABRICATION..... | 9-99 |
| 9 | 9-28.1 Signs 9-99 | |
| 10 | 9-28.1(1) General..... | 9-99 |
| 11 | 9-28.1(2) Plywood..... | 9-99 |
| 12 | 9-28.1(3) Sheet Aluminum Signs..... | 9-99 |
| 13 | 9-28.1(4) Reflective Sign Face Sheeting..... | 9-100 |
| 14 | 9-28.1(5) Non Reflective Sign Face Sheeting..... | 9-101 |
| 15 | 9-28.1(6) Sheeting Application..... | 9-101 |
| 16 | 9-28.1(7) Letters, Arrows, and Symbols..... | 9-101 |
| 17 | 9-28.1(8) Hardware..... | 9-102 |
| 18 | 9-28.2 Posts 9-102 | |
| 19 | 9-28.2(1) Parking Meter Post..... | 9-102 |
| 20 | 9-28.2(1)A General..... | 9-102 |
| 21 | 9-28.2(1)B Direct Burial Parking Meter Post..... | 9-102 |
| 22 | 9-28.2(1)C Surface Mounted Parking Meter Posts..... | 9-103 |
| 23 | 9-28.2(2) Telespar Qwik-Punch Sign Post and Post Anchor..... | 9-103 |
| 24 | 9-28.2(3) Street Name Sign Post..... | 9-103 |
| 25 | SECTION 9-29 PAVEMENT MARKING..... | 9-103 |
| 26 | 9-29.1 General..... | 9-103 |
| 27 | 9-29.2 Paint 9-103 | |
| 28 | 9-29.2(1) Color..... | 9-103 |
| 29 | 9-29.2(2) Prohibited Materials..... | 9-104 |
| 30 | 9-29.2(3) Low VOC Solvent Based Paint..... | 9-104 |
| 31 | 9-29.2(4) Low VOC Waterborne Paint..... | 9-104 |
| 32 | 9-29.2(5) Temporary Pavement Marking Paint..... | 9-106 |
| 33 | 9-29.3 Plastic..... | 9-106 |
| 34 | 9-29.3(1) Type A – Liquid Hot Applied Thermoplastic..... | 9-106 |
| 35 | 9-29.3(2) Type B – Pre-Formed Fused Thermoplastic..... | 9-106 |
| 36 | 9-29.3(3) Type C – Cold Applied Pre-Formed Tape..... | 9-106 |
| 37 | 9-29.3(4) Type D - Liquid Cold Applied Methyl Methacrylate..... | 9-107 |
| 38 | 9-29.4 Glass Beads for Pavement Marking Materials..... | 9-108 |
| 39 | 9-29.5 Temporary Pavement Marking Tape..... | 9-109 |
| 40 | 9-29.6 Temporary Raised Pavement Markers..... | 9-109 |
| 41 | 9-29.7 Field Testing..... | 9-109 |
| 42 | 9-29.7(1) Requirements..... | 9-109 |
| 43 | 9-29.7(1)A Retroreflectivity..... | 9-110 |
| 44 | 9-29.7(1)B Durability..... | 9-110 |
| 45 | 9-29.7(1)C Auto No-Track Time..... | 9-110 |
| 46 | 9-29.7(1)D Approval..... | 9-110 |
| 47 | SECTION 9-30 WATER DISTRIBUTION AND TRANSMISSION MATERIALS..... | 9-110 |
| 48 | 9-30.0 General..... | 9-110 |
| 49 | 9-30.1 Pipe 9-110 | |
| 50 | 9-30.1(1) Ductile Iron Pipe..... | 9-110 |
| 51 | 9-30.1(2) Steel Pipe..... | 9-111 |
| 52 | 9-30.1(2)A Steel Pipe Less Than 4 Inches Diameter..... | 9-111 |
| 53 | 9-30.1(2)B Steel Pipe 4 Inch Diameter and Larger..... | 9-111 |
| 54 | 9-30.1(3) Plastic Pipe and Asbestos Cement Pipe..... | 9-111 |
| 55 | 9-30.1(4) Pipe Coatings..... | 9-111 |
| 56 | 9-30.1(4)A Special Pipe Coatings..... | 9-111 |
| 57 | 9-30.1(4)B Multi Layered Polyethylene Tape Coating (Multi-Layered Polyethylene Encasement)..... | 9-111 |
| 58 | 9-30.1(4)C Thermoplastic Powder Coating..... | 9-112 |
| 59 | 9-30.1(4)C1 General..... | 9-112 |
| 60 | 9-30.1(4)C2 Quality of Ductile Iron Pipe..... | 9-112 |
| 61 | 9-30.1(4)C3 Surface Preparation..... | 9-112 |
| 62 | 9-30.1(4)C4 Application of Powder Coating..... | 9-112 |
| 63 | 9-30.1(4)C5 Testing..... | 9-113 |
| 64 | 9-30.1(4)C6 Field Repair and Touch Up..... | 9-113 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|-------------|---|-------|
| 1 | 9-30.1(4)C7 | Material Requirements | 9-113 |
| 2 | 9-30.1(4)D | Polyethylene Encasement (Film Wrap) | 9-114 |
| 3 | 9-30.1(4)E | Heat Shrink Joint Sleeve | 9-114 |
| 4 | 9-30.1(4)F | Wax Tape Coatings | 9-114 |
| 5 | 9-30.2 | Fittings | 9-114 |
| 6 | 9-30.2(1) | Ductile Iron Pipe | 9-114 |
| 7 | 9-30.2(2) | Steel Pipe | 9-115 |
| 8 | 9-30.2(3) | Restrained Joints | 9-115 |
| 9 | 9-30.2(4) | Wedge Restraint Glands | 9-115 |
| 10 | 9-30.2(5) | Transition Reducing, and Insulating Flexible Couplings | 9-115 |
| 11 | 9-30.2(5)A | Insulating Couplings | 9-115 |
| 12 | 9-30.2(5)B | Insulating Flange Kits | 9-115 |
| 13 | 9-30.2(6) | Restrained Flexible Couplings and Sleeves | 9-115 |
| 14 | 9-30.2(7) | Special Fittings | 9-116 |
| 15 | 9-30.2(8) | Two Inch Blowoff Assembly | 9-116 |
| 16 | 9-30.2(9) | Plastic Foam (Ethafoam) | 9-116 |
| 17 | 9-30.2(10) | Cement Concrete | 9-116 |
| 18 | 9-30.2(11) | Steel Casing Pipe | 9-116 |
| 19 | 9-30.2(12) | Seals and Spacers for Steel Casing Pipe | 9-116 |
| 20 | 9-30.2(12)A | Seals | 9-116 |
| 21 | 9-30.2(12)B | Spacers | 9-116 |
| 22 | 9-30.3 | Valves | 9-116 |
| 23 | 9-30.3(1) | General Manufacture and Marking | 9-116 |
| 24 | 9-30.3(2) | Gate Valves | 9-116 |
| 25 | 9-30.3(2)A | Gate Valves Double Disc | 9-116 |
| 26 | 9-30.3(2)B | Gate Valves Resilient Seat | 9-117 |
| 27 | 9-30.3(3) | Butterfly Valves | 9-117 |
| 28 | 9-30.3(4) | Valve Boxes | 9-117 |
| 29 | 9-30.3(5) | Combination Air Release / Air Vacuum Valves | 9-118 |
| 30 | 9-30.3(6) | End Connections | 9-118 |
| 31 | 9-30.3(7) | Operating Nut Extensions | 9-118 |
| 32 | 9-30.3(8) | Plastic Foam Rings | 9-118 |
| 33 | 9-30.3(9) | Valve Chambers | 9-118 |
| 34 | 9-30.3(9)A | Precast Valve Chamber | 9-118 |
| 35 | 9-30.3(9)B | Concrete Blocks for Valve Chambers | 9-118 |
| 36 | 9-30.3(9)C | Concrete Brick for Valve Chambers | 9-118 |
| 37 | 9-30.3(9)D | Clay Brick for Valve Chambers | 9-118 |
| 38 | 9-30.3(9)E | Mortar | 9-119 |
| 39 | 9-30.3(9)F | Cement Concrete | 9-119 |
| 40 | 9-30.3(9)G | Cast-In-Place Concrete Valve Chamber | 9-119 |
| 41 | 9-30.3(9)H | Frame and Cover and Valve Box Castings | 9-119 |
| 42 | 9-30.3(9)I | Mortar for Plaster Coating | 9-119 |
| 43 | 9-30.3(9)J | Ladders | 9-119 |
| 44 | 9-30.3(10) | Painting at Factory | 9-119 |
| 45 | 9-30.3(11) | Water Pressure Regulating Valves | 9-119 |
| 46 | 9-30.3(12) | Coatings for Valves | 9-120 |
| 47 | 9-30.4 | Hydrants | 9-120 |
| 48 | 9-30.4(1) | General | 9-120 |
| 49 | 9-30.4(2) | End Connections | 9-120 |
| 50 | 9-30.4(3) | Hydrant Dimensions | 9-120 |
| 51 | 9-30.4(4) | Operating Nuts | 9-120 |
| 52 | 9-30.4(5) | Hydrant Restraint | 9-120 |
| 53 | 9-30.4(5)A | Restraint System for Shackle Rods | 9-120 |
| 54 | 9-30.4(5)B | Restraint System for Wedge Restraint Glands | 9-120 |
| 55 | 9-30.4(6) | Breakaway Flange Construction | 9-121 |
| 56 | 9-30.4(7) | Hydrant Painting | 9-121 |
| 57 | 9-30.4(7)A | Hydrant Shop Painting | 9-121 |
| 58 | 9-30.4(7)B | Hydrant Field Touch Up Painting | 9-121 |
| 59 | 9-30.4(8) | Hydrant Factory Hydrostatic Test | 9-121 |
| 60 | 9-30.4(9) | Hydrant Connection Pipe | 9-121 |
| 61 | 9-30.4(10) | Hydrant Vertical Extensions | 9-121 |
| 62 | 9-30.4(11) | Hydrant Bleeder | 9-121 |
| 63 | 9-30.4(12) | Polyethylene Encasement and Special Tape Coating for Hydrants and Connections | 9-121 |
| 64 | 9-30.5 | Service Connections and Service Pipe or Tubing | 9-121 |
| 65 | 9-30.5(1) | General | 9-121 |
| 66 | 9-30.5(2) | Saddles | 9-121 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|---|--|-------|
| 1 | 9-30.5(3) | Corporation Stops | 9-122 |
| 2 | 9-30.5(4) | Service Pipe | 9-122 |
| 3 | 9-30.5(4)A | Copper Tubing | 9-122 |
| 4 | 9-30.5(5) | Compression Couplings | 9-122 |
| 5 | 9-30.5(6) | Meter Stops and Setters..... | 9-122 |
| 6 | 9-30.5(7) | Meter Box and Lid | 9-122 |
| 7 | 9-30.5(8) | Valves..... | 9-122 |
| 8 | 9-30.6 | Bedding, Foundation Material and Gravel | 9-122 |
| 9 | 9-30.7 | Joint Bond Cable | 9-122 |
| 10 | 9-30.8 | Thermite Weld Materials..... | 9-122 |
| 11 | 9-30.8(1) | General..... | 9-122 |
| 12 | 9-30.8(2) | Adapter Sleeves | 9-122 |
| 13 | 9-30.8(3) | Thermite Weld Caps and Primer | 9-122 |
| 14 | 9-30.8(4) | Coating Repair at Thermite Weld | 9-123 |
| 15 | 9-30.9 | Electrolysis Test Station | 9-123 |
| 16 | 9-30.9(1) | General Non Traffic Area..... | 9-123 |
| 17 | 9-30.9(2) | Test Box | 9-123 |
| 18 | 9-30.9(3) | Test Station Wires | 9-123 |
| 19 | 9-30.9(4) | Wire Connectors Inside Test Box | 9-123 |
| 20 | 9-30.9(5) | Zinc Reference Electrodes | 9-123 |
| 21 | 9-30.9(6) | Electrical Conduit and Fittings..... | 9-123 |
| 22 | 9-30.9(7) | Sacrificial Anodes..... | 9-123 |
| 23 | 9-30.10 | Turbine Meters (Meter, Cold Water, Magnetic Drive Turbine Type, Sizes 2" - 12")..... | 9-123 |
| 24 | 9-30.10(1) | General..... | 9-123 |
| 25 | 9-30.10(2) | Register And Register Box | 9-123 |
| 26 | 9-30.10(3) | Measuring Mechanism | 9-124 |
| 27 | 9-30.10(4) | Intermediate Gear Train | 9-124 |
| 28 | 9-30.10(5) | Capacity and Accuracy..... | 9-124 |
| 29 | 9-30.10(6) | Normal Flow Limits..... | 9-124 |
| 30 | 9-30.10(7) | Head Loss | 9-124 |
| 31 | 9-30.10(8) | Connections | 9-124 |
| 32 | 9-30.10(9) | Interchangeable Parts | 9-124 |
| 33 | 9-30.10(10) | Strainer..... | 9-124 |
| 34 | 9-30.10(11) | Remote Reading | 9-124 |
| 35 | 9-30.10(12) | Manufacture and Approval | 9-124 |
| 36 | 9-30.10(13) | Inspection | 9-124 |
| 37 | 9-30.10(14) | Guarantee | 9-124 |
| 38 | 9-30.10(15) | Test Report..... | 9-125 |
| 39 | 9-30.11 | Locating Wire..... | 9-125 |
| 40 | 9-30.12 | Coating for All Bolts and Shackle Rods | 9-125 |
| 41 | 9-30.13 | Backflow Prevention Assemblies (BPAs)..... | 9-125 |
| 42 | 9-30.13(1) | General..... | 9-125 |
| 43 | 9-30.13(2) | Atmospheric Vacuum Breakers (AVBs)..... | 9-125 |
| 44 | 9-30.13(3) | Pressure Vacuum Breaker Assemblies (PVBAs) | 9-125 |
| 45 | 9-30.13(4) | Double Check Valve Assemblies (DCVAs)..... | 9-125 |
| 46 | 9-30.13(5) | Reduced Pressure Principle Backflow Prevention Assemblies (RPBAs)..... | 9-125 |
| 47 | SECTION 9-31 ILLUMINATION AND ELECTRICAL MATERIALS..... | | 9-126 |
| 48 | 9-31.1 | Luminaires | 9-126 |
| 49 | 9-31.1(1) | General..... | 9-126 |
| 50 | 9-31.1(2) | Roadway Lighting Luminaire | 9-126 |
| 51 | 9-31.1(3) | Lamps..... | 9-126 |
| 52 | 9-31.1(4) | Photoelectric Controls | 9-126 |
| 53 | 9-31.1(5) | Underdeck Mounted Undercrossing Luminaire | 9-126 |
| 54 | 9-31.1(6) | Wall Pack Luminaire..... | 9-126 |
| 55 | 9-31.2 | Wire | 9-127 |
| 56 | 9-31.3 | Wire Splices..... | 9-127 |
| 57 | 9-31.4 | Fuses And Fuse Holders | 9-127 |
| 58 | 9-31.5 | Ground Rods, Clamps, and Hardware..... | 9-128 |
| 59 | 9-31.6 | Enclosures..... | 9-128 |
| 60 | 9-31.7 | Receptacles | 9-128 |
| 61 | SECTION 9-32 TRAFFIC SIGNALS SYSTEM | | 9-128 |
| 62 | 9-32.1 | Signal Heads, Vehicle..... | 9-128 |
| 63 | 9-32.1(1) | General..... | 9-128 |
| 64 | 9-32.1(1)A | Signal Head Components | 9-128 |
| 65 | 9-32.1(1)B | Housing..... | 9-128 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--------------|--|-------|
| 1 | 9-32.1(1)C | Door Assembly | 9-129 |
| 2 | 9-32.1(1)D | Optical Unit | 9-129 |
| 3 | 9-32.1(1)E | Backplate | 9-130 |
| 4 | 9-32.1(2) | Bi Modal Vehicle Signals Section | 9-130 |
| 5 | 9-32.1(3) | Directional Louvers | 9-130 |
| 6 | 9-32.2 | Signal Heads, Pedestrian | 9-130 |
| 7 | 9-32.2(1) | General..... | 9-130 |
| 8 | 9-32.2(2) | Message Module | 9-130 |
| 9 | 9-32.2(3) | Case..... | 9-132 |
| 10 | 9-32.2(4) | Eggcrate Visor..... | 9-132 |
| 11 | 9-32.3 | Pedestrian Pushbutton Assembly | 9-132 |
| 12 | 9-32.3(1) | Accessible Pedestrian Signal System | 9-133 |
| 13 | 9-32.4 | Detector Loops | 9-133 |
| 14 | 9-32.5 | Illuminated Sign | 9-133 |
| 15 | 9-32.6 | Emergency Vehicle Preemption..... | 9-134 |
| 16 | 9-32.6(1) | Opticom Discriminators | 9-134 |
| 17 | 9-32.7 | Interconnect Cable..... | 9-134 |
| 18 | 9-32.7(1) | UNDERGROUND..... | 9-134 |
| 19 | 9-32.7(2) | AERIAL (FIGURE 8)..... | 9-134 |
| 20 | 9-32.7(3) | INDOOR | 9-134 |
| 21 | 9-32.8 | Service Cabinet | 9-134 |
| 22 | 9-32.9 | Signal Wiring | 9-135 |
| 23 | 9-32.9(1) | Traffic Signal Cable | 9-135 |
| 24 | 9-32.9(2) | Pedestrian Pushbutton Cable..... | 9-135 |
| 25 | 9-32.9(3) | Electrical Service Connections | 9-135 |
| 26 | 9-32.9(4) | Overcurrent Protection | 9-135 |
| 27 | 9-32.9(5) | Terminal Cabinets | 9-135 |
| 28 | 9-32.9(6) | Ground Rods, Clamps and Bonding..... | 9-135 |
| 29 | 9-32.9(7) | Squeeze Cable Fittings | 9-135 |
| 30 | 9-32.10 | Span Wire..... | 9-135 |
| 31 | 9-32.11 | Pole Line Hardware | 9-135 |
| 32 | 9-32.12 | Galvanizing Repair Paint | 9-136 |
| 33 | SECTION 9-33 | POLES, PEDESTALS, AND FOUNDATIONS | 9-136 |
| 34 | 9-33.1 | General..... | 9-136 |
| 35 | 9-33.1(1) | Poles, Mast Arms, and Bracket Arms..... | 9-136 |
| 36 | 9-33.1(2) | Anchor Bolts | 9-136 |
| 37 | 9-33.1(3) | Galvanizing..... | 9-136 |
| 38 | 9-33.1(4) | Ground Lugs..... | 9-136 |
| 39 | 9-33.1(5) | Nut Covers | 9-136 |
| 40 | 9-33.1(6) | Concentricity..... | 9-137 |
| 41 | 9-33.1(7) | Grout | 9-137 |
| 42 | 9-33.2 | Steel Poles, Mast Arms, Bracket Arms, and Luminaire Extensions | 9-137 |
| 43 | 9-33.2(1) | General..... | 9-137 |
| 44 | 9-33.2(2) | Strength and Deflection Requirements..... | 9-137 |
| 45 | 9-33.2(3) | Bolt Circle | 9-137 |
| 46 | 9-33.2(4) | Welds | 9-137 |
| 47 | 9-33.2(5) | Handholes, Festoons, and Cable Outlets on Poles | 9-137 |
| 48 | 9-33.2(6) | Anchor Base Plates..... | 9-137 |
| 49 | 9-33.2(7) | Pole and Mast Arm Caps..... | 9-138 |
| 50 | 9-33.2(8) | Bracket Arms..... | 9-138 |
| 51 | 9-33.3 | Aluminum Poles..... | 9-138 |
| 52 | 9-33.3(1) | Roadway | 9-138 |
| 53 | 9-33.3(2) | Pedestrian Round..... | 9-138 |
| 54 | 9-33.3(3) | Pedestrian Square..... | 9-138 |
| 55 | 9-33.3(4) | Decorative | 9-138 |
| 56 | 9-33.4 | Wood Poles | 9-138 |
| 57 | 9-33.4(1) | General..... | 9-138 |
| 58 | 9-33.4(2) | Douglas Fir | 9-138 |
| 59 | 9-33.4(3) | Western Red Cedar..... | 9-138 |
| 60 | 9-33.5 | Steel Pedestals and Aluminum Pedestals | 9-139 |
| 61 | 9-33.5(1) | Steel Pedestals | 9-139 |
| 62 | 9-33.5(2) | Aluminum Pedestals..... | 9-139 |
| 63 | 9-33.6 | Pedestrian Pushbutton Posts | 9-139 |
| 64 | 9-33.7 | Back Guy Assemblies and Guy Wire | 9-139 |
| 65 | SECTION 9-34 | ELECTRICAL AND SIGNAL CONDUITS | 9-139 |

2017 Edition of City of Seattle Standard Specifications for Roads, Bridges, and Municipal Construction

| | | | |
|----|--|---|-------|
| 1 | 9-34.1 | General | 9-139 |
| 2 | 9-34.2 | Rigid Steel Conduit | 9-140 |
| 3 | 9-34.2(1) | General..... | 9-140 |
| 4 | 9-34.2(2) | Threads | 9-140 |
| 5 | 9-34.2(3) | Couplings and Fittings | 9-140 |
| 6 | 9-34.2(4) | PVC Coating..... | 9-140 |
| 7 | 9-34.2(5) | Expansion/Deflection Fittings in Non Hazard Areas | 9-140 |
| 8 | 9-34.3 | PVC Conduit..... | 9-140 |
| 9 | 9-34.4 | Conduit Riser | 9-141 |
| 10 | 9-34.5 | Pull Cord..... | 9-141 |
| 11 | 9-34.6 | Handholes | 9-141 |
| 12 | SECTION 9-35 ELASTOMERIC BEARING PADS | | 9-141 |
| 13 | SECTION 9-36 DETECTABLE WARNING | | 9-141 |
| 14 | 9-36.1 | General..... | 9-141 |
| 15 | 9-36.2 | Detectable Warning Plate – Cast-In-Place | 9-142 |
| 16 | 9-36.3 | Detectable Warning Plate Retrofit – Surface Applied | 9-142 |
| 17 | 9-36.4 | “Approved Equal” Requirements..... | 9-142 |
| 18 | SECTION 9-37 CONSTRUCTION GEOTEXTILES | | 9-142 |
| 19 | 9-37.1 | Geotextile and Thread for Sewing | 9-142 |
| 20 | 9-37.2 | Geotextile Properties | 9-143 |
| 21 | 9-37.3 | Aggregate Cushion for Permanent Erosion Control Geotextile..... | 9-145 |
| 22 | 9-37.4 | Geotextile Approval and Acceptance..... | 9-145 |
| 23 | 9-37.4(1) | Source Approval..... | 9-145 |
| 24 | 9-37.4(2) | Geotextile Samples for Source Approval And Engineer Testing | 9-145 |
| 25 | 9-37.4(3) | Acceptance Samples..... | 9-145 |
| 26 | 9-37.4(4) | Acceptance by Certificate Of Compliance | 9-146 |
| 27 | 9-37.4(5) | Approval Of Seams | 9-146 |
| 28 | SECTION 9-38 TEMPORARY TRAFFIC CONTROL MATERIALS | | 9-146 |
| 29 | 9-38.0 | General Requirements..... | 9-146 |
| 30 | 9-38.1 | Stop/Slow Paddles..... | 9-147 |
| 31 | 9-38.2 | Construction Signs..... | 9-147 |
| 32 | 9-38.3 | Wood Sign Posts | 9-147 |
| 33 | 9-38.4 | Sequential Arrow Signs | 9-147 |
| 34 | 9-38.5 | Portable Changeable Message Signs..... | 9-148 |
| 35 | 9-38.6 | Barricades | 9-148 |
| 36 | 9-38.7 | Traffic Safety Drums | 9-148 |
| 37 | 9-38.8 | Barrier Drums | 9-149 |
| 38 | 9-38.9 | Traffic Cones | 9-149 |
| 39 | 9-38.10 | Tubular Markers..... | 9-149 |
| 40 | 9-38.11 | Warning Lights and Flashers | 9-149 |
| 41 | 9-38.12 | Truck-Mounted Attenuator | 9-149 |
| 42 | 9-38.13 | Tall Channelizing Devices | 9-149 |
| 43 | 9-38.14 | Portable Temporary Traffic Control Signal..... | 9-150 |
| 44 | 9-38.14(1)A | Flashing Operations..... | 9-150 |
| 45 | 9-38.15 | Type III or Type IV Reflective Sheeting | 9-151 |
| 46 | | | |
| 47 | | | |

1 **DIVISION 1 GENERAL REQUIREMENTS**

2 **SECTION 1-01 DEFINITIONS AND TERMS**

3 **1-01.1 GENERAL**

4 Standard acronyms, abbreviations, definitions, and symbols common to the fields of engineering and construction are
 5 used throughout the Contract without further explanation. Acronyms and definitions often used in the Contract are found in
 6 Sections 1-01.2 and 1-01.3. Frequently used abbreviations are found in Standard Plan 002. Additional acronyms, definitions,
 7 and symbols may be found in the Project Manual or Drawings. Welding symbols are defined in the current edition of the
 8 American Welding Society Structural Welding Code.

9 When used in the Contract, the acronyms listed in Section 1-01.2(1) and terms defined in Section 1-01.3 or pronouns
 10 used in place of acronyms and terms have the indicated meanings unless the context implies otherwise.

11 Words in the plural include singular and vice versa.

12 Words of a particular gender include any gender.

13 **1-01.2 ABBREVIATIONS**

14 **1-01.2(1) ASSOCIATIONS AND MISCELLANEOUS**

15 The following standard acronyms are used throughout the Bid Documents:

| | | |
|----|--------|--|
| 16 | A2LA | American Association for Laboratory Accreditation |
| 17 | AAA | American Arbitration Association |
| 18 | AAN | American Association of Nurserymen |
| 19 | AAR | Association of American Railroads |
| 20 | AASHTO | American Association of State Highway and Transportation Officials |
| 21 | ACI | American Concrete Institute |
| 22 | ACIL | American Council of Independence Laboratories |
| 23 | ADA | Americans with Disabilities Act |
| 24 | AGA | American Gas Association |
| 25 | AGC | Associated General Contractors of America |
| 26 | AHERA | Asbestos Hazard Emergency Response Act |
| 27 | AI | Asphalt Institute |
| 28 | AIA | American Institute of Architects |
| 29 | AIHA | American Industrial Hygiene Association |
| 30 | AISC | American Institute of Steel Construction |
| 31 | AISI | American Iron and Steel Institute |
| 32 | AITC | American Institute of Timber Construction |
| 33 | ALSC | American Lumber Standards Committee |
| 34 | ANSI | American National Standards Institute |
| 35 | APA | American Plywood Association |
| 36 | API | American Petroleum Institute |
| 37 | APWA | American Public Works Association |
| 38 | ARA | American Railway Association |
| 39 | AREMA | American Railroad Engineering and Maintenance-of-Way Association |
| 40 | ARTBA | American Road and Transportation Builder's Association |
| 41 | ASA | American Standards Association |
| 42 | ASCE | American Society of Civil Engineers |
| 43 | ASLA | American Society of Landscape Architects |
| 44 | ASME | American Society of Mechanical Engineers |
| 45 | ASNS | American Standard for Nursery Stock |
| 46 | ASNT | American Society for Non Destruction Testing |
| 47 | ASSE | American Society of Sanitary Engineering |
| 48 | ASTM | American Society for Testing and Materials |
| 49 | AWCM | Arborist Wood Chip Mulch |
| 50 | AWPA | American Wood Preservers' Association |

| | | |
|----|--------|---|
| 1 | AWS | American Welding Society |
| 2 | AWWA | American Water Works Association |
| 3 | BMP | Best Management Practice |
| 4 | BR | Bridge Replacement and Redevelopment Program |
| 5 | CARB | California Air Research Board |
| 6 | CBD | Central Business District |
| 7 | CBE | Combination Business Enterprise |
| 8 | CCTV | Closed-Circuit Television |
| 9 | CDBG | Community Development Block Grant |
| 10 | CDF | Controlled Density Fill |
| 11 | CESCL | Certified Erosion and Sediment Control Lead |
| 12 | CFR | Code of Federal Regulations |
| 13 | CLI | Chain Link Institute |
| 14 | CPCS | City Purchasing and Contracting Services |
| 15 | CPESC | Certified Professional in Erosion and Sediment Control |
| 16 | CPM | Critical Path Method |
| 17 | CRAB | County Road Administration Board |
| 18 | CRSI | Concrete Reinforcing Steel Institute |
| 19 | CRT | Controlled Releasing Terminal |
| 20 | CSECP | Construction Stormwater and Erosion Control Plan |
| 21 | CSI | Construction Specifications Institute |
| 22 | CWA | Community Workforce Agreement |
| 23 | DBE | Disadvantaged Business Enterprise |
| 24 | DBH | Diameter at Breast Height |
| 25 | DBRA | Davis Bacon and Related Acts |
| 26 | DIPRA | Ductile Iron Pipe Research Association |
| 27 | ECY | Washington State Department of Ecology |
| 28 | EE | Engineer's Estimate |
| 29 | EEI | Edison Electric Institute |
| 30 | EEO | Equal Employment Opportunity |
| 31 | EPA | Environmental Protection Agency |
| 32 | ESCBMP | Erosion and Sedimentation Control Best Management Practices |
| 33 | ESD | Employment Security Department |
| 34 | FAS | Department of Finance and Administrative Services |
| 35 | FEMA | Federal Emergency Management Agency |
| 36 | FHWA | Federal Highway Administration |
| 37 | FSS | Federal Specifications and Standards, General Services Administration |
| 38 | FTA | Federal Transit Administration |
| 39 | HPMA | Hardwood Plywood Manufacturers Association |
| 40 | HUD | United States Department of Housing and Urban Development |
| 41 | IAPMO | International Association of Plumbers and Mechanical Officials |
| 42 | ICEA | Insulated Cable Engineers Association |
| 43 | ICOR | Interagency Commission on Outdoor Recreation |
| 44 | IEEE | Institute of Electrical and Electronic Engineers |
| 45 | IES | Illuminating Engineering Society |
| 46 | IMSA | International Municipal Signal Association |
| 47 | IPCEA | Insulated Power Cable Engineers' Association |
| 48 | ISA | International Society of Arboriculture |
| 49 | ISTEA | Intermodal Surface Transportation Efficiency Act |
| 50 | ITE | Institute of Transportation Engineers |
| 51 | ITS | Intelligent Transportation Systems |

| | | |
|----|---------|--|
| 1 | JAC | Joint Administrative Committee |
| 2 | KCM | King County METRO |
| 3 | LED | Light Emitting Diode |
| 4 | LPI | Lighting Protection Institute |
| 5 | MBE | Minority Business Enterprise |
| 6 | METROKC | King County Department of Transportation |
| 7 | MSDS | Material Safety Data Sheet |
| 8 | MTCA | Washington Model Toxics Control Act |
| 9 | MSHA | Mine Safety and Health Act |
| 10 | MUTCD | Manual on Uniform Traffic Control Devices |
| 11 | MWBE | Minority and Women Business Enterprise |
| 12 | NACE | National Association of Corrosion Engineers |
| 13 | NAPA | National Asphalt Pavement Association |
| 14 | NCMA | National Concrete Masonry Association |
| 15 | NCSPA | National Corrugated Steel Pipe Association |
| 16 | NEC | National Electrical Code |
| 17 | NECA | National Electrical Contractors Association |
| 18 | NEMA | National Electrical Manufacturer's Association |
| 19 | NEPA | National Environmental Policy Act |
| 20 | NESC | National Electrical Safety Code |
| 21 | NETA | International Electric Testing Association |
| 22 | NFPA | National Fire Protection Association |
| 23 | NFPA | National Forest Products Association |
| 24 | NHS | National Highway System |
| 25 | NPCA | National Precast Concrete Association |
| 26 | NPDES | National Pollution Discharge Elimination System |
| 27 | NRMCA | National Ready Mix Concrete Association |
| 28 | NRCA | National Roofing Contractors Association |
| 29 | NSF | National Sanitation Foundation |
| 30 | NTCIP | National Transportation Communication for ITS Protocol |
| 31 | NTP | Notice to Proceed |
| 32 | NTPEP | National Transportation Product Evaluation Program |
| 33 | OMWBE | Office of Minority and Women's Business Enterprises |
| 34 | OSHA | Occupational Safety and Health Administration |
| 35 | PACP | Pipeline Assessment and Certification Program |
| 36 | PCA | Portland Cement Association |
| 37 | PDF | Portable Document Format |
| 38 | P/PCI | Precast/Prestressed Concrete Institute |
| 39 | PORT | Port of Seattle |
| 40 | PPI | Plastic Pipe Institute |
| 41 | PSCAA | Puget Sound Clean Air Agency |
| 42 | PW | Public Works |
| 43 | RCW | Revised Code of Washington |
| 44 | REA | Rural Electrification Association |
| 45 | ROW | Right of Way |
| 46 | RRP | Railway Highway Grade Crossing Program |
| 47 | SCADA | Supervisory Control and Data Acquisition |
| 48 | SAC | Washington State Apprenticeship and Training Council |
| 49 | SAE | Society of Automotive Engineers |
| 50 | SBRC | Supplemental Bidder Responsibility Criteria |
| 51 | SCS | Soil Conservation Service |

| | | |
|----|--------|---|
| 1 | SCL | Seattle City Light |
| 2 | SDCI | Seattle Department of Construction and Inspections |
| 3 | SDOT | Seattle Department of Transportation |
| 4 | SEPA | State Environmental Policy Act |
| 5 | SKCDPH | Seattle King County Department of Public Health |
| 6 | SMC | Seattle Municipal Code |
| 7 | SP | Spill Plan |
| 8 | SPP | Serial Port Protocol |
| 9 | SPR | Seattle Parks and Recreation |
| 10 | SPU | Seattle Public Utilities |
| 11 | SOP | Standard Operating Procedure |
| 12 | SSPC | Society of Protective Coatings |
| 13 | SSPC | Steel Structures Painting Council |
| 14 | STA | Seal of Testing Insurance |
| 15 | STCM | Seattle Traffic Control Manual |
| 16 | SWPPP | Stormwater Pollution Prevention Plan |
| 17 | TCM | Traffic Control Manager |
| 18 | TCP | Traffic Control Plan |
| 19 | TCS | Traffic Control Supervisor |
| 20 | TDP | Temporary Discharge Plan |
| 21 | TVSPP | Tree, Vegetation and Soil Protection Plan |
| 22 | UBI | Unified Business Identifier |
| 23 | UL | Underwriters Laboratory |
| 24 | UMTA | Urban Mass Transit Administration |
| 25 | USACE | United States Army Corps of Engineers |
| 26 | USCGS | United States Coastal and Geodetic Survey |
| 27 | USDA | United States Department of Agriculture |
| 28 | USDOE | United States Department of Energy |
| 29 | USEPA | United States Environmental Protection Agency |
| 30 | WAC | Washington Administrative Code |
| 31 | WACA | Washington Aggregates and Concrete Association |
| 32 | WALP | Washington Association of Landscape Professionals |
| 33 | WAQTC | Western Alliance for Quality Transportation Construction |
| 34 | WBE | Women’s Business Enterprise |
| 35 | WCLIB | West Coast Lumber Inspection Bureau |
| 36 | WISHA | Washington Industrial Safety and Health Administration |
| 37 | WMBE | Women or Minority Business Enterprise |
| 38 | WRI | Wire Reinforcement Institute |
| 39 | WSATC | Washington State Apprenticeship and Training Council |
| 40 | WSDOT | Washington State Department of Transportation |
| 41 | WSDSHS | Washington State Department of Social and Health Services |
| 42 | WSEM | Washington State Energy Management |
| 43 | WWPA | Western Wood Products Association |

1-01.2(2) BID ITEMS OF WORK AND UNITS OF MEASUREMENT

45 Standard abbreviations are included on Standard Plan 002. Standard symbols are included on Standard Plan 003. When
46 abbreviations are used in the Bid Form to denote Bid Items of Work and units of measurement, each abbreviated term has the
47 meaning specified for it as noted in the subparagraph immediately above unless a Bid Item measurement or payment
48 description specifies another meaning.

1-01.3 DEFINITIONS

As used in this Contract, the terms listed below are defined as indicated. Unless the Contract specifically indicates otherwise, the definitions of electrical and electronic abbreviations, terms and phrases used in the Contract are those contained in the official edition of the IEEE Dictionary of Electrical and Electronic Terms.

Definitions for street designations and classifications are found in the current edition of Seattle's Rights of Way Improvements Manual. The manual applies solely to street Rights of Way and does not apply to Rights of Way dedicated solely for utility purposes.

ADDENDUM

A document issued to all Bidders before the Bid Opening Date identified as an Addendum, which modifies or clarifies the Bid Documents and Contract.

ADDITIVE

Additional Work identified separately in the Bid, which may be Awarded at the discretion of the Owner.

ADVERTISEMENT FOR BIDS

The official public notice soliciting Bids for Work and published in the City's official newspaper and on-line solicitation website.

AFFIDAVIT

A written document in which the signer swears under oath before a notary public or someone authorized to take oaths that the statements in the document are true.

AFFIRMATIVE EFFORTS

The good faith efforts for inclusion of women and minority-owned firms (WMBEs) documented in the Inclusion Plan form as part of a Bid.

AGREEMENT FORM

The Owner-provided form with authorized signatures of the Contractor and the Owner to Execute the Contract.

ALTERNATE

Work or Bid Items, identified separately in the Bid Documents, which permits a choice of different methods or Materials of construction for performing the same Work.

APPRENTICE

Any worker enrolled in an Apprentice Training Program.

APPRENTICE TRAINING PROGRAM

A program registered and in compliance with the Washington State Apprenticeship and Training Council as defined by RCW 49.04, WAC 296-05-011, and WAC 296-05-013.

ARCHITECT

An individual licensed and registered in the State of Washington to practice architecture.

ASSISTANT

The Engineer's authorized representative assigned to make detailed inspection of the Work.

AWARD

The Owner's decision to accept the lowest responsive Bid of a responsible Bidder for the Work.

BASE BID

The sum of Bid Item amounts (extensions) or the lump sum Bid on the Bid Form, excluding Additives, Alternates, and Deductives.

BID (BID FORM)

The price the Bidder offers, to perform the Work.

BIDDER

A business (sole proprietor, individual, partnership, firm, corporation, limited liability company or joint venture, etc.) submitting a Bid.

BID DOCUMENTS

The parts of the proposed Contract which may include the Advertisement for Bids, Bid Form, Agreement Form, Project Manual, Drawings, Addenda and any other documents incorporated into the Contract by reference.

BID GUARANTY

Bid bond, cashier's check or certified check accompanying the Bid, which is the guarantee that the Bidder will enter into the Contract with the Owner to perform the Work if Awarded the Contract.

BID ITEM

A unit of Work that is to be performed as part of the project by the Contractor as detailed in the Contract.

CAPABILITY OR CAPABLE

A business that the City determines to be able to perform the Work in question.

CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL)

A Contractor employee responsible for erosion and sediment control, water quality protection, and implementation of the Construction Stormwater and Erosion Control Plan (CSECP), and holds a Certificate of Training in Construction Site Erosion and Sediment Control from a course approved by the Washington State Department of Ecology.

CHANGE ORDER

A written order issued by the Engineer to the Contractor directing and/or authorizing a change to the Contract. A Change Order establishes the basis of payment and time adjustments for the Work affected by the change.

COMMERCIALLY USEFUL FUNCTION

The determination by the Owner that Work on the Contract is being performed.

COMMUNITY WORKFORCE AGREEMENT (CWA)

The agreement between the Director, on behalf of the City, and signatory labor unions which is incorporated in the Contract (also referred to as a Project Labor Agreement (PLA)), which dictates the supply and management of workers for the Work. All Contractors of every tier must be compliant unless expressly excluded.

CONTAMINATED MATERIAL(S)

Soil/material/debris/liquid that contains contaminant levels above the more stringent of their respective applicable MTCA Method A cleanup level, Method B cleanup level, or Table 749-2 level, all for unrestricted land use per current Chapter 173-340 WAC, or that contains asbestos, or that contains radionuclides above natural background levels as defined by WAC 173-340-200.

CONTAMINATED MATERIAL(S) NOT DESIGNATED AS DANGEROUS WASTE OR TSCA WASTE

Contaminated Material(s) that contains contaminants at levels below that which would cause it to be designated as Dangerous Waste(s) or TSCA Waste(s).

CONTRACT

The comprehensive written documents between the Owner and Contractor which contain the entire obligations of both parties including, but not limited to; the signed Agreement Form, Bid, conditions of the Contract, Project Manual, Drawings, Standard Specifications, Standard Plans, Addenda, certifications, supplemental agreements, Change Orders and all other documents specifically incorporated by reference.

CONTRACT PRICE

1. Awarded Contract Price: The sum total of Bid Item amounts or extensions, including selected additives or alternates, or a lump sum amount for all Work, including applicable taxes.
2. Revised Contract Price: The Awarded Contract Price, as adjusted after Award but before the Completion Date.
3. Final Contract Price: The total amount of money payable to the Contractor.

CONTRACT TIME

The period of time, established as Working Days in the Contract, between Notice to Proceed and when the Work is physically completed.

CONTRACTOR

The business contracting with the Owner to complete the Work.

CORE EMPLOYEE

An employee of an Open-Shop Contractor that meets the Core Employee criteria established under the CWA.

CORE WORKER

See Core Employee.

COVERED PROJECT

A City public works project with a project budget at or above \$5M that is not federally funded, in a remote area or otherwise not subject to the CWA.

CULVERT

Drainage Structure that may, or may not, directly support traffic and that extends across and beneath a highway, street, driveway, alley, arterial, or other public way.

DANGEROUS WASTE(S)

Solid wastes designated in WAC 173-303-070 through 173-303-100 as dangerous, or extremely hazardous or mixed waste. Dangerous Waste(s) includes all federal hazardous waste, plus certain wastes exhibiting characteristics based on toxicity or persistence.

DATES

1. Bid Due Date: The day the Bids are due.
2. Bid Opening Date: The day on which the Owner publicly opens and reads the Bids.

3. Award Date: The day the Owner accepts the lowest responsive Bid of a responsible Bidder.
4. Contract Execution Date: The day the Owner signs the Contract.
5. Notice to Proceed Date: The day on which the Contract Time starts. The Notice to Proceed Date is counted as the first Working Day of Contract Time.
6. Substantial Completion Date: The day the Engineer determines the Owner has full and unrestricted use and benefit of the completed Work, from an operational and safety standpoint. Only minor incidental Work, replacement of temporary substitute facilities, or correction or repair may remain for the physical completion of the Contract.
7. Physical Completion Date: The day the Owner determines that all Work is physically complete. Documentation required by the Contract and/or by law need not to be furnished by the Contractor by this date.
8. Completion Date: The day, certified in writing by the Owner, when all Work is determined to be complete and all obligations of the Contractor under the Contract are fulfilled. All documentation required by the Contract and/or by law must be furnished before establishment of this date.

DAY

Unless otherwise specified, day(s) are the same as Calendar Day(s).

1. Business Day: Any Day except Saturday, Sunday, or Holiday.
2. Calendar Day: The time period of 24 hours measured from midnight to the next midnight.
3. Non-Working Day: The following are Non-Working Days:
 - a. Saturday
 - b. Sunday
 - c. Holiday
 - d. A Day on which the Engineer issues a suspension order for an excusable delay or a Day declared an Unworkable Day.
 - e. A Day the Contract specifically requires the Contractor to suspend the Work.
4. Working Day: A Day not otherwise defined as a Non-Working Day.
5. Unworkable Day: A Working Day that the Engineer declares to be unworkable because of unsuitable weather, or another condition beyond the control of the Contractor that prevents ongoing or scheduled work on the critical path.

DECLARATION

The statement on the Bid Form in which the Contractor acknowledges the terms and conditions of the Contract and receipt and understanding of Addenda.

DEDUCTIVE

A supplemental unit of Work or group of Bid Items identified separately in the Bid that may, at the discretion of the Owner, be deducted from the base Bid prior to Award.

DIRECTOR

The Director of City Purchasing and Contracting Services, FAS.

DISADVANTAGED BUSINESS ENTERPRISE (DBE)

An OMWBE certified small business 51 percent owned by 1 or more individuals who are both socially and economically disadvantaged or, of a corporation, in which 51 percent of the stock is owned by 1 or more such individuals; and whose management and daily business operations are controlled by 1 or more of the socially and economically disadvantaged individuals who own it.

DISPATCH

The process by which a union refers workers for employment to Contractors as provided in the CWA.

DRAWINGS

The graphic or pictorial form of the design, location, dimensions, Materials, and other information regarding the Work.

DUAL BENEFITS

When Open-Shop Contractor or Subcontractor contributes into both an existing employer-sponsored benefit plans while also making required payments into a Trust Fund.

ECONOMICALLY DISTRESSED AREA, ECONOMICALLY DISTRESSED ZIP CODES

A geographic area defined by zip code and found by the Director to have a high concentration of individuals; 1) living at or below 200% of the Federal Poverty Level; 2) unemployed; and or 3) without a college degree, as compared to other zip codes. King County zip codes with a high density per acre of at least 2 of the 3 criteria will be identified as Economically Distressed Areas. There are 2 classes of such zip codes: tier 1 zip codes located within the City of Seattle and tier 2 zip codes located within King County and outside the City of Seattle.

ELECTRICAL SAFETY OBSERVER

The Assistant assigned to monitor electrical safety, unless indicated otherwise in the Contract.

ENGINEER

The Owner’s representative, or Assistant, who administers the Work of this project.

EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES (ESCBMPS)

The required on-site construction practices and devices that prevent, reduce, or treat erosion and sedimentation and maintain surface water quality.

EXECUTION

The date the Owner and Contractor enter into a Contract after receipt of the necessary bond, insurance, and any other required documents, as evidenced by the authorized signatures on the Agreement Form.

HELMETS TO HARDHATS

A nonprofit program that connects National Guard, Reserve, retired and transitioning active-duty military service members with skilled training and quality career opportunities in the construction industry.

HOLIDAY

Per SMC 4.20.190 and RCW 1.16.050, Holidays for the City of Seattle are:

1. First Day of January (New Year’s Day)
2. Third Monday of January (Dr. Martin Luther King, Jr.’s Birthday)
3. Third Monday of February (President’s Day)
4. Last Monday of May (Memorial Day)
5. Fourth Day of July (Independence Day)
6. First Monday of September (Labor Day)
7. Eleventh Day of November (Veterans’ Day)
8. Fourth Thursday of November and the Friday immediately following (Thanksgiving Day)
9. Twenty fifth Day of December (Christmas Day)

When any Holiday falls on a Sunday, the following Monday is considered a Holiday. When any Holiday falls on a Saturday, the preceding Friday is considered a Holiday. Holidays are Non-Working Days.

INCLUSION PLAN

The Contractor’s plan provided on the Owner-provided form, that documents the utilization of WMBE on the Contract.

INSPECTOR

See Engineer.

JOB SITE

See Project Site.

JOBS COORDINATOR

The City employee or third party entity named by the City that facilitates the hiring of Priority Workers in collaboration with Contractors and dispatch.

JOURNEY-LEVEL

An individual who has sufficient skills and knowledge of an occupation, either through a formal Apprentice Training Program or through practical on-the-job work experience, to be recognized by a state or federal registration agency and/or an industry as being fully qualified to perform the work of the occupation. Practical experience must be equal to or greater than the term of apprenticeship.

LABORATORY

The materials Laboratory of the Engineer or such other laboratories authorized in writing by the Engineer.

LABOR HOURS

Hours performed on projects by workers who are subject to prevailing wages under RCW 39.12.

LETTERS OF ASSENT

The letter that is required of all Contractors and Subcontractors of all tiers working on Covered Projects that commits the Contractor and Subcontract to be bound to the City of Seattle CWA.

LIQUIDATED DAMAGES

The amount stated in the Contract to be paid to the Owner by the Contractor for each Working Day of delay in achieving the Physical Completion Date within the Contract Time.

MATERIALS

Any substance specified for use in the project that enters into and forms a part of the finished Work.

MATERIALPERSON

The supplier that furnishes material, supply, commodity, equipment, or manufactured or fabricated products and does not perform labor at the Project Site.

1 MINERAL AGGREGATE

2 Rock, gravel, sand or a blend thereof, with properties defined in the Standard Specifications.

3 NON-MANUAL POSITION

4 A job position on a public works project that is not primarily for the purpose of performing physical construction work,
5 including but not limited to, superintendents, supervisors, staff engineers, quality control and quality assurance personnel, time
6 keepers, mail carriers, clerks, office workers, messengers, guards, safety personnel, emergency medical and first aid
7 technicians and other engineering, administrative supervisory and management employees.

8 NOTICE OF INTENT TO AWARD

9 Written notice from the Owner to the successful Bidder signifying acceptance of the Bid.

10 NOTICE TO PROCEED

11 Written notice from the Engineer to the Contractor authorizing and directing the Contractor to proceed with the Work
12 stating the date on which the Contract Time starts.

13 ON-SITE ELECTRICAL LEAD

14 The Contractor's on-site representative responsible for and authorized to resolve electrical safety related issues including
15 those raised by the Engineer, Assistant, or Electrical Safety Observer.

16 OPEN-SHOP CONTRACTOR

17 A Contractor that is not signatory to a collective bargaining agreement with a Union representing the trade(s) of the
18 Contractor's workers, also known as non-union Contractors.

19 OWNER

20 The City of Seattle.

21 PAYMENT AND PERFORMANCE BOND

22 The approved form of security, furnished by the Contractor and the Contractor's Surety, guaranteeing faithful Contract
23 performance and payment to persons supplying labor and Materials on the project. The Owner will provide the Payment and
24 Performance Bond form to the Contractor.

25 PHYSICAL COMPLETION

26 See Dates.

27 PRIORITY HIRE

28 The priority hire ordinance (SMC Ch. 20.37) prioritizes workers living in economically distressed ZIP codes, women,
29 people of color and preferred entry candidates for hire on City Covered Projects.

30 PRIORITY WORKER

31 An individual prioritized for recruitment, training and employment opportunities because the individual is a Resident in an
32 Economically Distressed Area.

33 PROJECT BUDGET

34 For purposes of determining CWA Covered Projects, the project budget is the Engineer's Estimate plus construction
35 contingency at the time of Bid.

36 PROJECT LABOR AGREEMENT

37 See Community Workforce Agreement.

38 PROJECT MANUAL

39 The compilation of the requirements for the Work related to a specific project. The Project Manual includes, but is not
40 limited to, the requirements for Bids, Agreement Form, conditions of the Contract, Drawings and Specifications, Special
41 Provisions, revised Standard Plans, and Addenda.

42 PROJECT SITE

43 The geographic location, defined in the Contract, where the Work is to be performed.

44 REAL PROPERTY

45 Land and improvements permanently affixed to the land.

46 RESIDENT

47 A person who provides evidence, to the satisfaction of the Director, demonstrating that the person lives at a particular
48 address.

49 RIGHT OF WAY

50 Real property secured and reserved for public or private transportation, utility, or other purposes.

51 SEWER

52 Any pipe, conduit, or Structure intended to carry sewage and other waste liquids, excluding discharges prohibited by
53 SMC 21.16 (the side Sewer Code).

SHOP DRAWINGS

Working Drawings, shop plans, erection plans, falsework plans, framework plans, cofferdam, cribbing and shoring plans, bending diagrams for reinforcing steel, retaining wall designs, schematic diagram, or any other supplementary plans or similar information that the Contractor submits to the Engineer for acceptance.

SPECIAL PROVISIONS

Supplemental provisions and modifications to the Standard Specifications that apply to an individual project and that are designated by the Owner and found in the Project Manual.

SPECIFICATIONS

Written technical descriptions of materials, equipment, construction systems, standards, and workmanship that, with the Drawings and other Contract documents, detail the requirements for the Work.

STANDARD PLANS

Adopted by the Owner, the current edition of The City of Seattle Standard Plans for Municipal Construction as modified by updates found in the appendix of the Project Manual.

STANDARD SPECIFICATIONS

Adopted by the Owner, the current edition of The City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction including the City of Seattle Traffic Control Manual for In-Street Work.

STATE

The State of Washington.

STORM DRAIN

A pipe, conduit, or Structure intended to collect and convey rainwater and other permissible discharges as identified in SMC 22.800-22.808, the Stormwater Code.

STRUCTURES

Bridges, Culverts, walls, buildings, foundations, water tanks, transmission towers, cribbing, caissons, or cofferdams, and other similar features that are classified as Structures in the Contract.

SUBCONTRACTOR

A business contracted to perform a portion of Work under the Contract.

SUBSTANTIAL COMPLETION

See Dates.

SUPPLIER

See Materialperson.

SUPPLIES

Any substance or matter used or consumed in construction of the project and its appurtenances that do not become part of the Structure or improvement.

SURETY

A company that is bound with the Contractor to ensure:

- 1. Faithful Contract performance, and
- 2. Payment of laborers, mechanics, Subcontractors and Materialperson and all entities that source any provisions and Supplies for the Work.

TRAFFIC

Vehicular and non-vehicular, including pedestrians, bicyclists, wheelchairs and equestrians.

TRAFFIC CONTROL MANUAL FOR IN STREET WORK (STCM)

The City of Seattle guide for Work within the Right Of Way, with and as a supplement to the current Manual on Uniform Traffic Control Devices (MUTCD), the Washington Department of Transportation (WSDOT).

TRAINING PROGRAMS

Pre-apprenticeship and/or registered Apprenticeship Training Programs.

TSCA WASTE(S)

Soil/material/debris/liquid of any kind that contains polychlorinated biphenyls (PCBs) at a level that equals or exceeds 50 parts per million, and oil of any kind that contains PCBs at a level that equals or exceeds 2 parts per million. TSCA Waste(s) is regulated by the Federal Toxic Substances Control Act.

UNION

A representative labor organization whose members collectively bargain with employers to set the wages and working conditions in their respective trade or covered scope of work.

WATER MAIN

A water supply pipe for public or community use.

WMBE GOAL

The voluntary commitment by the Contractor for the Work that will be awarded, performed and paid to WMBEs.

WOMEN OR MINORITY BUSINESS (WMBES)

A business that self-identify or are certified by the Office of Minority and Women's Business Enterprise (OMWBE) to be at least 51 percent owned by women and/or minority group members including, African Americans, Native Americans, Asians/Pacific Islanders, and Hispanics/Latinos.

WORK

The provision of all labor, Materials, equipment, Supplies, and everything needed to complete the project.

SECTION 1-02 BID PROCEDURES AND CONDITIONS**1-02.1 RESPONSIBLE BIDDER**

In the sole opinion of the Owner, for a Bidder to be considered responsible, the Bidder must meet all criteria in this section and must provide the Supplemental Bidder Responsibility Criteria Form (SBRC) along with any documentation necessary for the Owner to establish that the Bidder can meet expectations and perform the Work. The documentation must demonstrate that the Bidder is experienced in performing the Work based on the firm's completion of past work and the firm's compliance with legal and contractual requirements. The Owner may take whatever action is necessary to establish the ability of the Bidder to perform the Work to the Owner's satisfaction.

To be considered responsible, the Bidder must meet the following mandatory and supplemental responsibility criteria:

1. At the time of Bid submittal, have a certificate of registration in compliance with Chapter 18.27 RCW;
2. At the time of Bid submittal have a current State unified business identifier number;
3. If required by the business type, have industrial insurance coverage for the Bidders' employees working in Washington as required in Title 51 RCW, an employment security department number as provided in Title 50 RCW, and a State excise tax registration number as provided in Title 82 RCW. If the Contractor has no employees, the Contractor must comply with the alternative election process and provide documentation under Title 50 and Title 51;
4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065 and not listed on the US Government's System of Award Management database (<http://www.sam.gov/>) with an active exclusion; and
5. Meet the supplemental criteria in Section 1-02.2.

The Bidder may request that the supplemental Bidder responsibility criteria be modified. Such request must be submitted to CPCS via the Form submittal methods listed on the Supplemental Bidder Responsibility Criteria Form before 5:00 p.m., 5 business Days before the Bid Opening Date. The request must be marked, Request to Modify Supplemental Bidder Responsibility Criteria – PW# _____. If the City determines a modification is necessary, an Addendum to the Bidding Documents will be issued to identify the new criteria.

If the Owner determines a Bidder to be not responsible, the Owner will provide, by email or other writing, the reasons for the determination. The Bidder may protest the determination within the time period specified in the Bid Documents, see Section 1-03.6 regarding protests, by presenting additional information to the Owner. The Owner will consider the additional information before issuing its final determination. If the final determination affirms that the Bidder is not responsible, the Owner will not Execute a Contract with any other Bidder until 2 Business Days after the Bidder determined to be not responsible has received the final determination.

Additionally, the Bidder must verify the mandatory and supplemental responsibility criteria for each Subcontractor. Likewise a Subcontractor of any tier that hires other Subcontractors must verify responsibility criteria for each. Verification must include that each Subcontractor, during subcontract execution, meets the responsibility criteria listed in items in Section 1-02.1 and 1-02.2 and possess an electrical or plumbing Contractor license, if required by Chapter 19.28 RCW, or an elevator Contractor license, if required by Chapter 70.87 RCW.

1-02.2 SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA FORM (SBRC)**1. Work Experience**

The Bidder must document on the SBRC that the Bidder and the Bidder's personnel have completed projects of a similar type, size, and scope as this project, and have available capacity to take on the work.

It is the Bidder's responsibility to verify that the names and phone numbers provided for references are current. If the Owner is unable to contact the individuals to verify Bidder or Subcontractor experience, the related experience may not be considered by the Owner.

2. Personnel

The Bidder certifies, by submitting the SBRC, it will assign the named personnel to the Project. In the event it becomes necessary for the Bidder to substitute personnel during the life of the Contract, the following provisions apply:

- 1 a. Before substituting a new project manager or superintendent, the Contractor must submit for the approval of the
 2 Engineer or Owner, a current resume for the new personnel documenting that the new personnel comply with the
 3 supplemental bidder responsibility criteria established for the project.
- 4 b. The Engineer or Owner may suspend the project if the Contractor substitutes a project manager or
 5 superintendent without the Engineer or Owner's approval. The Contractor is fully liable for the additional costs
 6 resulting from the suspension of work and no adjustments in Contract Time resulting from the suspension of work
 7 will be allowed.

8 3. Compliance History

9 By submitting the SBRC the Bidder must answer questions demonstrating their compliance history and capabilities in
 10 performing these categories. The Owner may use a Bidder's past compliance history as part of the determination of
 11 responsibility.

12 The Bidder may request that the supplemental Bidder responsibility criteria be modified. Such request must be submitted
 13 to CPCS before 5:00 p.m., 5 business Days before the Bid Opening Date. The request must be marked, Request to Modify
 14 Supplemental Bidder Responsibility Criteria – PW# _____. If the City determines a modification is necessary, an Addendum
 15 to the Bidding Documents will be issued to identify the new criteria.

16 If the Owner determines a Bidder is not responsible, the Owner will provide, in writing, the reasons for the determination.
 17 The Bidder may protest the determination in the time specified in Section 1-03.6. The Owner will consider the protest and
 18 issue a final determination. The Owner will wait until the protest period concludes before proceeding with next low Bidder.

19 If the Bidder fails to supply documentation or falsely represents the information the Owner may reject the Bidder as not
 20 responsible by taking the following actions:

- 21 a. Rejection of the Bidder's Bid under Section 1-02.14;
 22 b. Revocation of the Contract Award;
 23 c. Termination of the Contract under Section 1-08.10; or
 24 d. Proceeding with debarment under Section 1-08.10(8) and SMC 20.70

25 1-02.3 ESTIMATED QUANTITIES

26 The quantities shown on the Bid Form are estimates only. The Owner does not warrant, expressly or by implication, that
 27 the actual quantities of the Work will correspond with those estimated. The Engineer may increase or decrease the amount of
 28 any Bid Item of Work, or change the Work as necessary. Payment will be made on the basis of the actual quantities of each
 29 Bid Item of Work completed as specified in the Contract.

30 1-02.4 EXAMINATION OF BID DOCUMENTS AND PROJECT SITE

31 1-02.4(1) GENERAL

32 Bid Documents are available for download at: <http://www.seattle.gov/contracting/bidding.htm>.

33 The Bidder is responsible to examine the Bid Documents. Submittal of a Bid is evidence that the Bidder has made these
 34 examinations and understands all requirements of the Bid process and for the performance of the Work. By submitting a Bid,
 35 the Bidder further warrants, agrees, and acknowledges that they:

- 36 1. Have taken all steps necessary to ascertain the full scope, nature, and location of the Work.
- 37 2. Have investigated and are satisfied as to the general and local conditions that can affect the Work and its cost,
 38 including but not limited to:
- 39 a. Conditions bearing on acquisition, transportation, disposal, handling, and storage of materials;
 40 b. Availability of labor, materials, water, electric power, and roads;
 41 c. Uncertainties of weather, river stages, tides, or similar physical conditions at the Project Site;
 42 d. Conformation and condition of the ground;
 43 e. The equipment and facilities needed preliminary to and during Work; and
 44 f. Site and environmental conditions which by statute, law, or regulation require specific training and certifications
 45 for employees.
- 46 3. Are satisfied as to the character, quality, and quantity of surface and subsurface information or obstacles that may be
 47 encountered insofar as this information can reasonably be ascertained from an inspection of the Project Site,
 48 including Materials sites, as well as from the Bid Documents and other information made a part of this Contract.
- 49 4. Are satisfied that adequate time has been allowed for physical completion of the Project.
- 50 5. Take responsibility for properly estimating the difficulty and cost of performing the Work.
- 51 6. Are familiar with and will comply with all federal, state, and local laws, ordinances; and regulations that might affect
 52 the Work or those engaged in the Work. The Bidder is not relieved of this obligation because of the Bidder's
 53 misunderstanding or ignorance of such requirements.
- 54 7. Is satisfied that their Bid Items prices reflect their cost for completing the Work, including Materials, labor, equipment,
 55 and costs including insurance and bonding.

1 The Bidder has a responsibility to ask about any perceived defect or ambiguity in the Bid Documents or Contract. Bidders
2 who need an explanation or clarification of the Bid Documents must make this request in writing before 5:00 p.m. 3 Business
3 Days before Bid opening.

4 **1-02.4(2) SUBSURFACE INFORMATION**

5 If the Engineer has made a subsurface investigation of the Project Site of the proposed Work, the boring log data, soil
6 sample test data, and geotechnical reports accumulated by the Engineer will be provided for inspection by the Bidders. The
7 boring logs are part of the Contract. However, the Engineer makes no representation, guaranty, or warranty, expressed or
8 implied, that:

- 9 1. The Bidder's interpretation from the boring logs or geotechnical reports is correct;
- 10 2. Moisture conditions and indicated water tables do not vary from those found at the time the borings were made;
- 11 3. The ground at the location of the borings has not been physically disturbed or altered after the boring was made; and
- 12 4. The conditions, materials, or proportions of the materials is consistent between the specific borings.

13 In addition to the above data, SDCI has geotechnical reports for private property located in an Environmentally Critical
14 Area Geographically Hazardous zone if the private property has been under SDCI permit review. This data is available for the
15 Contractor's review at: SDCI, Soils Reports, 700 Fifth Avenue, 22nd Floor, Seattle, WA 98104, (206) 684-8860, (206) 233-
16 7902 (FAX).

17 The availability of subsurface information from the Engineer does not relieve the Bidder or the Contractor of any
18 responsibility to make examinations and investigations as required by Section 1-02.4(1) and any other responsibility under the
19 Contract, or as may be required by law.

20 **1-02.5 FORM AND STYLE OF BID**

21 A Bid must only be submitted on the Bid Form issued by the Owner. Bids must be typewritten or printed in ink by hand. A
22 price must be submitted for each Bid Item listed. The Bid Form must be complete.

23 Any and all corrections or changes to a Bid must be initialed, and are considered valid and binding. The Bidder must not
24 make a stipulation on the Bid Form or qualify the Bid in any manner. A Bid amount must be included for every Additive,
25 Alternate, or Deductive identified in the Bid Form, unless otherwise specified. A person authorized to legally bind the Bidder
26 must sign the Declaration in the Bid Form.

27 **1-02.6 ADDENDA**

28 If the Engineer determines modifications or clarifications to the Bid Documents are required, they will be provided by
29 Addenda. Oral explanations, interpretations, or instructions are not binding on the Owner. Only modifications or clarifications
30 issued by a written Addendum are binding. Notifications of Addenda and other project information will only be sent to official
31 plan holders who downloaded or ordered documents through the City's official electronic Bid solicitation website, including
32 plan centers that obtained documents through the website. A link to the current electronic Bid solicitation website is found at
33 <http://www.seattle.gov/contracting/bidding.htm>. All Bidders are encouraged to check the electronic Bid solicitation website for
34 Addenda at least 24 hours before Bid Opening.

35 The Bidder must acknowledge receipt of each Addendum by filling in the appropriate spaces on the Bid Form
36 Declaration.

37 **1-02.7 BID GUARANTY**

38 The Bid Guaranty must be equal to 5 percent of the maximum Bid amount that could be Awarded based on the Bidder's
39 Bid, including sales tax, Additives, and Alternates, if applicable. A Bid will not be accepted or considered unless accompanied
40 by a Bid Guaranty.

41 A Bid must be accompanied by a Bid Guaranty in the form of:

- 42 1. A certified or cashier's check payable to The City of Seattle; or
- 43 2. A Bid bond on the form issued by the Surety.

44 Bid bonds must be issued by a Surety company that is authorized to do business in the State of Washington and appears
45 on the current list of authorized insurance companies published by the Office of the Washington State Insurance
46 Commissioner.

47 Bid bonds must be original and contain the following:

- 48 a. Project name and number
- 49 b. The City of Seattle named as obligee
- 50 c. The amount of the Bid bond stated as 5 percent of the maximum Bid amount that could be Awarded
- 51 d. The signature of the Surety's officer empowered to sign the bond and the power of attorney

52 **1-02.8 NONCOLLUSION REQUIREMENT**

53 The Bidder must declare that they have not, either directly or indirectly, entered into any agreement, participated in any
54 collusion, or otherwise taken any action in restraint of free, competitive bidding in the preparation and submission of its Bid.

1 The Bidder and other potential Bidders or participants in collusion may be declared not responsible under Section 1-02.14 and
2 may be debarred under SMC Chapter 20.70.

3 **1-02.9 BID SUBMITTAL**

4 **1-02.9(1) GENERAL**

5 The Bid must be sealed and received by CPCS by the time, date, and at the location specified in the Advertisement for
6 Bids or as modified by Addenda. The Bid Form, together with the Bid Guaranty and any other required documents, must be
7 enclosed in a sealed envelope marked with the project name and the Bidder's name, and be addressed to CPCS.

8 CPCS designates the official Bid clock. The Bidder is responsible for the timely submittal or delivery of the Bid at the
9 location designated in the Advertisement for Bids. Mailed Bids must be received by CPCS by the time, date, and at the
10 location specified. A Bid submitted or received after the time fixed for receipt of Bids will not be accepted.

11 If sending by courier such as UPS or FedEx, use the physical street address. Enclose the Bid inside a separate sealed
12 envelope and note "Bid Enclosed" and the "Name of the Project" on the front of the envelope. If mailing by regular US mail,
13 use the Post Office Box with the proper Zip Code.

14 Address to:

15 City Purchasing and Contracting Services
16 Department of Finance and Administrative Services

17

18 Physical Address:

19 Seattle Municipal Tower
20 700 Fifth Avenue, Suite 4112
21 Seattle, WA 98104-5042

22

23 Mailing Address:

24 City of Seattle
25 P.O. Box 94687
26 Seattle, WA 98124-4687

27 **1-02.9(2) CHANGE OF BID SUBMITTAL DATE**

28 The Owner may change the date and time for Bid submittal. Notification of the change will be by Addendum.

29 **1-02.9(3) BIDDER/SUBCONTRACTOR LIST**

30 In compliance with RCW 39.30.060 for all projects estimated to cost \$1,000,000 or more, all Bidders must complete and
31 submit the Bidder/Subcontractor List, Section 0-01.5 of the Project Manual. The completed Bidder/Subcontractor list must
32 identify the Subcontractors that the Bidder will contract with for HVAC, plumbing, and electrical work; or indicate that the
33 Bidder intends to self-perform the work, if Awarded the Contract; or that category of work is not applicable. The
34 Bidder/Subcontractor List may be submitted with the Bid, or separately within 1 hour of the time and date for Bid submittal. The
35 Bidder is responsible for the timely delivery of the Bidder/Subcontractor List.

36 The Bidder may list no more than 1 Subcontractor for each category of work, unless Subcontractors vary with Bid
37 Alternates, Additives, or Deductives, in which case the Bidder must indicate on a separate Bidder/Subcontractor List which
38 Subcontractor will be used for which Alternate, Additive, or Deductive.

39 If the HVAC, plumbing, or electrical specialty is left blank, meaning either the name of a Subcontractor is blank, or a
40 checkbox is not checked, the City will accept the blank as self-performance. The Bidder is bound to self-performance of that
41 specialty for the duration of the Project.

42 The Bid will be rejected as non-responsive if the Bidder/Subcontractor list is not provided. The Bidder/Subcontractor List
43 may be submitted at the addresses listed in Section 1-02.9(1), or by email to Judy.Keefe@Seattle.gov on a signed PDF
44 version. Clearly mark the PW# and project name and Bidder's name to ensure the form is routed correctly.

45 If Awarded the Contract, the Bidder agrees to use the Subcontractors identified on the Bidder/Subcontractor List unless
46 the City agrees to a substitution.

47 **1-02.9(4) INCLUSION PLAN**

48 For all public works projects having an Engineer's Estimate of \$300,000 or more, all Bidders must complete and submit
49 the Inclusion Plan, Section 0-01.4 of the Project Manual, with the Bid. A Bid will be rejected as non-responsive for failure to
50 submit a completed Inclusion Plan. The Bidder's completed Inclusion Plan will be given points to determine responsiveness,
51 as directed in the Inclusion Plan.

52 For the Inclusion Plan, the project type and past performance of WMBE utilization rates will be included in the Project
53 Manual.

1-02.10 MODIFICATION OR WITHDRAWAL OF BID

After submitting a Bid, but prior to the Bid Due Date, a Bidder may either (1) withdraw or (2) revise its Bid.. Revised Bids must be submitted in a properly marked and sealed envelope.

1-02.11 ADDITIVE, ALTERNATE, DEDUCTIVE

The Owner reserves the right to arrange the Bid Form with Alternate, Additive, and/or Deductive items. The Bidder must Bid on all Alternates, Additives and Deductives in the Bid Form.

1-02.12 PUBLIC OPENING OF BIDS

Bids will be opened and read immediately after 2:00 p.m. on the date specified in the Advertisement for Bids or in an Addendum, in the Seattle Municipal Tower, 700 Fifth Avenue, Suite 4112, Seattle, WA 98104.

1-02.13 IRREGULAR BIDS

The Owner has the right to review Bids for material irregularities. If the Owner determines a Bid to be irregular and rejects, notification will be sent to the Bidder in writing containing the reason for the determination.

1. A Bid will be considered irregular and non-responsive if:
 - a. The authorized Bid Form is not used;
 - b. The completed Bid Form contains any unauthorized additions, deletions, alternate Bids, or conditions;
 - c. The Bidder did not Bid on all Additives, Deductives, or Alternates, when required;
 - d. The Bid does not include a Bid Item price for every Bid Item;
 - e. The Bid Guaranty is not included with the Bid;
 - f. For projects estimated to cost \$1,000,000 or more, the Bidder did not comply with the Bidder/Subcontractor list requirements, see Section 1-02.9(3), Bidder/Subcontractor List;
 - g. The Bid does not constitute a definite and unqualified offer to comply with the material terms of the Bid invitation;
 - h. The Inclusion Plan is not submitted with the Bid when required; or
 - i. The Inclusion Plan does not receive the minimum score as identified in the plan to be considered responsive when submitted with the Bid when required.
2. A Bid may be considered irregular and non-responsive if:
 - a. The Bid Guaranty is not complete or not sufficient;
 - b. Any of the Bid Item prices are excessively above or below the amount of a reasonable Bid, to the potential detriment of the Owner; or
 - c. A lump sum Bid is excessively lower than other Bids;
 - d. Receipt of Addenda is not acknowledged;
 - e. The Bidder is a member of a joint venture or partnership and the joint venture or partnership submits a Bid for the same project. In such an instance, both Bids may be rejected;
 - f. The entries in the Bid Form are not typewritten or entered in ink; or
 - g. The Bid is not properly Executed.

1-02.14 DISQUALIFICATIONS OF BIDDERS

See Section 1-02.1 for Bidder Responsibility.

SECTION 1-03 AWARD AND EXECUTION OF CONTRACT**1-03.1 CONSIDERATION OF BIDS****1-03.1(1) BID TABULATION**

After Bid opening, Bids will be checked for mathematical correctness of Bid Item price extensions and the total Bid price. A discrepancy between a Bid Item price and the extended amount will be resolved by accepting the Bid Item price as correct. If a minimum Bid amount has been established for any item and the Bidder's unit or lump sum price is less than the minimum specified amount, the Owner will revise the unit or lump sum price, to the minimum specified amount and recalculate the extension and/or the total Bid price.

1-03.1(1)A RECIPROCAL PREFERENCE FOR RESIDENT CONTRACTORS

Per RCW 39.04.380, a Bid which is received from a nonresident Contractor from a state that provides a percentage bidding preference, a comparable percentage disadvantage must be applied to the Bid of that non-resident Contractor. The comparable percentage disadvantage will be per the Contractor's resident state. A non-resident Contractor will be one whom, at the time of Bid, does not have an office located in the State of Washington. The resident state is the state in which the Contractor was incorporated or where the Contractor's business entity was formed.

1 <http://www.des.wa.gov/SERVICES/CONTRACTINGPURCHASING/Pages/ReciprocalPreference.aspx>

2 For the purpose of determining the apparent low Bidder, the Owner will multiply the non-resident Contractor's Bid amount by
3 the comparable percentage disadvantage (CPD). The Bid amount is the total of the Base Bid and all selected Additives,
4 Alternates, or Deductives to be Awarded. The Owner will add the product of the CPD percentage and the Bid amount to the
5 nonresident Contractor's Bid amount, which determines the nonresident disadvantaged total Bid pertaining to the nonresident
6 Contractor to be used for comparison of competing bids. The nonresident disadvantage total will be compared to the resident
7 Contractor's Bid amount. The Bidder with the lowest total is the successful Bidder.

8
9 **1-03.1(1)B IDENTICAL BID TOTALS**

10 If two or more responsive Bids are exactly equal, in order to establish the apparent low Bidder, the Owner will draw a
11 Bidder's name from a hat. See Section 1-02.9.

12 **1-03.1(2) CLAIM OF ERROR AND RELIEF OF AWARD**

13 A Bidder who wishes to claim error or miscalculation of their Bid or would like to withdrawal their Bid after the Bids have
14 been opened, must submit a signed statement, accompanied by original worksheets used in the Bid preparation, requesting to
15 withdraw. The statement must describe the error, or circumstance, and certify that the worksheets are originals. The statement
16 and the worksheets must be submitted to: City Purchasing and Contracting Services, City of Seattle, Department of Finance
17 and Administrative Services, 700 Fifth Avenue, Suite 4112, Seattle Municipal Tower, Seattle, WA 98104-5042, (206) 684-0444
18 or by email to Judy.Keefe@Seattle.gov by 5:00 p.m. the next Business Day or as acceptable to the Owner.

19 The Owner will determine the validity of the error claim. If the Owner concurs the Bid will be withdrawn and the Bid
20 Guaranty will be returned. Thereafter, at the discretion of the Owner, all Bids may be rejected or Award made to the next
21 lowest responsible Bidder. A low Bidder who claims error is prohibited from bidding on the same project if the project is re-bid.

22 **1-03.1(3) DECLARATION OF THE LOWEST RESPONSIVE BID**

23 The low Bid will be determined by the sum of the Base Bid (Bid Item price extensions corrected where necessary),
24 plus any Additives, Alternates, and/or Deductives that the Owner decides to include in the Contract Award. Additives,
25 Alternates, and/or Deductives may be selected in any order that the Owner determines to be within available funds.

26 Once the Owner has determined the Bid to be responsive and the lowest price, all Bidders will be notified.

27 **1-03.1(4) PRE AWARD INFORMATION AND RIGHTS OF THE OWNER**

28 The Owner will evaluate all Bids to determine the lowest responsive Bid of a responsible Bidder as specified in Section 1-
29 02.1 and 1-02.2. This evaluation may include investigations to establish the responsibility and relevant construction
30 experience, with experienced personnel available to do the Work under the Contract. It is at the sole discretion of the Owner to
31 determine the responsiveness of the Bid and the responsibility of the Bidder.

32 The apparent low Bidder under consideration for Award may be required to furnish:

- 33 1. A complete statement as to the origin, composition, and manufacture of any and all Materials to be used in the
34 project, together with samples which may in turn be subjected to tests to determine their quality and fitness for the
35 Work, as provided for in the Contract.
- 36 2. A critical path schedule in the form required by the Engineer showing the order of the Work and the time required on
37 the various phases of the Work.
- 38 3. A breakdown of costs assigned to any Bid Item or a schedule of values for lump sum Bids.
- 39 4. Any additional information requested by the Owner in understanding the Bid price or ascertaining the Bidder's general
40 ability to perform the Work.

41 In addition to such other rights as may be reserved elsewhere in the Contract, the Owner reserves the right to:

- 42 a. Reject any or all Bids at the Owner's discretion;
- 43 b. Re-advertise for Bids;
- 44 c. Waive informalities or immaterial irregularities in the Bidding, Award, and Execution processes;
- 45 d. Accept the lowest responsive Bid of a responsible Bidder;
- 46 e. Correct arithmetical errors in a Bid;
- 47 f. Cancel the Work; and
- 48 g. Award such Additive, Deductive, or Alternate, as may be set forth in the Bid Form in the order most advantageous to
49 the Owner.

50 **1-03.2 AWARD OF CONTRACT**

51 After the Owner has determined the lowest responsive and responsible Bidder, the Owner will provide Notice of Award to
52 all Bidders. Any Bidder who has not provided an email address as part of its Bid, assumes responsibility for monitoring the
53 City's official electronic Bid solicitation website for such notice.

1 The Owner will endeavor to Award the Contract within 60 Days after the Bid Opening Date. If the Contract is not
2 Awarded within that 60 Day period, a Bidder may withdraw their Bid in writing at any time on or after the 60 Days. All Bids will
3 otherwise continue to be eligible for consideration until the Owner Awards the Contract.

4 **1-03.3 REQUIRED DOCUMENTS FOR EXECUTION OF THE CONTRACT**

5 Within 10 Business Days of Award, unless extended by mutual agreement, the successful Bidder must submit to CPCS
6 insurance, original, fully executed Payment and Performance Bond, Retainage Bond if applicable, and the original signed
7 Agreement Form.

8 **1-03.3(1) EVIDENCE OF INSURANCE**

9 The successful Bidder must submit to CPCS the evidence of insurance as required in Section 1-07.18. E-mail delivery is
10 acceptable to Judy.Keefe@Seattle.gov.

11 **1-03.3(2) PAYMENT AND PERFORMANCE BOND**

12 The apparent low Bidder must provide to CPCS an original, executed Payment and Performance Bond for the Awarded
13 Contract Price. The Payment and Performance Bond must:

- 14 1. Be on a form furnished by the Owner; and
- 15 2. Be signed by the principal and notarized;
- 16 3. Be signed and notarized by an approved Surety or Sureties that:
 - 17 a. Is registered with the Washington State Insurance Commissioner;
 - 18 b. Appears on the current Authorized Insurance List in the State of Washington published by the Office of the
19 Insurance Commissioner; and
 - 20 c. Has a current rating of at least A-VII in A.M. Best's Key Rating Guide or is included in the U.S. Department of the
21 Treasury's Listing of Approved Sureties (Circular 570).
- 22 4. Be accompanied by an original Power of Attorney document with the same date as the notarization by the Surety.

23 The Owner may require the Surety or Sureties named on the Payment and Performance Bond to appear and qualify
24 itself. Whenever the Owner determines the security to be inadequate, the Owner may require in writing that the Contractor
25 furnish additional security to cover any remaining Work. No payments will be made until the added security is furnished.

26 **1-03.3(3) AGREEMENT FORM**

27 The successful Bidder must submit to CPCS the original Agreement Form signed by a person authorized to bind the
28 Bidder's business.

29 After the Owner has counter signed the Agreement Form, indicating Execution of the Contract, the Owner will forward a
30 copy of the fully Executed Agreement Form to the successful Bidder.

31 No physical work is allowed within the Project Site or within sites furnished by the Owner until the successful Bidder has
32 been provided the Notice to Proceed as specified in Section 1-08.4. The Contractor bears all risks for any work begun before
33 the issuance of the Notice to Proceed except for submittal and procurement work as specified in Section 1-08.4.

34 **1-03.4 FAILURE TO EXECUTE THE CONTRACT**

35 The Bidder's Bid Guaranty is forfeited if the Bidder to whom the Award was made fails to:

- 36 1. Execute the Agreement Form within the required time period; or
- 37 2. Furnish satisfactory bonds and insurance within the required time period.

38 In such case, the Owner may then Award the Contract to the second lowest responsible Bidder. If the second lowest
39 responsible Bidder fails to execute the Agreement Form and furnish satisfactory bonds and insurance within 10 Business Days
40 after Award has been made to the second Bidder, or within the time period mutually agreed on by the Owner and second
41 Bidder, the second Bidder's Bid Guaranty will also be forfeited. The Contract may continue in a like manner to the remaining
42 responsible Bidders until the Agreement Form is executed and bonds and insurance furnished by a responsible Bidder or the
43 remaining Bids are rejected.

44 **1-03.5 RETURN OF BID GUARANTY**

45 If the Bid Guaranty submitted by unsuccessful Bidders is in the form of a certified or cashier's check, the funds may be
46 returned upon request after Award.

47 The Bid Guaranty of the successful Bidder submitted in the form of a check will be returned after Contract Execution. A
48 Bid Guaranty in the form of a bond from the successful Bidder must be filed with the Executed Contract.

49 **1-03.6 PROTESTS**

50 Bidder may protest a determination or action of the Owner. Any protest must be filed in writing by 5:00 p.m. on the
51 second Business Day after notification such as:

- 52 1. A Notice of Award, see Section 1-03.2.

2. A notice that a Bid is non-responsive, see Section 1-02.13(3).

3. A notice that a Bidder is not responsible, see Section 1-02.14(3).

All such protests must be in writing and submitted to the Director. The protestor accepts all risks of the delivery method they choose. The Owner is not responsible to assure the protest is received by CPCS within the protest deadlines. If CPCS does not receive the protest in a timely manner, the protest may be refused.

Submit the protest to: Director, City Purchasing and Contracting Services, Department of Finance and Administrative Services.

Physical Address:

700 Fifth Avenue, Suite 4112

Seattle Municipal Tower

Seattle, WA 98104-5042

By mail, or email:

P.O. Box 94687

Seattle, Washington 98124-4687

Email: Judy.Keefe@Seattle.gov

To be considered, the protest must comply with these requirements:

1. The protestor must have submitted a Bid.
2. The protest must not be on a matter which should have been known to the Bidder before the Bid deadline, including matters specified in Section 1-02.4.
3. The protest must allege:
 - a. A matter of bias, discrimination, or conflict of interest;
 - b. Errors in responsiveness or responsibility; and/or
 - c. Non-compliance with procedures described in the Bidding Documents.
4. All protests must be in writing and state that the Bidder is submitting a formal protest. A notice that a Bidder intends to protest does not reserve the right to protest. The Bidder must file a comprehensive protest within the required deadlines, following the proper format. A casual inquiry, complaint, or protest that does not comply with the form, content, or deadlines herein may not be acted on as a protest. Failure to provide any of the following information may result in refusal of the protest:
 - a. Company name, mailing address, phone number, and name of company individual responsible for submission of the protest;
 - b. Specify the Public Works Number and project name;
 - c. State the specific action or decision protested;
 - d. Indicate the basis and support for the protest include specific facts and all documentation to support the protest. Additional documentation or information regarding any portion of the bidding or Award process will not be accepted after the protest submittal;
 - e. Indicate what relief or corrective action the Bidder believes the Owner should make;
 - f. Demonstrate that the Bidder made every reasonable effort within the bidding process to resolve the issue, including asking questions, attending the pre-bid conference, seeking clarification, requesting addenda, and otherwise alerting the Owner to any perceived problems; and
 - g. Be signed by an authorized agent of the company.

The Director, or designee, of City Purchasing and Contracting Services will review and decide all such protests. The Director's decision on the protest is final and exhausts all administrative remedies.

SECTION 1-04 SCOPE OF WORK

1-04.1 INTENT OF THE CONTRACT

The intent of the Contract is to prescribe a complete Work. Omissions from the Contract of details of the Work that are necessary to carry out the intent of the Contract do not relieve the Contractor from performing the omitted Work. The Contractor must include all costs of completing the Work in the Bid Item prices. Unless otherwise specified, the Contractor is responsible for the means, methods, techniques, sequences, and procedures of construction within the Contract requirements.

1 1-04.1(1) BID ITEMS INCLUDED IN THE BID

2 The Contractor must provide all labor, Materials, tools, equipment, transportation, Supplies, and incidentals required to
3 complete all Work.

4 1-04.1(2) BID ITEMS NOT INCLUDED IN THE BID

5 Where the Contract requires Work that is not listed as a Bid Item in a payment section of the Contract, then the costs are
6 incidental and included within the Bid Item prices of the various Bid Items in the Contract. If Work is performed and a Bid Item
7 for that Work is not included in the Bid Form but is found in the payment section of the Contract, then payment will be as
8 specified in Section 1-04.3.

9 No separate or additional payment will be made for Work which is incidental to other Bid Items specified in the Contract
10 or is an obvious defect or ambiguity in the Contract under Section 1-02.4.

11 1-04.2 COORDINATION OF CONTRACT DOCUMENTS

12 All parts of the Contract are essential and complementary. A requirement occurring in 1 is binding as though occurring in
13 all. The Contractor must provide any Work or Materials clearly implied in the Contract even if the Contract does not mention it
14 specifically. The Contractor must notify the Engineer immediately, in writing, if the Contractor finds:

- 15 1. A discrepancy between various parts of the Contract;
- 16 2. An error or omission in the Drawings; or
- 17 3. A discrepancy in the layouts and instructions provided by the Engineer.

18 The Contractor must not proceed with any Work affected by such discrepancy, error, or omission until directed to do so
19 by the Engineer.

20 In the event of any conflicting provisions or requirements between the component parts of the Contract, the component
21 parts of the Contract take precedence in the following order:

- 22 a. Change Orders
- 23 b. Agreement Form
- 24 c. Addenda
- 25 d. Special Provisions included in the Project Manual
- 26 e. Seattle City Light guidelines, standards, or procedures referenced in the Contract or included in the Appendix of the
27 Project Manual
- 28 f. Drawings
- 29 g. Standard Plan updates in the appendix of the Project Manual
- 30 h. The current version Standard Specifications
- 31 i. The current version Standard Plans
- 32 j. Inclusion Plan
- 33 k. Supplemental Bidder Responsibility Criteria

34 This order of precedence does not apply when Work is required by one part of the Contract but omitted from another part
35 or parts of the Contract. The Work required in one part must be furnished even if not mentioned in other parts of the Contract.

36 Any electronic version of the Standard Specifications and the Standard Plans is for informational purposes only. Should
37 any discrepancy exist between the hard copy version of the Standard Specifications and electronic versions of the Standard
38 Specifications, the hard copy version Standard Specifications take precedence over all other versions.

39 Written dimensions take precedence over scaled dimensions.

40 If any part of the Contract requires Work that does not include a description for how the Work is to be performed, the
41 Work must be performed per standard trade practices. For purposes of the Contract, a standard trade practice is one having
42 such regularity of observance in the trade as to justify an expectation that it will be observed by the Contractor in doing the
43 Work.

44 In case of any ambiguity or dispute over interpretation of the provisions of the Contract, the decision of the Owner is final
45 as specified in Section 1-05.1.

46 1-04.3 CHANGES

47 As the Work proceeds, the Engineer may, at any time and without notice to the Surety or Sureties, change the Work.
48 Changes to the Work do not invalidate the Contract or release the Surety. The changes may include:

- 49 1. Deleting any part of the Work;
- 50 2. Increasing or decreasing quantities;
- 51 3. Altering Specifications, designs, or both;
- 52 4. Revising the way the Work is to be done;
- 53 5. Adding extra Work;

- 1 6. Altering facilities, equipment, Materials, services, or sites provided by the Engineer; or
- 2 7. Ordering the Contractor to speed up or delay the Work.

3 If changed Work increases the Awarded Contract Price by more than 25 percent or if the Owner specifically requests the
 4 Surety's consent, the Contractor must obtain and furnish to the Owner, the written consent of the Surety or Sureties in a form
 5 acceptable to the Owner,

6 Changes in the Work will be incorporated into the Contract by Change Order. The exception is that a Change Order is
 7 not required for changes noted on field stakes placed by the Engineer or variations from estimated quantities that are less than
 8 25 percent of the original Bid quantity. Changes noted on field stakes placed by the Engineer or variations from estimated
 9 quantities that are less than 25 percent of the original Bid quantity will be paid at the Bid Item prices that apply. The Contractor
 10 must respond immediately to changes shown on field stakes and proceed with the Work without waiting for further notice.

11 The Contractor accepts all terms and requirements of a Change Order by endorsing the Change Order, writing a
 12 separate acceptance, or not disputing a Change Order as provided for in Section 1-04.4.

13 There may be Change Orders which change the Work or the Contract without resulting in a change in the Contractor's
 14 costs or time to do the Work. Such Change Orders are commonly referred to as 'no cost' Change Orders.

15 If the Engineer determines that a change increased or decreased the Contractor's costs or time to do any of the Work,
 16 including unchanged Work, the Engineer will make an equitable adjustment to the Contract. If the Contractor believes that any
 17 written directive or change increased or decreased the Contractor's costs or time to do any of the Work, and the Contract has
 18 not been equitably adjusted by the Engineer, the Contractor must file a dispute as specified in Section 1-04.4. If the Contractor
 19 believes they have encountered differing Project Site conditions (changed conditions), the Contractor must comply with the
 20 process specified in Section 1-04.6. In general, the Engineer will seek the Contractor's agreement on the equitable
 21 adjustment; however, if the parties cannot come to an agreement, the Engineer will unilaterally determine the total price of the
 22 equitable adjustment as specified in Section 1-09.4 and, if applicable, Section 1-08.8. An equitable adjustment for deleted
 23 work will be made as specified in Section 1-09.5. An equitable adjustment for an increase or decrease exceeding 25 percent of
 24 the original quantity of any Bid Item, will be made as specified in Section 1-04.5. The Engineer's decision concerning an
 25 equitable adjustment of costs and time is final unless the Contractor files a dispute and the dispute or a subsequent claim is
 26 upheld as specified in Section 1-04.4.

27 The Contractor must proceed with the Work upon receiving:

- 28 a. A written Change Order approved by the Engineer; or
- 29 b. A written directive from the Engineer.

30 **1-04.4 DISPUTE AND CLAIMS RESOLUTION PROCESS**

31 This Section describes dispute and claim resolution processes. The scope of the dispute set forth in the written dispute
 32 notice will direct and limit the scope of all subsequent claim, mediation, or litigation on the subject matter, and the Contractor is
 33 not allowed to enlarge the scope of any claim beyond that originally presented in the written dispute notice. All subcontract
 34 agreements will contain the same provisions as this section in its entirety. All disputes must be resolved prior to final payment.

35 **1-04.4(1) DISPUTE RESOLUTION SEQUENCE**

36 The dispute resolution process sequence is: dispute, claim, mediation, litigation, in that order. The Contractor agrees to
 37 follow this sequence, and failure to do so constitutes a waiver of any right to dispute or to claim for additional time or additional
 38 payment for the disputed Work.

39 Either party has the right to dispute. All disputes must start with the delivery of written notice to the other party. If the
 40 Contractor provides notice to the Owner, the Engineer will evaluate the notice and make a written decision on the matter as
 41 specified in Section 1-04.4(2). If the Contractor disagrees with the decision, in whole or in part, the Contractor may file a claim
 42 as specified in Section 1-04.4(3). If the Engineer denies the claim, the Owner and Contractor must at the Contractor's request,
 43 go to mediation as specified in 1-04.4(4). If the claim is not resolved at mediation, the Contractor may file suit in the King
 44 County Superior Court at Seattle, WA as specified in Section 1-04.4(5).

45 **1-04.4(2) DISPUTES**

46 If the Contractor, or Subcontractor, disagrees with a decision or any Change Order, including any written directive by
 47 the Engineer, the Contractor must notify the Engineer in writing that it disputes the decision. Notification must be delivered
 48 before the close of the second full Working Day following the date the Engineer issued the Change Order or written
 49 notification.

50 In the event that the dispute involves quantities, the written dispute notice must be filed before the placement of the
 51 changed quantities and not later than the close of the second full Working Day.

52 The written dispute notice must identify the Change Order, Owner's decision or other Engineer's directive being disputed
 53 and a brief explanation of the basis for the dispute.

54 The Engineer may issue a written decision or may ask in writing for further information.

55 If the Engineer asks for further information, the Contractor must, within 10 Working Days of the date of that request,
 56 furnish a dated, signed written supplemental statement containing:

- 57 1. The date of the supplemental written statement;

2. The date of the directive to perform ;
3. The nature and circumstances which caused the dispute;
4. The Contract provisions that relate in any way to the dispute;
5. The estimated additional dollar cost, if any, of performing the disputed Work and how that estimate was determined, in detail;
6. An analysis of the accepted critical path schedule in effect at the time the dispute arose, showing the schedule change or disruption, if the Contractor is asserting a schedule change or disruption; and
7. Any additional information the Engineer requests.

The Contractor may request an extension of time to furnish the additional written information. The Engineer will determine if such additional information would be helpful and if the Engineer determines it would be helpful, the Engineer will specify a reasonable extension of time. Any extension must be approved in writing by the Engineer.

Within 10 Working Days from the date the Contractor filed the dispute or the receipt of requested information, the Engineer will issue a written decision regarding the dispute. At the Engineer's sole discretion, the Engineer may furnish written notice to the Contractor extending the time for the decision for a period not to exceed 20 additional Working Days.

If the Engineer rejects any or all of the Contractor's dispute, the Engineer's notice will contain the reasons for the rejection. Payment for approved Work will be made as specified in Section 1-09.4. In the event that the Engineer fails to decide the dispute within the 10 Working Days, unless extended by the Engineer, the Contractor may deem the dispute rejected and file a claim as specified in Section 1-04.4(3).

The dispute does not relieve the Contractor from the obligation to promptly proceed with the Work, including the disputed Work. The Contractor must timely perform all Work unless directed in writing by the Engineer to stop work in whole or in part. When performing any disputed Work, the Contractor must keep complete records of actual costs and actual time incurred, identifying extra costs and extra time associated with the disputed Work.

1-04.4(3) CLAIMS

Both the Owner and the Contractor have an interest in the prompt and fair resolution of claims. The purpose of the claims provisions of this Contract is to create a clearly defined process intended to fairly resolve claims at the earliest possible point in time without unnecessary delay or expense, including the expense of administration, mediation or litigation. The Contractor must only pursue administrative resolution of any claim with the Engineer or Assistant.

In order for the Engineer to accurately evaluate and decide claims, the Contractor is responsible for presenting all relevant information in support of a claim at the claims stage, including the information required in this Section. The Contractor is not permitted to present information known or available to the Contractor (including Subcontractors and Suppliers), schedules or schedule logic, or basis of the dispute, at the mediation or litigation stage, which was not presented to the Engineer at the time the claim was presented.

If the Contractor disagrees with the Engineer's decision as specified in Section 1-04.4(2), the Contractor may file a claim as provided in this Section.

Claims of less than \$50,000 must be filed within 10 Working Days of the date of the Engineer's written notice under Section 1-04.4(2).

Claims equal to or greater than \$50,000 must be filed within 20 Working Days of the date of the Engineer's written notice.

The Contractor may request an extension for filing a claim. Any extension must be approved in writing by the Engineer.

The Contractor waives any claim for additional payment if a claim is not filed as provided in this Section.

All claims must be in writing, contain sufficient detail to enable the Engineer to ascertain the basis and amount of the claim, be certified by the Contractor as stated below, and be filed with the Engineer.

No claim will be allowed after the Completion Date.

At a minimum, each claim must include the following information:

1. The date of filing the claim.
2. A detailed factual statement supporting the claim, including all relevant dates, locations, and Bid Items of Work affected by the claim.
3. The date on which facts arose which gave rise to the claim.
4. The name and title of each individual involved in or knowledgeable about the subject of the claim.
5. The specific provisions of the Contract which support the claim and a statement of the reasons why such provisions support the claim.
6. If the claim relates to a decision of the Engineer in which the Contract provides that the Engineer's decision is final, the Contractor must set out in detail all facts supporting its position relating to the decision of the Engineer.
7. A copy of the original, signed notice of dispute, as well as a copy of any supplemental documentation provided to the Engineer and a copy of any written communication from the Engineer regarding the dispute.
8. Copies of diaries, meeting minutes, notes, or field records prepared contemporaneously with any oral communications that relate to the subject of the claim.

- 1 9. Copies of any additional documents that support the claim. Manuals which are standard to the industry governing the
2 Work in which the claim is being made may be included by reference; however, the Contractor must clearly state
3 which part or parts of the industry standard the Contractor is relying upon.
- 4 10. If an extension of Contract Time is sought, the following information must also be provided:
- 5 a. The specific Days and dates for which it is sought.
- 6 b. The specific reasons the Contractor believes a time extension should be granted.
- 7 c. The Specifications of Section 1-08.8 under which an extension is sought.
- 8 d. The Contractor's written explanation of the reason for the requested change including the method of analysis
9 used and where appropriate referring to the relevant schedules; supporting documents such as look-ahead, as-
10 built, daily records, time sheets, and the basis for the rates of affected tasks that the base CPM was founded on,
11 may be required by the Engineer.
- 12 11. If additional payment is sought, the Contractor must document the exact dollar amount sought supported by a
13 breakdown of: the dollar amounts as-Bid, and/or as incorporated into the Contract via approved Change Orders, the
14 actual amounts accrued, and the additional payment sought. The basis of any of these amounts may be required by
15 the Engineer. The Contractor must provide the documentation of the amount in the following categories, as
16 applicable:
- 17 a. Direct Labor (hours): This includes regular time rates and overtime rates for all employees and work
18 classifications. These rates must include the basic prevailing wage and fringe benefits, the current rates for
19 Federal Insurance Compensation Act (FICA), Federal Unemployment Tax Act (FUTA) and State Unemployment
20 Tax Act (SUTA), the company's present rates for Medical Aid and Industrial Insurance premiums and the planned
21 payments for travel and per diem payment. This excludes overhead and profit.
- 22 b. Direct Material (invoices): The invoice cost for Contractor-supplied Materials. This cost must include freight and
23 handling charges and applicable taxes as shown on the invoices issued by the Supplier. This excludes overhead
24 and profit.
- 25 c. Direct Equipment (hours, invoice, and rental agreements as applicable): Separately identify each piece of
26 equipment used and the operation cost for each piece of equipment including all fuel, oil, lubrication, ordinary
27 repairs, maintenance, and all other costs incidental to furnishing and operating the equipment, and the standby
28 rate for each piece of equipment. This excludes overhead and profit. All equipment must have detailed
29 descriptions, including but not limited to year, make, and model.
- 30 1) Where the equipment is Contractor owned through outright ownership or through a long-term lease, the
31 Contractor must document the Contractor's actual internal Bid rates. Bid rates are the equipment rates used
32 by the Contractor or Subcontractors for bidding and project cost tracking; these rates typically exclude labor
33 for operation; if an operator is included in a Bid rate, it must be indicated as such.
- 34 2) Where the equipment is rented and operated by the Contractor, the Contractor must document the actual
35 rental amounts including the actual rates for the equipment, excluding labor for operation.
- 36 3) Where the equipment is rented from a third-party with operator, the Contractor must document the actual
37 rental amounts including the actual rates for the equipment, including labor for operation.
- 38 d. Services (invoices/agreements): All invoices and agreements; additional breakdown may be required by the
39 Engineer. This excludes overhead and profit.
- 40 e. Overhead and Profit (percentages that apply to direct costs in a, b, c, & d above): Markups for overhead and profit
41 must be provided in detail under the following categories listed below. General company overhead, project
42 overhead, and profit percentages must be provided for each affected Bid Items of Work, the mobilization Bid Item,
43 and for the project as a whole.
- 44 1) General Company Overhead: Costs of the Contractor's home or corporate office necessary to run the
45 business and to support the projects in the field. The Engineer may require that the general company
46 overhead be supported with documentation of company financial information for the past 2 years.
- 47 2) Project Overhead: Indirect costs that cannot be identified with a specific construction activity but support the
48 project as a whole. The Engineer may require documentation of actual costs accrued.
- 49 3) Profit: Net proceeds after expenses. The Engineer may require a detailed justification with supporting
50 documentation of the company's financial information for the past 2 years.
- 51 f. Subcontractor Costs: Payments the Contractor makes to Subcontractors at any tier for performing Work are to be
52 included in the claim. This cost must be calculated and itemized in the same manner prescribed for the
53 Contractor.
- 54 g. Costs for repair or replacement of defective work or damage to property, of Contractor caused delays, or other
55 inefficiencies resulting from the Contractor operations, including Subcontractors, services, and Suppliers, must
56 not be included in actual or projected costs.
- 57 h. Costs must not be included more than once in the claim documentation.
- 58 12. Any additional information requested in writing by the Engineer.
- 59 13. A notarized statement containing the following language:

1 STATE OF WASHINGTON
 2 SS.
 3 THE COUNTY OF KING
 4 The undersigned, _____,
 5 (name)
 6 _____, of _____,
 7 (title) (company)

8 being first duly sworn on oath, deposes and says:

9
10 The claim for extra payment and/or time made herein for Work on this Contract is a true statement of the actual costs
11 incurred and/or time sought, and is fully documented and supported as required by the Contract between the parties.

12 Dated _____ /s/ _____

13 Subscribed and sworn before me this _____ Day of _____

14 Notary Public in and for the State of Washington
 15 residing at _____
 16 My appointment expires

17 It is the responsibility of the Contractor to keep full and complete records of the actual additional costs and the actual
18 additional time incurred for any alleged claim. The Contractor must retain these records for a period of not less than 3 years
19 after the Completion Date. The Contractor must allow the Engineer complete and unrestricted access to these records and
20 any other records as may be requested by the Engineer to determine the facts or contentions involved in the claim.

21 Failure to submit information and details as described, to provide access to the records, or as requested in writing by the
22 Engineer for any claim, will result in waiving of the Contractor's claims.

23 Provided that the Contractor has fully complied with all provisions of this Section, the Engineer will respond to the claim
24 by written notice to the Contractor as follows:

- 25 a. Within 45 Working Days from the date the claim is filed if the claim amount is less than \$50,000;
- 26 b. Within 90 Working Days from the date the claim is filed if the claim amount is equal to or greater than \$50,000; or
- 27 c. If the Engineer determines that the above constraints are unreasonable due to the complexity of the claim under
28 consideration, the Engineer will notify the Contractor within 15 Working Days from the date the claim is filed as to the
29 amount of time which will be necessary for the Engineer to prepare its response.

30 If the Engineer fails to provide written notice within the time periods set forth above, the claim is considered denied and
31 the Contractor may proceed to mediation as specified in Section 1-04.4(4).

32 **1-04.4(4) MEDIATION**

33 If the Engineer denies the claim or the claim is deemed denied as specified in Section 1-04.4(3), the Contractor may
34 request mediation, provided the Contractor does so by delivering written notice to the Engineer within 30 Days of receiving the
35 Engineer's written notice of denial or the date on which the claim is deemed denied including the date the Engineer failed to
36 respond.

37 The date the Contractor's written notice is received by the Engineer is the date of filing the written notice. Failure to file
38 the written notice within the time period stated above will result in the Engineer's decision regarding the claim being final and
39 binding on the Contractor and all its Subcontractors.

40 The parties will select a mutually agreed on mediator. If they are unable to agree, the Owner and the Contractor must
41 seek the selection of the mediator by the King County Superior Court at Seattle, WA.

42 Mediation will occur within 60 Days of the filing of the Contractor's written notice to mediate unless both the Contractor
43 and the Engineer agree to a later date or unless the mediator's schedule requires a later date.

44 Each party will participate in the mediation process in good faith and may be represented at the mediation by lawyers.
45 The parties will each bear their respective costs incurred in connection with this procedure, except that they must share
46 equally the fees and expenses of the mediator and the costs of the facility for the mediation.

47 If mediation does not resolve the disputed matter, the Contractor may pursue judicial resolution as specified in Section 1-
48 04.4(5).

49 **1-04.4(5) LITIGATION**

50 If mediation does not resolve the disputed matter, the Contractor may serve and file a lawsuit in King County Superior
51 Court in Seattle, WA. Such lawsuit must be filed within 180 Days of the Physical Completion Date or within 90 Days of the
52 completion of the mediation process specified in Section 1-04.4(4), whichever is later. This requirement cannot be waived
53 except by an explicit waiver signed by the Owner. The failure to file a lawsuit within the 180 Day period will result in the
54 Engineer's decision rendered as specified in Section 1-04.4(3) being final and binding on the Contractor and all its
55 Subcontractors.

1 Actions by the Contractor against the Owner or between the Contractor and its Subcontractors arising out of a common
 2 set of circumstances must, upon demand by the Owner, be submitted in a single forum or the Owner may consolidate such
 3 claims or join any party necessary to the complete adjudication of the matter in the same forum.

4 **1-04.4(6) AUDITS**

5 All claims by the Contractor for additional payment are subject to audit as specified in Section 1-09.10. In the event of an
 6 audit the Contractor must make available to the Owner all documents the Engineer requests within 7 Days of a written notice
 7 from the Engineer. Failure of the Contractor or a Subcontractor of any tier, to maintain or retain sufficient records to allow the
 8 Owner to verify all or a portion of the claim or to allow Owner access to the books and records of the Contractor, or
 9 Subcontractor of any tier, constitutes a waiver of the portion of the claim that cannot be documented and will bar any recovery
 10 for any portion of a claim that cannot be documented.

11 **1-04.5 VARIATION IN ESTIMATED QUANTITIES**

12 The Contractor will be paid for the actual quantities of Work performed and accepted under the Contract. When the
 13 accepted quantity of Work performed under a unit item varies from the original Bid quantity, a Change Order will be issued and
 14 payment will be made using the unit Contract Price unless adjusted as described herein.

15 The adjusted final quantity will be determined by starting with the final accepted quantity measured after all Work under
 16 an item has been completed. From this amount, subtract any quantities included in Additive Change Orders accepted by both
 17 parties. Then, to the resulting amount, add any quantities included in Deductive Change Orders accepted by both parties. The
 18 final result of this calculation becomes the adjusted final quantity and the basis for comparison to the original Bid quantity.

19 Increased Quantities: Either party to the Contract will be entitled to renegotiate the price for that portion of the adjusted
 20 final quantity in excess of 125 percent of the original Bid quantity. The price for that excess quantity will be determined as
 21 specified in Section 1-09.4.

22 Decreased Quantities: Either party to the Contract will be entitled to an equitable adjustment if the adjusted final quantity
 23 of Work performed is less than 75 percent of the original Bid quantity. The equitable adjustment is based on and limited to 3
 24 factors:

- 25 1. Any increase or decrease in unit costs of labor, materials or equipment, used for Work actually performed, resulting
 26 solely from the reduction in quantity.
- 27 2. Changes in production rates or methods of performing Work actually done to the extent that the nature of the Work
 28 actually performed differs from the nature of the Work included in the original Contract.
- 29 3. An adjustment for the anticipated contribution to unavoidable fixed cost and overhead from the units representing the
 30 difference between the adjusted final quantity and 75 percent of the original Contract quantity.

31 Adjustment Limits: The following limitations apply to renegotiated prices for increases or equitable adjustments for
 32 decreases or both:

- 33 a. The equipment rates are actual cost but must not exceed the rates set forth in the AGC/WSDOT Equipment Rental
 34 Agreement, referred to in Section 1-09.6, that is in effect at the time the Work is performed.
- 35 b. No payment will be made for extended or unabsorbed home office overhead and field overhead expenses to the
 36 extent that there is an unbalanced allocation of such expenses among the Contract Bid Items.
- 37 c. No payment for consequential damages or loss of anticipated profits will be allowed because of any variance in
 38 quantities from those originally specified in the Contract.
- 39 d. The total payment including the adjustment amount and unit prices for Work performed for any item that experiences
 40 an equitable adjustment for decreased quantity must not exceed 75 percent of the extended amount originally Bid for
 41 the item.

42 If the adjusted final quantity of any item does not vary from the quantity shown on the Bid Form by more than 25 percent,
 43 then the Contractor and the Owner agree that all Work under that item will be performed at the original Contract unit price.

44 When ordered by the Engineer, the Contractor must proceed with the Work pending the determination of the cost or time
 45 adjustment for the variation in quantities.

46 The Contractor and the Owner agree that there will be no cost adjustment for decreases if the Owner has entered the
 47 amount for the item in the Bid Form only to provide a common Bid basis for Bidders.

48 **1-04.6 DIFFERING SITE CONDITIONS - "CHANGED CONDITIONS"**

49 The Contractor must provide written notice to the Engineer if the Contractor, or Subcontractors, encounters:

- 50 1. Pre-existing subsurface or latent physical conditions differing substantially from those specified in the Contract and
 51 information available to Bidders; or
- 52 2. Pre-existing unknown physical conditions at the Project Site of an unusual nature, differing materially from those
 53 ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract and
 54 information available to Bidders.

55 The notice must be submitted before the conditions are disturbed on the date of discovery or promptly the next Working
 56 Day. The Contractor must not proceed with that portion of the Work until ordered to do so.

1 Upon notification by the Contractor, or when the Engineer suspects a differing site condition, the Engineer will promptly
2 investigate the alleged changed condition and:

- 3 a. If the Engineer determines that differing conditions do not exist, the Contractor will be notified in writing. Should the
4 Contractor disagree with such determination, the Contractor may file a written notice of dispute with the Engineer
5 under the requirements of Section 1-04.4; or
- 6 b. If the Engineer finds that conditions are materially different and cause an increase or decrease in the Contractor's
7 cost of, or the time required for, performing all or any part of the Work, the Engineer will make an equitable
8 adjustment in the payment for the performance of the Work as specified in Section 1-09.4 or the time for performance
9 as specified in Section 1-08.8.

10 No equitable adjustment will be allowed unless the Contractor has provided the written notice required in above. The time
11 for providing the written notice may be extended by the Engineer for good cause. The time for giving written notice will not be
12 extended beyond the time the Contractor knew, or should have known, of the existence of the differing condition.

13 If there is a decrease in the cost or time required to perform the Work, failure of the Contractor to notify the Engineer of
14 the differing condition does not affect the Engineer's right to make an adjustment in cost or time.

15 **1-04.7 PROGRESS ESTIMATES AND PAYMENTS**

16 Engineer issued progress estimates or payments for any part of the Work must not be used as evidence of performance
17 or quantities. Progress estimates serve only as a basis for making payments. The Engineer may revise progress estimates
18 any time before the Certificate of Completion is issued.

19 **1-04.8 USE OF BUILDINGS OR STRUCTURES**

20 Any building or Structure within the Right of Way that is not to remain during the Work or that may be used by the
21 Contractor will be specified in the Contract.

22 **1-04.9 USE OF MATERIALS FOUND ON THE PROJECT SITE**

23 With written approval of the Engineer, the Contractor may use on the Project Site:

- 24 1. Stone, gravel, sand, or other Mineral Aggregates obtained from on-site excavations
- 25 2. Timbers removed in the course of the Work

26 Approval to use these materials will be granted provided the materials satisfy the requirements of the Contract, and are
27 not required for other use by the Contract or for use as selected Materials.

28 The order of disposal for suitable materials obtained in the course of the Work is as follows unless the Engineer approves
29 otherwise:

- 30 a. Used as selected Material, as specified in Section 2-10.2(1);
- 31 b. Delivered to the Engineer as salvage as specified in Section 2-02.3(7); or
- 32 c. Disposed of as specified in Section 2-01.2.

33 **1-04.10 PROJECT CLEANLINESS AND FINAL CLEANUP**

34 The Contractor must keep the Project Site clean and remove debris, refuse, and discarded materials of any kind resulting
35 from the Work.

36 Disposal of waste must be as specified in Section 1-07.3 and all applicable provisions of the Contract.

37 The Contractor must also perform final cleanup as specified in this Section. The Engineer will not establish the Physical
38 Completion Date until final cleanup is completed. The street Right of Way, Material sites, quarry or pit sites, borrow sites, sites
39 used for temporary waste storage, and all other areas the Contractor occupied to do the Work must be left neat, clean, and
40 presentable. The Contractor must not remove warning, regulatory, or guide signs unless approved otherwise in writing by the
41 Engineer. In the event that the Contractor fails to complete clean-up, the Owner, after providing 5 Days notice, may complete
42 the clean-up and deduct the costs thereof from moneys due or to become due to the Contractor.

43 The Contractor must:

- 44 1. Remove and dispose all rubbish, surplus materials not identified as salvage by the Owner, any discarded materials,
45 falsework, piling, camp buildings, temporary structures, equipment, and debris.
- 46 2. Remove from the Project Site, all unneeded rock, aggregate, and similar material left from grading, surfacing, or
47 paving unless the Contract specifies otherwise or the Engineer approves otherwise.
- 48 3. On all concrete and asphalt pavement Work, clean the pavement and dispose of the wash water and debris per SMC
49 22.800-22.808, which prohibits such discharges from entering the Storm Drain system.
- 50 4. Sweep and clean structure decks and properly dispose of wash water and debris per SMC 22.800-22.808, which
51 prohibits such discharges from entering the Storm Drain system.
- 52 5. Clean out from all Culverts and Storm Drains, inlets, catch basins, maintenance holes, and Water Main valve
53 chambers, within the limits of the Project Site, all dirt and debris of any kind that results from Contractor's operations.
- 54 6. Level and fine grade all excavated material not used for backfill where the Contract requires.

- 1 7. Fine grade all slopes and around all Structure piers, bents, and abutments.
- 2 8. Ensure that the final cleanup of clearing and grubbing disposal sites and borrow sites specified in Sections 2-01.2
- 3 and 2-10.2(2), and any temporary waste sites created by the Contractor, have been performed per the requirements
- 4 specified in the Grading Ordinance, permits, property agreements, and the Contract.
- 5 9. Upon completion of grading and cleanup operations at any privately owned site for which a written agreement
- 6 between the Contractor and property owner is required, the Contractor must obtain and furnish to the Engineer a
- 7 written release from all damages, duly executed by the property owner, stating that the restoration of the property has
- 8 been satisfactorily completed.
- 9 10. Remove all temporary construction stormwater pollution prevention elements within 5 Working Days after final Project
- 10 Site stabilization, or after they are no longer needed, whichever is later.
- 11 11. Before the completion of the Work, amend all new, replaced, and disturbed topsoil as specified in Section 8-01 and
- 12 Section 8-02.
- 13 12. Remove warning, regulatory, or guide signs once removal has been approved in writing by the Engineer.
- 14 13. Clean, remove, and dispose of any debris of any kind that results from Contractor's operations within or outside of the
- 15 Project Site.
- 16 All costs associated with cleanup and disposal are incidental to the Work and must be included in the various Bid Items
- 17 in the Bid and at no additional cost to the Owner.

SECTION 1-05 CONTROL OF WORK

1-05.1 AUTHORITY OF ENGINEER

All Work must be done as specified in the Contract, to the satisfaction of the Engineer. The Contract gives the Engineer authority over the Work. Whenever it is so provided in this Contract, the decision of the Engineer is final, provided that such decision may be disputed as specified in Section 1-04.4.

The Engineer's decisions are final on all questions including, but not limited to:

- 1. Quality and acceptability of Materials and Work
- 2. Substitutions
- 3. Measurement of Bid Item Work
- 4. Acceptability of rates of progress on the Work
- 5. Interpretation of the Contract
- 6. Determination as to the existence of differing Project Site conditions
- 7. Fulfillment of the Contract by the Contractor
- 8. Payments under the Contract including equitable adjustments
- 9. Suspension of the Work
- 10. Determination as to Unworkable Days
- 11. Reviews of submittals
- 12. Determination of Notice to Proceed Date, Substantial Completion Date, and Physical Completion Date, see Section 1-01.3

If the Contractor fails to respond promptly to the requirements of the Contract or direction from the Engineer:

- a. The Engineer may use the Engineer's forces, other Contractors, or other means to accomplish the Work as specified in Section 1-05.8,
- b. The Owner is not obligated to pay the Contractor, and will deduct from the Contractor's payments, additional costs when any other means must be used to carry out the Contract requirements or Engineer's direction, as specified in Section 1-09.9(3).

The Engineer may suspend all or part of the Work, as specified in Section 1-08.6, if:

- 1) The Contractor fails to fulfill Contract terms, to carry out the Engineer's orders, or to correct unsafe conditions of any nature;
- 2) The Contractor fails to comply with environmental implementation requirements, corrective action, testing, or self-reporting requirements;
- 3) The weather or other conditions are unsuitable; or
- 4) It is in the public interest.

Nothing in the Contract requires the Engineer to provide the Contractor with direction or advice on how to do the Work. If the Engineer takes no exception or renders an opinion on any method or manner for doing the Work or producing Materials, it does not:

- a) Guarantee that following the method or manner will result in compliance with the Contract;
- b) Relieve the Contractor of any risks or obligations under the Contract; or

1 c) Create any liability for the Owner.

2 **1-05.2 AUTHORITY OF ASSISTANTS AND ELECTRICAL SAFETY OBSERVER**

3 **1-05.2(1) AUTHORITY OF ASSISTANTS**

4 The Engineer may appoint Assistants to assist in determining if the Work and Materials comply with the requirements of
5 the Contract. Assistants have the authority to reject defective material and suspend Work that is being done improperly,
6 subject to the final decision of the Engineer. Assistants may exercise such additional authority as may be delegated to them by
7 the Engineer.

8 Assistants and inspectors are not authorized to accept Work, to accept Materials, to issue instructions, or to provide
9 advice that is contrary to the Contract. Work done or Material furnished which does not comply with the Contract requirements
10 is at the Contractor's risk and is not a basis for a claim even if the inspectors or Assistants purport to change the Contract to
11 provide for such Work or Material, to approve or accept such Work or Material, or issue any instructions contrary to the
12 Contract.

13 Although Assistants may advise the Contractor of any faulty Work or Materials or infringements of the terms of the
14 Contract, failure of the Engineer or Assistant to do so does not constitute acceptance or approval.

15 **1-05.2(2) AUTHORITY OF ELECTRICAL SAFETY OBSERVER**

16 The Engineer will assign an Electrical Safety Observer when Work is performed in a substation; in a switchyard; in an
17 energized vault; at other locations containing high voltage lines or equipment; when installing ducts and vaults in the vicinity of
18 energized underground electrical transmission or distribution system; or when any excavation is within 15 feet of an energized
19 electrical transmission or distribution system as indicated by marked for locate as specified in Section 1-07.17(1); or as
20 otherwise deemed necessary by the Engineer. The only exception is when the Contract specifies, and contains a Bid Item,
21 that the Contractor provides a qualified Contractor's Electrical Safety Observer who is approved by SCL.

22 The Contractor must provide a minimum 7 Working Days advance notice request for an Electrical Safety Observer, see
23 Section 1-07.28 for notification requirements. The Contractor must provide an adequate description of the Work to be
24 performed, equipment to be used, and the Work duration. When the Contractor, or its Subcontractor, does not schedule Work
25 on a specific Day or Days, the Contractor must provide 1 Working Day advance notice unless arranged otherwise with the
26 Electrical Safety Observer. Failure to notify the Electrical Safety Observer at least 1 Working Day in advance will result in the
27 Owner back charging the Contractor for the Electrical Safety Observer's services at the site.

28 The Electrical Safety Observer's involvement with Project Site safety will be limited to electrical safety, unless the
29 Contract indicates otherwise. The Electrical Safety Observer will notify the Contractor of electrical hazards and may instruct,
30 warn, and if necessary, direct Contractor and Subcontractor personnel to move a safe distance from electrical system
31 components. In addition to all other rights of the Owner and Engineer, the Electrical Safety Observer will have the authority,
32 but not the responsibility, to stop Work if the Electrical Safety Observer judges that there is any hazard that immediately
33 imperils life, health, or property.

34 The Contractor is solely responsible for safety under the Contract. The presence or absence of an Electrical Safety
35 Observer does not change the Contractor's responsibility for the occupational health and safety of individuals on the Project
36 Site or relieve the Contractor of any of its legal obligations for worker safety.

37 The Contractor must assign a Contractor's on-site electrical lead and must ensure that each Subcontractor assigns a
38 Subcontractor's on-site electrical lead when Work requires an Electrical Safety Observer. The on-site electrical lead is
39 authorized to resolve safety related issues raised by the Engineer, Assistant, or Electrical Safety Observer. The Contractor
40 must ensure that such on-site electrical lead is physically present at the Project Site requiring an Electrical Safety Observer.
41 Each on-site electrical lead, whether Contractor's or Subcontractor's, must identify themselves to the Electrical Safety Observer
42 at the briefing/tailgate conference.

43 At the briefing/tailgate conference on each Day when an Electrical Safety Observer is required, the Contractor must
44 notify the Electrical Safety Observer of the work to be performed requiring an Electrical Safety Observer. Each on-site
45 electrical lead, or Contractor's or Subcontractor's on-site supervisory representative, must complete and sign the Safety Watch
46 Checklist and Certification of Training form provided by the Electrical Safety Observer before work starts for which an
47 Electrical Safety Observer is required.

48 **1-05.3 SUBMITTALS**

49 The Contractor must not perform Work or procure Material or start fabrication based on a required submittal until the
50 Engineer has returned the approved submittal. If a submittal is required by the Contract, any related portion of Work performed
51 by the Contractor before the Engineer's return of an approved submittal, or as otherwise specified by the Engineer, is solely at
52 the Contractor's risk and expense.

53 The City encourages the use of environmentally friendly materials and methods. Unless the Contract or Engineer
54 specifies otherwise, electronic submittals will be used to the maximum extent feasible. When hard copy submittals are
55 required, the Contractor must use recycled and reusable products including recycled content paper.

56 Section 1-05.3 specifies submittals required by the Engineer. Other documentation required by the Owner will be
57 specified in the applicable Sections.

The electronic submittal received by the Engineer is considered the official and governing document unless a non-electronic submittal is required. The date on which the submittal is received by the Engineer either physically or electronically is considered the date submitted, except that submittals received by the Engineer on a Non-Working Day, or received after 4:00 p.m. on a Working Day, are considered submitted on the following Working Day.

1-05.3(1) GENERAL

1-05.3(1)A ELECTRONIC SUBMITTALS

Electronic submittals must be submitted via email or other means as mutually agreed. Electronic submittals must be in PDF unless otherwise specified in the Contract or on Engineer provided forms. PDF is a digital file format that captures all elements of a printed document as an electronic image such that it can be viewed, navigated, printed, electronically searched and copied, and/or forwarded via email. Whenever practicable, convert text documents to PDF, as opposed to scanning images, to enhance the capability of electronic searching and copying. The PDF file, when printed, must fulfill the page size and format requirements of the applicable specification.

Email addresses will be provided at the preconstruction conference.

1-05.3(1)B NON-ELECTRONIC SUBMITTALS

Typically, non-electronic submittals are any oversize document or any document that requires an original signature or ink stamp. Non-electronic submittals must be submitted as a hard copy. Examples of submittals required in this format include: formal correspondence, pay estimates, Change Orders, Drawings greater than 11" x 17" in size, and Drawings requiring a Professional Engineer's or Licensed Professional's stamp.

Faxes and other forms of copies are not acceptable as submittals when an original signature or ink stamp are required.

1-05.3(1)C BULK SAMPLE SUBMITTALS

Bulk sample submittals, unless the Engineer agrees otherwise, must include Mineral Aggregate, hot mix asphalt, geotextile, and pipe. Bulk sample submittals received on or after 2:00 p.m. on a Working Day will be considered as received on the following Working Day. Unless directed otherwise, deliver bulk samples to: SPU Materials Laboratory, 707 South Plummer Street, Seattle, WA 98134, (206) 386-1236

1-05.3(1)D SUBMITTAL NUMBERING

The use of unique identifying numbers for submittals is considered helpful in facilitating Contract-related communications and is therefore encouraged by the Owner. During the preconstruction meeting, the Engineer may propose one or more submittal numbering procedures to be used during the Work. The Contractor must cooperate and comply with all such submittal numbering proposals.

1-05.3(1)E GENERAL SUBMITTAL DISTRIBUTION AND FORMAT SUMMARY

In order to be considered by the Engineer, submittals and items of correspondence must be submitted in the format set forth in the following table. The Engineer's review/approval period runs from the date of receipt of a submittal or item of correspondence delivered in the required format.

This table also provides a general overview of typical format and distribution requirements for various documents and submittals that may be required by the Contract and for correspondence and responses from the Engineer. However, specific submittal requirements are more fully described in the Sections pertaining to them, and to the extent there are conflicts between the table below and the detailed Specification requirements, the detailed Specification requirements govern unless directed otherwise by the Engineer.

| General Submittal Distribution and Format Summary Table | | | | |
|---|--|---|-------------------------|--------------------------------------|
| Submittal/Correspondence Description | | Required Format For Review Period Or Formal Action To Start | | Additional Paper Copies ¹ |
| | | Preferred | Alternate | |
| From Contractor | All Oversize documents (larger than 11" x 17"), regardless of submittal type | Paper | None | 3 |
| | As-built Drawings | Paper | None | 3 |
| | Bulk Samples | Paper Form per Spec, delivered with sample | None | N/A |
| | Catalogue Cut Sheets | Paper | Electronic | 1 |
| | Change Orders | Paper | Electronic ² | 0 |
| | CPM Schedules | Electronic | Paper | 3 |
| | Cutting/Patching Proposal | Electronic | Paper | 1 |
| | E-mails | Electronic | None | 0 |

| General Submittal Distribution and Format Summary Table | | | | |
|---|---|---|-------------------------|--------------------------------------|
| Submittal/Correspondence Description | | Required Format For Review Period Or Formal Action To Start | | Additional Paper Copies ¹ |
| | | Preferred | Alternate | |
| | Environmental Pollution Control Plans | Electronic | Paper | 1 |
| | Field Memos | Electronic | Paper | 0 |
| | Health and Safety Plans | Electronic | Paper | 1 |
| | Letters, Formal Correspondence | Paper | None | 0 |
| | Modification Proposal | Electronic | Paper | 1 |
| | Operations and Maintenance Manuals | Paper | None | 3 |
| | Pay Estimate | Paper | Electronic ² | 0 |
| | Product Data | Electronic | Paper | 1 |
| | Project Equipment List | Electronic | Paper | 1 |
| | Project Labor List | Electronic | Paper | 1 |
| | Reports | Electronic | Paper | 1 |
| | Request for Information (RFI) | Electronic | Paper | 1 |
| | Request for Material Source Approvals | Electronic | Paper | 1 |
| | Schedule of Values | Electronic | Paper | 0 |
| | Shop Drawings with Professional Engineering Stamp | Paper | None | 3 |
| | Soil Transfer Forms | Electronic | Paper | 1 |
| | Subcontractor Approval Requests | Electronic | Paper | 1 |
| | Submittal Schedule | Electronic | Paper | 1 |
| | Substitution Requests | Electronic | Paper | 1 |
| | Test Results | Electronic | Paper | 1 |
| | Warranties | Paper | None | 1 |
| | Waste Management Plan | Electronic | Paper | 1 |

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| General Submittal Distribution and Format Summary Table | | | | |
|---|--------------------------------------|---|------------|--------------------------------------|
| Submittal/Correspondence Description | | Required Format For Review Period Or Formal Action To Start | | Additional Paper Copies ¹ |
| | | Preferred | Alternate | |
| From Engineer | Design Changes | Electronic | Paper | |
| | E-mails | Electronic | None | |
| | Field Directive | Paper | Electronic | |
| | Field Memos | Electronic | Paper | |
| | Inspection Reports | Paper | Electronic | |
| | Letters, Formal Correspondence | Paper | None | |
| | Preconstruction Meeting Announcement | Paper | Electronic | |
| | Progress Meeting Minutes | Electronic | Paper | |
| | RFI Responses | Electronic | Paper | |
| | Submittal Review Responses | Electronic | Paper | |

2

NOTES:

3

1. These are minimum requirements in addition to the original submittal.

4

2. The Engineer requires originals of signed pages for this document. The Contractor may submit an electronic version to trigger the Engineer's approval process, but must then additionally provide a paper version with original signature before completion of the Engineer's review/approval process.

5

6

7

1-05.3(2) SUBMITTAL TRANSMITTAL AND RESPONSE FORM (ST&R FORM)

8

This form is required by several City departments, and when so required, must be filled out by the Contractor and emailed as part of the complete package along with the submittal in PDF to the Engineer. The form must also be attached to

9

1 the original hardcopy of the submittal when required and delivered to the Engineer or SPU Materials Laboratory. The Engineer
2 will complete the form and respond electronically.

3 **1-05.3(3) CONTRACTOR SUBMITTAL DELIVERY AND REVIEW TIMELINES**

4 The submittal received date for submittals is specified in Section 1-05.3(1).

5 Unless otherwise specified in the Contract, the Contractor must allow the Engineer the following submittal review
6 timelines:

- 7 1. 20 Working Days for Structural Shop Drawings
- 8 2. 15 Working Days for other Shop Drawings
- 9 3. 10 Working Days for all other submittals

10 The Contractor must transmit submittals in a timely manner to comply with Contract Time, and must take into
11 consideration the possibility of resubmittal.

12 Submittals required before or at the preconstruction conference as specified in Section 1-05.3(5) must be provided and
13 will be reviewed as specified in the Contract or as mutually agreed. Unless specified or mutually agreed otherwise, submittals
14 received before the preconstruction conference are considered as received at the preconstruction conference for purposes of
15 determining the start of the Engineer's review cycle.

16 **1-05.3(4) SUBMITTAL CONTROL DOCUMENT**

17 At the preconstruction conference, the Contractor must be prepared to discuss the nature and timelines of all submittals
18 as they relate to the various portions of the Work, to the Bid Items, and to the proposed progress schedule. The Contractor
19 must prepare and submit to the Engineer a Submittal Control Document listing all submittals and when these submittals will be
20 delivered to the Engineer. The Contractor may reference the CPM schedule and show major submittals and review times in
21 the CPM. The initial Submittal Control Document must be submitted with the base CPM schedule, see Section 1-08.3(1) for
22 time requirements.

23 The data in the submittal control document does not relieve the Contractor of the obligation to comply with the
24 requirements regarding Contract Time. Unless all submittals are shown in the CPM schedule, the Contractor must review the
25 Submittal Control Document at least every 30 Days and update or correct the Submittal Control Document as necessary. It is
26 recommended that the Submittal Control Document updates be submitted concurrently with CPM schedule updates. Submittal
27 Control Document updates are incidental to the Bid Items and not required when all pending submittals are shown on the CPM
28 schedule.

29 At a minimum, the Submittal Control Document and/or CPM schedule must address Material submittals, Shop Drawings,
30 and the standard submittals specified in Section 1-05.3(1).

31 **1-05.3(5) EARLY SUBMITTALS**

32 The following must be submitted before or at the preconstruction conference:

- 33 1. Preliminary CPM schedule, see Section 1-08.3
- 34 2. Initial Submittal Control Document, see Section 1-05.3(4)
- 35 3. List of waste, recycle and disposal sites, see Section 1-07.3
- 36 4. Signed "Transfer of Coverage for Construction Stormwater General Permit" form, as applicable, see Section 1-07.15
- 37 5. Social Equity Plan (including Apprenticeship Utilization Plan), as applicable, see Section 1-07.11(3)A

38 When applicable, the following must be submitted and approved by the Engineer before mobilization to the Project Site:

- 39 a. Construction Stormwater and Erosion Control Plan (CSECP), see Section 8-01
- 40 b. Tree, Vegetation, and Soil Protection Plan (TVSPP), see Section 8-01
- 41 c. Spill Plan (SP), see Section 1-07.15(1) and Section 8-01
- 42 d. Health and Safety Plan, if applicable, see Section 1-07.1(2)
- 43 e. SDOT Street Use Permit and approved traffic control plan, see Section 1-07.6 and Section 1-10

44 **1-05.3(6) CONTRACTOR'S REQUEST FOR INFORMATION, SUBSTITUTIONS, AND DEVIATIONS**

45 The Engineer's review of requests for clarification, approved submittal deviations, and/or substitution does not relieve the
46 Contractor from responsibility for the submittal review timeline requirements of the Contract.

47 Request for Information (RFI): Information requests must be submitted to the Engineer using the RFI form. The
48 Contractor must comply with the procedures specified in Section 1-05.3(1) and will supplement the form with any other
49 appropriate information. The required notice form titled: Request for Information will be provided in an electronic format by the
50 Engineer upon request.

51 Each Contractor's RFI must use this form in the format provided, completed in its entirety, supplemented with other
52 appropriate information as may be specified elsewhere, and submitted with attachments necessary for proper review by the
53 Engineer. RFI submittals found to contain errors, or unapproved deviations or variations from the Contract, may be determined

1 by the Engineer to be out of compliance with the Contract. Any costs or delays associated with non-conforming RFIs are the
2 Contractor's sole responsibility and the Engineer has no requirement to extend Contract Time or to make additional payments.

3 If the Contractor determines any comment by the Engineer on the returned RFI to constitute a change, the Contractor
4 must make such written notice as specified in Section 1-04.3.

5 Submittal Update (Deviation): Where the Contractor intends to change, deviate from, or supplement a previously
6 reviewed submittal accepted by the Engineer, the Contractor must resubmit the originally reviewed submittal to the Engineer
7 for additional review indicating the proposed changes or deviations from the originally reviewed submittal and must clearly
8 state reasons, additional calculations, additional details, as necessary to support such need for change or deviation.

9 Contract Deviation Request: Any request for a variation or deviation from the Contract, except substitutions addressed
10 below, must allow the Engineer a minimum 10 Working Days to review and return the request and must clearly state reasons,
11 additional calculations, additional details, as necessary to support such request or deviation from the Contract. The Engineer
12 may deny requests for deviation from the Contract if the request is not in the best interest of the Engineer, or if time or
13 resources are not available for review. The Engineer's decision will be final and the Contractor must Bid accordingly.

14 Substitution: All Materials, equipment or methods proposed by the Contractor as a substitution for a brand name,
15 trademark, patent number, proprietary process, or specified item with an "or equal" allowance must be addressed in the
16 submittal. In making a request for substitution, the Contractor's submittal must demonstrate that the proposed substitution fully
17 meets or exceeds the requirements in Section 1-06.1(1) and the applicable technical Section. Any request to use a substitute
18 for a non-proprietary material, equipment, or process must be proposed through correspondence and must allow the Engineer
19 10 Working Days to review and return the request and must fully comply with or exceed the requirements in Section 1-06.1
20 and the applicable technical Section.

21 **1-05.3(7) TECHNICAL SUBMITTAL DESCRIPTIONS**

22 Where a submittal contains information with more than 1 option, such as catalog cut, manufacturer's written instructions,
23 recognized trade association standard, or specified designation, the option applicable to the submittal must be clouded or
24 highlighted.

25 Include the type of submittal in the description. Examples include: Shop Drawings, product data (catalog cuts,
26 illustrations), samples (bulk of Materials), design data (calculations, mix designs, analyses), test reports (by authorized
27 professional of private testing laboratory or certified individuals), manufacturer's certificate of compliance, manufacturer's
28 written instruction (installation of a product, system, or Material, including special notices and material safety data sheets
29 (MSDS)), operating and maintenance manuals, CPM schedule, as-built Drawings, or others as deemed applicable.

30 **1-05.3(8) SUBMITTAL REVIEW AND POSSIBLE RESPONSE ACTIONS**

31 The Engineer's submittal review is to ensure compliance with the requirements of the Contract. The Engineer's review
32 does not extend to consideration of the Contractor's means, methods, techniques, sequences or procedures of construction or
33 to safety precautions or programs incident thereto, except where a specific means, method, technique, sequence, or
34 procedure of construction is required or prohibited by the Contract or a regulatory agency. Engineer review of a separate Bid
35 Item does not indicate approval of the assembly in which the Bid Item functions. The Contractor is responsible for confirming
36 and correlating all dimensions; fabrication and construction techniques; coordinating the Contractor's Work with that of all
37 other trades; and the satisfactory performance of the entire Work in strict accordance with the Contract.

38 The following notations are interpreted as follows:

- 39 1. No Exception Taken: Submittals returned and marked No Exception Taken authorize the Contractor to proceed with
40 the portion of the Work, proceed with the fabrication, or to procure Materials or equipment, as contained in the
41 submittal. Where more than 1 submittal is required for a portion of the Work or for a greater portion of Work
42 containing the submittal portion, no portion of Work must proceed until all submittals required of that Work portion are
43 returned by the Engineer without requiring resubmittal. The Contractor must not change in any way, a portion of the
44 Work or fabrication based on submittal returned No Exception Taken. Revisions must only be made as specified in
45 Section 1-05.3(10).
- 46 2. Make Corrections Noted: Submittals returned and marked Make Corrections Noted authorize the Contractor to
47 proceed with the portion of Work covered by the submittal as long as the corrections noted are followed. For
48 submittals prepared by a Professional Engineer, the Contractor must provide a return copy showing the noted
49 corrections. The Contractor is responsible for the submittal; if they do not agree with the corrections noted, they must
50 resubmit before proceeding with that portion of the Work.
- 51 3. Submit Specified Item: Submittals returned and marked Submit Specified Item indicate an incomplete submittal and
52 does not authorize the Contractor to perform that portion of the Work. The specified item must be resubmitted as
53 specified in Section 1-05.3(10).
- 54 4. Rejected or Revise and Resubmit: Submittals returned and marked Rejected or Revise and Resubmit indicate the
55 submittal is incomplete or does not comply with Contract requirements, and must be resubmitted with appropriate
56 changes before proceeding with that portion of the Work, as specified in Section 1-05.3(10).

1 **1-05.3(9) ACTIONS BY CONTRACTOR BEFORE SUBMITTAL RETURN BY ENGINEER**

2 The Contractor bears all risks associated with purchasing any Material or equipment or for starting fabrication or starting
3 any Work requiring a submittal, until the Contractor has received a submittal response from the Engineer that authorizes the
4 Contractor to proceed with the portion of the Work.

5 **1-05.3(10) RESUBMITTALS**

6 Submittals returned to the Contractor marked Rejected, Revise and Resubmit, or Submit Specified Item will include the
7 Engineer's comments. The Contractor must address the Engineer's comments in its resubmittal, with corrections clearly
8 identified in the resubmittal to assist the Engineer's review.

9 Resubmittal is considered a new submittal; a new submittal review period of the duration specified for the original
10 submittal starts on receipt of the resubmittal by the Engineer. See Section 1-05.3(3) for review timelines. No extension of
11 Contract Time will be allowed for resubmittals.

12 **1-05.3(11) SHOP DRAWINGS**

13 The Contractor must submit supplemental Shop Drawings with calculations as required for the performance of the Work.
14 The Drawings must be on sheets measuring 24 x 36 inches, 11 x 17 inches, or on sheets with dimensions in multiples of 8-1/2
15 x 11 inches. All Drawings must be to scale. The design calculations must be on sheets measuring 8-1/2 x 11 inches. Shop
16 Drawings must be legible, with all terms identified, and may include computer printouts.

17 The Drawings and calculations must be provided far enough in advance of actual need to allow for the review process by
18 the Engineer, which may involve rejection, revision, or resubmittal, as specified in Section 1-05.3(8). Shop Drawings must be
19 submitted, and re-submitted if required, by the Contractor in an orderly sequence so that they may be reviewed by the
20 Engineer in the order in which they are received, without creating delay. The Contractor may suggest the sequence in which
21 these Shop Drawing submittals are to be reviewed by the Engineer in order to comply with the critical path scheduling needs.

22 Shop Drawing and calculation submittals must be prepared by, or under the direction of, a Professional Engineer,
23 licensed under Title 18 RCW, State of Washington, and must carry the Professional Engineer's signature and seal, see
24 Section 1-05.3(12).

25 If more than the specified number of Working Days are required for the Engineer's review of any individual submittal or
26 resubmitted, an extension of time will be considered as specified in Section 1-08.8.

27 Before submittal of Shop Drawings, the Contractor must determine and verify all quantities, dimensions, specified
28 performance criteria, installation requirements, Materials, catalog numbers and similar data, and review or coordinate each
29 Shop Drawing with other Shop Drawings and with the requirements of the Contract. Section 1-04.2 specifies the precedence
30 of figured and scaled dimensions. Copies of the Drawings or Standard Plans as substitutes for Shop Drawings will be rejected
31 and will require resubmittal.

32 **1-05.3(11)A SHOP DRAWINGS VARYING FROM CONTRACT REQUIREMENTS**

33 Submittal of a Shop Drawing that varies from the Contract requirements is considered a Contract deviation request and
34 must be as specified in Section 1-05.3(6).

35 **1-05.3(12) SUBMITTAL PREPARED BY PROFESSIONAL ENGINEER OR OTHER LICENSED PROFESSIONAL**

36 Where the Contract requires a submittal prepared by a Professional Engineer or other licensed professional, such as
37 Surveyor, Landscape Architect or Architect hereafter referred to as Licensed Professional, all Drawings and design
38 calculations must be prepared by, or under the direct supervision of, a Licensed Professional, with current license under Title
39 18 RCW, State of Washington, who is registered and qualified in the applicable branch of engineering, or a special profession.
40 Any plan details or Drawings requiring design calculations by a Licensed Professional are considered a Shop Drawing.

41 Each sheet of the Drawings must carry the following:

- 42 1. Licensed Professional's original signature, date of signature, original seal, and registration number;
- 43 2. The initials and dates of all participating design professionals;
- 44 3. Clear notations of all revisions including identification of who authorized the revision, who made the revision, and the
45 date of the revision;
- 46 4. The Contract public works number, Contract title, and sequential sheet number. These must also be on all related
47 documents; and
- 48 5. Identification of where each drawing sheet will be used by referencing the Contract Drawing sheet number and
49 related item or detail.

50 Design calculations must carry on the cover page the Licensed Professional's original signature, date of signature,
51 original seal, and registration number. The cover page must also include the Contract PW number, Contract title, and
52 sequential index to calculation page numbers.

53 A State of Washington Licensed Professional, licensed under Title 18 RCW, State of Washington, and qualified in the
54 applicable branch of engineering or a special profession may be retained to check, review and certify Shop Drawings and
55 calculations of an individual who is licensed in another state, provided the following conditions are satisfied:

- a. The Work being reviewed was legally prepared by an individual holding valid registration in another State in the applicable branch of engineering or a special profession.
- b. The Washington State Licensed Professional conducts independent calculations and reviews all technical matters contained within the subject Work, Drawings, Specifications, legal requirements, technical standards, and other related documents; and has verified that the design meets all applicable Specifications and is in agreement with the specific Project Site conditions and geometry.
- c. All submitted plan sheets must carry the Washington State Licensed Professional's original signature, date of signature, original seal, and registration number.
- d. The Washington State Licensed Professional's independent calculations must be submitted for review along with the Drawings. The independent calculations must carry on the cover page the Washington State Licensed Professional's original signature, date of signature, original seal, and registration number. The cover page must also include the following: the Contract PW number, Contract title, and sequential index to calculation page numbers.
- e. The Washington State Licensed Professional must keep a signed and sealed copy of the falsework, formwork plans, independent calculations, Specifications, and other related documentation that represents the extent of the review.

1-05.3(13) AS-BUILT RECORDS SUBMITTALS

Where Contractor provided as-built records are required in the Contract, the Contractor must keep at the Project Site Shop Drawings and other Drawings accurately detailing deviations from the original Drawings. As-built records must include all changes to the Work including, but not limited to: design changes, fabrications, assembly diagrams, and other as-built records as specified in the Contract and as required by the Engineer.

As-built records must be kept up-to-date as the Work requiring as-built records progresses and must be available for review by Engineer.

The Contractor must submit to the Engineer an as-built record set showing all as-built information required in the Contract within 10 Working Days of completion of that portion of the Work. These as-built records must be accurate, clean, clear, easily readable, and will become the official as-built record set for the applicable portion of the Work. All as-built records are required for Physical Completion.

1-05.3(14) CONTRACTOR'S FAILURE TO PROVIDE OR COMPLETE SUBMITTALS AND PROGRESS OF THE WORK

All submittals required of the Contractor must be provided by the Contractor. The Contractor acknowledges that its failure to timely provide or complete all submittals will place an extra and unnecessary burden on the Engineer in meeting other obligations and exposes the Owner to increased costs associated with delay in the completion of the Work. The Contractor agrees that failure to provide and complete all submittals is cause for the Engineer to withhold payment in the progress estimate for any and all Bid Items where the Contractor has failed to comply with the specified requirement to provide such submittal. No claim for delay or extension to Contract Time will be allowed for time lost due to Contractor's late submittal or to Contractor's resubmittal.

1-05.4 CONFORMITY WITH AND DEVIATIONS FROM DRAWINGS AND STAKES

Work performed must conform to the lines, grades, cross-sections, data, and dimensions indicated on the Drawings or staked by the Engineer. These stakes and marks will govern the Contractor's Work. The Contractor is solely responsible for detailed dimensions, elevations, and slopes measured from them.

Where specific tolerances are stated in the Contract, the Work must be performed within those stated limits. The Engineer will determine if the Work is in conformity with the lines, grades, cross-sections, and dimensions provided. The Engineer's decision on whether the Work is in conformity is final, as specified in Section 1-05.1.

Before undertaking each part of the Work, the Contractor must carefully study and compare the Contract to existing field conditions by checking and verifying pertinent figures shown in the Contract, and checking and verifying all applicable field measurements. The Contractor must promptly provide written notice to the Engineer of any conflict, error, discrepancy, or omission discovered.

The Contractor must not deviate from the requirements in the Contract except when authorized to do so, in writing, by the Engineer.

1-05.5 CONSTRUCTION STAKES

All Work constituting the practice of engineering or land surveying requires NAVD88 as the vertical datum, and NAD83 (1991) as the horizontal datum (see Standard Plan 001).

Before the Engineer will provide survey controls and offset points, the Contractor must first provide a Project Site that has been prepared for safe and orderly installation of such controls and points as determined by the Engineer.

The Engineer will furnish survey controls and offset points for Work areas at the Project Site as follows:

1. 2 intervisible horizontal control points for each continuous street between consecutive intersections, and no less than 2 points per 1320 linear feet measured along the centerline of street. T intersections branching off a street with no Work on that branching street will have 1 control point at the T intersection. T intersections branching off a street with Work on that branching street will have horizontal control points per the first sentence of this item 1.

2. Two vertical control points for each continuous street between intersections within the Project Site. A minimum of 2 points per 1320 feet will be provided.
3. Offset points to establish line and grade for the following City of Seattle owned utilities:
 - a. Water Main, hydrants, valve boxes and chambers;
 - b. Storm Drain, inlets, catch basins, Culverts, maintenance holes, and Sewer, not including side Sewer; and
 - c. SCL electrical conduit and vaults.

The Standard Specifications also address additional survey controls provided by the Engineer for specific constructions. See Section 2-09.3(2) and, unless the Contract specifies otherwise, where the Engineer may provide additional staking, Sections 2-04.1(1), 2-09.1, 2-10.3(6), 2-13.3(1)A, 4-04.3(5), 5-04.3(4)C1, 7-18.3(1)A, 8-11.3(3), 8-15.3(1), 8-15.3(5), 8-16.1, and 8-18.3(1).

The Contractor must use these Owner-furnished survey controls and offset points for all necessary calculation and survey for the Contractor to complete the Work, and assumes full responsibility for detailed dimensions, elevations, lines, grades, excavation slopes, and as may be required of the Work measured from these Engineer furnished survey controls and offset points.

Survey controls and offset points provided by the Engineer for the Contractor must be preserved and not be disturbed.

Should any discrepancy in survey controls or offset points provided by the Engineer be identified by the Contractor, then upon discovery, the Contractor must immediately notify the Engineer of such discrepancy including providing timely follow up with written notice. In the absence of such immediate notification and follow-up written notice, the Contractor is responsible and liable for any error in alignment or grade at no separate or additional cost to the Owner.

Any claim by the Contractor for extra payment or delay due to error in the Engineer provided survey controls and offset points is not allowed unless the original Engineer provided survey controls and offset points still exist undisturbed. For straight line and straight grade, the Contractor must provide at least 3 consecutive points to determine variation from a straight line or grade.

The Contractor's surveyor must be, or must work under the direct supervision of, a Land Surveyor licensed under Title 18 RCW in the State of Washington and regularly performing survey work in the State of Washington. The Contractor must keep updated survey field notes in a standard field book and in a format generally accepted in the Land Survey profession. These field notes must include all survey work performed by the Contractor's surveyor in establishing line, grade and slopes for the Work. Provide copies of these field notes upon request.

The Contractor must submit a legible and complete copy of all Contractor surveyor notes and calculations used in the Contractor's survey to the Engineer; these become the property of the Owner.

The Contractor must submit any request for Engineer provided surveying services at least 10 Working Days in advance of the need. The Engineer cannot guarantee that such request can be performed by the Engineer; however, should the Engineer determine he or she can perform such survey or portion thereof, then such additional survey by the Engineer and the Engineer's hourly dollar rates must be agreed to by the Contractor before such survey work starts. The Contractor agrees that all Engineer cost for providing such survey will be charged to the Contractor and deducted from each progress payment as it may come due, see Section 1-07.16(1) regarding responsibilities associated with monumentation.

If the survey work provided by the Contractor does not meet the standards of the Engineer, of WAC 196, or of RCW 18.43, the Contractor must remove the individual or individuals doing the Contractor's survey work upon the Engineer's written notice. Thereafter, the survey work may be completed by the Engineer by such means as the Engineer determines appropriate at the Contractor's sole expense, and all cost for completing the Contractor's survey work by the Engineer will be addressed as specified in Section 1-09.9(3).

All costs for survey work the Contractor is required to perform will be included in the Bid Item prices Bid for the Work.

1-05.6 INSPECTION OF WORK AND MATERIALS

Work performed and Materials furnished will be subject to inspection by the Engineer. The Contractor must provide the Engineer a minimum 1 Working Day advance notice when Work and Materials are ready for inspection, testing, review, approval, or retesting as applicable. The Contractor must provide such facilities as are deemed necessary by the Engineer for sufficient and safe access to the Work or to the Material. Such facilities must include but not be limited to, walkways, railings, ladders, platforms, support systems, safety harnesses, safety lines, and safety nets.

Upon request, the Contractor must furnish, without charge, samples of Materials used, or to be used in the Work, for inspection and testing, to ensure conformance with the Contract. If Materials are tested and approved for the Work, then used for purposes not connected with the Work, the cost of testing and inspection will be deducted from monthly progress estimates for payment to the Contractor. Materials used without inspection may be ordered removed and replaced, and the cost of the Material, including the work associated with the removal and replacement of the Material and any other Material and Work impacted by the removal and replacement, is at the Contractor's sole expense.

If the Contractor fails to furnish Material samples and/or test results as required in the Contract, the Engineer and/or testing agency designated by the Engineer, may sample and/or test the Material at the Contractor's sole expense to verify compliance of the Material with the Contract. Reimbursement for sampling and/or testing performed by the Engineer will be charged to the Contractor at a rate of \$85.00 per hour. Reimbursement for sampling and/or testing performed by a testing agency will be by invoice from the designated testing Laboratory, except for Laboratory retest and field revisit charges as

1 specified in Section 1-05.7. These charges will be deducted from moneys due or to become due the Contractor on monthly
2 progress estimates.

3 Inspections, tests, measurements and other actions taken by the Engineer are for the sole purpose of assisting the
4 Engineer to assess whether or not Work, Materials, rate of progress, and quantities comply with the Contract. These actions
5 by the Engineer do not relieve the Contractor from determining independently that full compliance with the Contract is met at
6 all times, or relieve the Contractor from any responsibility for the Work.

7 Upon request, the Contractor must remove or uncover any portions of completed Work for inspection by the Engineer.
8 After inspection, the Contractor must make restoration conforming to the standards required by the Contract. The costs
9 associated with uncovering, removing, testing, and retesting as applicable, and restoring exposed Work and Material, including
10 compensating the Engineer for any additional professional services required including retesting and as specified in Section 1-
11 05.7, is at the Contractor's sole expense, if:

- 12 1. The exposed Work or Material proves to be unacceptable; or
- 13 2. The exposed Work or Material was placed without authority or due notice to the Engineer.

14 If the exposed Work proves to be acceptable and the Contractor had performed the original Work with the authority of
15 and due notice to the Engineer, payment will be made as extra Work for all costs associated with the uncovering, removing,
16 and restoration and the Contract Time will be adjusted.

17 Where Work is required to be performed on any facility of a public agency, railroad, or utility, or to the satisfaction of any
18 federal, state, county, or municipal agency, their representatives must be permitted to inspect the Work when the Contractor is
19 advised by the Engineer to allow them to do so. The Contractor agrees that such inspection does not make such
20 representatives a party to the Contract, and does not constitute an interference with the rights of the Owner or the Contractor.

21 **1-05.7 DEFECTIVE WORK AND UNAUTHORIZED WORK**

22 The Engineer will not pay for unauthorized Work or defective Work. Work and Materials that do not conform to the
23 requirements of the Contract, Work done beyond lines and grades shown on the Drawings or established by the Engineer, or
24 extra Work and Materials furnished without written approval of the Engineer will be considered defective Work or unauthorized
25 Work as applicable. Such Work is at the Contractor's risk and sole expense and may be rejected, even if the Work has been
26 inspected, or a progress estimate is made for payment.

27 When directed by the Engineer, such Work or Material must immediately be remedied, removed, replaced, or disposed of
28 and all costs, including retesting costs as applicable, associated with such Work is at the Contractor's sole expense. Such
29 Laboratory retesting costs of replaced or reconstructed Work or Material will be charged to the Contractor per the following
30 schedule:

| Test Name | Specification Section | Unit | Cost of Unit Retest |
|---|-----------------------|------|---------------------|
| Field Soil Density Reading | Section 2-11 | Each | \$100.00 |
| Concrete Pavement Coring | Section 5-05 | Each | \$200.00 |
| Asphalt Pavement Coring | 5-04.3(9) | Each | \$200.00 |
| Soil/Aggregate Sieve Analysis | 9-03.13 | Each | \$150.00 |
| Moisture-Density Curve | Section 2-11 | Each | \$250.00 |
| L A Abrasion | 9-03.13, 9-03.15 | Each | \$150.00 |
| Soundness | 9-03.15 | Each | \$100.00 |
| Organic Content | 9-14.1(5) | Each | \$50.00 |
| Epoxy Pull Out Test | 6-02.3(24) | Each | \$250.00 |
| Asphalt Concrete Sieve Analysis | 5-04.3(7)A | | \$200.00 |
| Asphalt Concrete Binder Content | 5-04.3(7)A | | \$100.00 |
| Asphalt Concrete Air Void Analysis (VA) | 5-04.3(7)A | | \$200.00 |

32
33 Each field revisit by the Laboratory for the purpose of retesting previously identified unacceptable Work or Material will be
34 charged to the Contractor at the rate of \$100.00 each visit. For test methods not shown here, the rate for reimbursement will
35 be charged to the Contractor as the actual cost of the test incurred by the Owner.

36 These charges will be deducted from moneys due or to become due the Contractor on monthly progress estimates.

37 Failure on the part of the Engineer or an Assistant to reject defective Work or unauthorized Work does not release the
38 Contractor from the Contractor's contractual obligations, be construed to mean acceptance of such Work or Material by the
39 Owner or, after the Completion Date, bar the Owner from recovering damages or obtaining such other remedies as may be
40 permitted by law.

41 No adjustment in the Contract Time or payment will be allowed because of delays in the performance of the Work as a
42 result of correcting defective Work or unauthorized Work.

1-05.8 ENGINEER'S RIGHT TO CORRECT AND RECOVER COSTS FOR DEFECTIVE OR UNAUTHORIZED WORK

If the Contractor fails to remedy defective Work and/or unauthorized Work within the time specified in a written notice from the Engineer, or fails to perform any part of the Work required by the Contract, the Engineer may correct and remedy such Work, as may be identified in the written notice, by any means necessary, including the use of Owner forces.

If the Contractor fails to comply with a written notice to remedy what the Engineer determines to be an emergency situation due to defective or unauthorized Work or due to the Contractor failing to perform Work, the Engineer may have the defective Work and unauthorized Work, or both as may apply, corrected immediately, have the rejected Work removed and replaced, or have Work the Contractor fails to perform completed by using in house or other forces. An emergency situation is any situation that, in the opinion of the Engineer, a delay in its remedy could be potentially unsafe, or might cause serious risk of loss or damage to the public.

The Contractor must pay any direct or indirect costs incurred by the Engineer to correct or remedy the Contractor's defective or unauthorized Work, or any damage resulting from the Contractor's refusal or failure to perform any Work. This includes the cost to repair or replace work completed by others damaged due to correcting or removing the Contractor's defective or unauthorized work. Payment will be deducted by the Engineer from any payments due to the Contractor.

No adjustment in Contract Time, payment, or both will be allowed because of the delay in the performance of the Work attributable to Owner's exercise of the right provided by this Section. Exercise of this right does not diminish the Owner's right to pursue additional remedy or damages with respect to the Contractor's failure to perform the Work as required.

1-05.9 EQUIPMENT AND MACHINERY

Equipment and machinery must be adequate for the purposes used, kept in good working condition, and operated by competent operators. The Contractor is alerted that several Sections have additional specific equipment or machinery requirements. The Contractor is also alerted that several Sections have requirements for the Engineer to have safe and convenient access to facility and Contractor equipment for observation and sampling purposes, and may also require a safe and convenient temporary area for on-site testing purposes, see Sections 1-09.1, 1-09.2, 5-04.3(1), 5-05.3(3), and 6-02.3(4).

Upon request, the Contractor must provide, at no additional cost to the Owner, an operating and maintenance manual for each model or type of mixing, placing, or processing equipment before using it in the Work. The Contractor must also provide test instruments to confirm whether the equipment meets operating requirements, such as vibration rate, revolutions per minute, or any other requirements.

The Contract may require automatically controlled equipment for some operations. If the automatic controls on such equipment fail, the Contractor may operate the equipment manually for the remainder of that Working Day, provided the method of operation produces results otherwise meeting the Specifications. Continued operation of the equipment manually beyond this Working Day will be permitted only by specific authorization of the Engineer.

The Engineer will reject equipment that repeatedly breaks down or fails to produce results within the required tolerances. The Contractor must promptly replace rejected equipment. Rejection and replacement of equipment does not provide the Contractor a right to additional payment or time.

1-05.10 GUARANTEES AND WARRANTIES

The obligations under this Section must survive the Completion Date or termination of this Contract.

1-05.10(1) GENERAL GUARANTY AND WARRANTY

The Contractor must furnish to the Engineer any guaranty or warranty furnished as a normal trade practice in connection with the purchase, by the Contractor or a Subcontractor, of any equipment, Materials, or items incorporated in the Work.

Upon written notice, the Contractor must promptly return and correct, if within 1 year after the Physical Completion Date, defective or unauthorized Work at no additional cost to the Owner. If the Contractor does not promptly comply with the written notice to correct defective and unauthorized Work as may apply, or if an emergency exists, the Engineer may have defective Work and unauthorized Work corrected or removed and replaced as provided by Section 1-05.8.

The Contractor agrees the above 1 year limitation does not exclude or diminish the Owner's rights under any law to obtain damages and recover costs resulting from defective Work and from unauthorized Work discovered after 1 year but before the expiration of the legal time period set forth in RCW 4.16.040 limiting actions on a Contract in writing, or liability expressed or implied arising out of a written agreement.

1-05.10(2) WARRANTY OF TITLE

The Contractor must warrant good title to all Materials, Supplies, and equipment purchased for, or incorporated in, the Work. Nothing contained in this paragraph, however, defeats or impairs the right of persons furnishing Materials or labor, to recover under any bond provided by the Contractor for their protection, or any rights under any law permitting such persons to look to funds due the Contractor in the hands of the Owner.

The provisions of this paragraph must be inserted in all subcontracts and Material Contracts, and notice of its provisions must be provided to all persons furnishing Materials for the Work when no formal Contract is entered into for such Materials.

1-05.11 FINAL INSPECTION**1-05.11(1) SUBSTANTIAL COMPLETION DATE**

When the Contractor considers the Work to be substantially complete, notify the Engineer and request the Engineer establish the Substantial Completion Date. To be considered substantially complete the following conditions must be met:

1. The Owner must have full and unrestricted use and benefit of the facilities, both from an operational and safety standpoint.
2. Only minor incidental Work, replacement of temporary substitute facilities, or corrective or repair Work remains to reach physical completion of the Work.
3. Operation and Maintenance information, when specified in the Contract in Section 1-05.3 and 1-05.11(3) as required to allow the Owner to have full unrestricted use.

The Contractor's request must list the specific items of Work in Section 1-05.11(1) item 2. that remain to be completed to reach physical completion. The Engineer will schedule an inspection of the Work with the Contractor to determine the status of completion.

If, after inspection, the Engineer concurs with the Contractor that the Work is substantially complete, the Engineer will, by written notice to the Contractor, establish the Substantial Completion Date. The Contractor must then prepare for final inspection and Physical Completion as specified in Section 1-05.11(2).

If, after this inspection, the Engineer does not consider the Work substantially complete, the Engineer will, by written notice, notify the Contractor giving the reasons.

The Contractor must provide the Engineer with a revised critical path schedule indicating when the Contractor expects to reach Substantial and then Physical Completion of the Work.

The above process must be repeated until the Engineer establishes the Substantial Completion Date.

The Engineer may also establish the Substantial Completion Date unilaterally.

1-05.11(2) FINAL INSPECTION AND PHYSICAL COMPLETION DATE

The Engineer will not make the final inspection until the physical Work required of the Contract has been completed. This Work must include: final cleanup as specified in Sections 1-04.10 and 1-07.24; providing the Engineer with all required submittals as specified in Section 1-05.3; completing operational testing; and all extra Work ordered by the Engineer. If the Engineer believes a written release from a private property owner, as specified in Sections 1-04.10 and 1-07.24, is being arbitrarily withheld, the Engineer may at his or her sole discretion accept that portion of the Work involved.

When the Contractor considers the Work physically complete and ready for final inspection, request in writing that the Engineer schedule a final inspection. Within 5 Days, the Engineer will set a date for final inspection. The Engineer and the Contractor will then make a final inspection, and the Engineer will notify the Contractor in writing of all particulars in which the final inspection reveals the Work incomplete or unacceptable. The Contractor must immediately take such corrective measures as are necessary to remedy the listed deficiencies. Corrective Work must be pursued vigorously, diligently, and without interruption until physical completion of the listed deficiencies.

If action to correct the listed deficiencies is not initiated within 7 Days after receipt of the written notice listing the deficiencies, the Engineer may, upon written notice to the Contractor, take whatever steps are necessary to correct those deficiencies. Such steps may include the correction of defects using in house forces or by others. In such case, the direct and indirect costs incurred by the Engineer will be deducted from moneys due or becoming due the Contractor. Such indirect or direct costs must include payment for additional professional services required in cost of repair and replacement of the Work of others which is destroyed or damaged by correction, removal, or replacement of the Contractor's deficient Work. The Contractor will not be allowed an extension of Contract Time because of a delay in the performance of the Work attributable to the exercise of the Engineer's right hereunder.

Upon correction of all deficiencies, the Engineer will notify the Contractor and the Owner, in writing, of the date on which the Work was determined physically complete. That date constitutes the Physical Completion Date of the Contract, but does not imply all obligations of the Contractor under the Contract have been fulfilled.

1-05.11(3) OPERATIONAL TESTING, AND OPERATION AND MAINTENANCE (O&M) MANUALS

It is the intent of the Owner to have, at the Substantial Completion Date, a complete draft and operable system with all information necessary to operate and maintain the system. Therefore, when the Work involves the installation of machinery or other mechanical equipment; street lighting; electrical distribution and transmission systems; signal systems; irrigation systems, buildings; or other similar Work, it may be desirable for the Engineer to have the Contractor operate and test the Work for a period of time after Substantial Completion but before the final inspection. Whenever items of Work are listed in the Project Manual for operational testing, they must be fully tested under operating conditions for the time period specified to ensure their acceptability before the Substantial Completion Date. During and following the test period, the Contractor must correct any items of workmanship, Materials, or equipment that proves faulty, or are not in first class operating condition. Equipment, electrical controls, meters, or other devices and equipment to be tested during this period must be tested under the observation of the Engineer, so that the Engineer may determine their suitability for the purpose for which they were installed. The Physical Completion Date cannot be established until testing and corrections have been completed to the satisfaction of the Engineer.

1 Before operational testing or as acceptable to the Engineer, the Contractor must submit 3 sets of O&M manuals for the
2 item being tested. During operational testing, the Contractor must accommodate the Engineer in understanding and applying
3 O&M manual instruction and recommendation. Should inconsistencies between the O&M manual and actual operation or
4 actual maintenance be discovered, the Contractor must provide 3 sets of Supplier provided amendments addressing all
5 correction.

6 Each O&M manual must include the following:

- 7 1. A title indicating its contents permanently labeled on the outside of the binder.
- 8 2. A cover sheet identifying equipment with the process or assembly with which it is used, according to:
 - 9 a. Location
 - 10 b. Section number and title
 - 11 c. Engineer’s Drawing (sheet) number
- 12 3. A table of contents.
- 13 4. A text as prepared by the manufacturer and including the following information or materials, as applicable:
 - 14 a. Equipment operating instructions including start-up and shut-down procedures, safety precautions, and
 - 15 instructions on specific controls;
 - 16 b. Electrical test reports, including electrical system and motor test reports;
 - 17 c. Mechanical test reports, including factory running tests and performance rating tests for motorized equipment;
 - 18 d. Shop Drawings;
 - 19 e. Assembly Drawings;
 - 20 f. Parts list;
 - 21 g. Bill of Materials;
 - 22 h. Wiring diagrams;
 - 23 i. Maintenance instructions to cover any routine operation required to insure the satisfactory performance and
 - 24 longevity of the equipment, such as lubrication instructions, lists of lubricants, and belt tensioning;
 - 25 j. Maintenance summary forms; and
 - 26 k. Manufacturer’s warranty.

27 Manuals must be bound in 3-ring or spiral binders with plastic or other stain resistant covering. Manuals must be 8-1/2 x
28 11 inches in size except for oversize Drawings, which must be bound in fold out fashion or folded and placed inside a bound in
29 envelope. Multiple thinner binders are preferred to extra-large and bulky binders where subdivisions of the contents permit.
30 Equipment operating instructions and test reports must be bound in front of maintenance instructions and other materials.

31 Unless the Contract specifies otherwise, the costs for power, fuel, labor, Material, Supplies, and everything else needed
32 to complete operational testing, must be included in the various Bid Item prices related to the system being tested, unless
33 specifically set forth otherwise in the Bid Form.

34 Operational and test periods, when required by the Engineer, do not affect a manufacturer’s guaranties or warranties
35 furnished under the terms of the Contract.

36 **1-05.12 COMPLETION AND CONTRACT CLOSE OUT**

37 After the Physical Completion Date is established and after all obligations of the Contract, except retainage release have
38 been completed, the Engineer will submit an acceptance package and supporting documents to CPCS as specified in Section
39 1-09.9(4)A.

40 On behalf of the City, CPCS will establish the Contract Completion Date, submit the Notification of Completion to the
41 State agencies, and publish notice of the Completion Date as specified in Section 1-09.9(4)B.

42 After all legal requirements are met, retainage will be released according to the priority and process under RCW 60.28
43 and as specified in Section 1-09.9(4)C.

44 **1-05.13 SUPERINTENDENTS, LABOR, AND EQUIPMENT**

45 **1-05.13(1) GENERAL**

46 The Contractor must keep a copy of the Contract at the Project Site, give the Work the attention required to maintain
47 scheduled progress, and cooperate with the Engineer in the administration of the Work.

48 The Contractor must be present, in person, or be continuously represented by a duly authorized representative at the
49 Project Site during progress of the Work. The Contractor must assign a project manager or superintendent named in the
50 SBRC or in writing before starting the Work, who is experienced, capable of understanding the Contract, and able to supervise
51 the performance of the Work. The superintendent or project manager must comply with the SBRC specified in Section 1-02.2.
52 The Contractor’s superintendent or project manager must have full authority to represent and act for the Contractor. Written
53 notice provided to the project manager or superintendent is as binding as if provided to the Contractor.

54 The Work must be performed under the continuous supervision of competent personnel experienced in performing the
55 class of Work. Upon written direction of the Engineer, the Contractor must discharge any incompetent, careless, or negligent

1 employees, including supervisors. Upon written direction of the Engineer, the Contractor must immediately remove from the
 2 Project Site any superintendent who repeatedly fails to comply with a written order, direction, instruction, or determination from
 3 the Engineer. The Contractor must then request the assignment of a new superintendent, in writing to the Engineer. Failure to
 4 comply with such direction is sufficient grounds for termination of the Contract.

5 Machinery and equipment must comply with Section 1-05.9.

6 **1-05.13(2) PERFORMANCE**

7 The full 360 Review Form is located in the Appendix of the Project Manual.

8 A 360 Review process and form is required for all projects with an engineer's estimate of \$1,000,000 or more. This form
 9 and process will be used by the City for other projects if the City has determined that it may prove beneficial to the City and
 10 Contractor.

11 The 360 Review is intended to:

- 12 1. Evaluate Contractor performance.
- 13 2. Support collaborative communications on City construction projects.
- 14 3. Share information at preconstruction, project midpoint, and project physical completion to team and facilitate a quality
 15 construction experience for both the Owner and the Contractor.
- 16 4. Document corrective actions and lessons learned on projects.

17 At the final 360 Review meeting the Form will be filled out with an overall rating of both the Contractor and the City
 18 processes. An overall Contractor rating of 2 or below may be grounds for a determination of non-responsibility. Three overall
 19 ratings of 2 or below may be considered grounds for debarment under Section 1-08.10(8).

20 **1-05.13(3) CONSTRUCTION STORMWATER POLLUTION PREVENTION COORDINATION**

21 The Contractor must assign a Construction Stormwater and Pollution Prevention Coordinator (CSPPC) to the Work and
 22 must identify the CSPPC at the preconstruction conference. CSPPC responsibilities must be formally assigned to one or more
 23 of the Contractor's supervisors who are actively involved in the planning and management of field Contract activities.
 24 Alternates may be identified. The CSPPC is responsible for ensuring the Contractor's compliance with all City of Seattle, other
 25 local jurisdictions, county, state, and federal, construction stormwater pollution prevention requirements and must be available
 26 on call 24 hours per Day through the duration of the Work. The CSPPC must be listed on the emergency contact list as
 27 specified in Section 1-05.13(4).

28 The CSPPC has overall responsibility for compliance and coordination of the following plans and submittals for the
 29 project as specified in Section 8-01, and any other pollution prevention elements on the project:

- 30 1. CSECP
- 31 2. TVSPP
- 32 3. SP
- 33 4. TDP
- 34 5. Temporary dewatering plan

35 Identify a lead for each plan listed above. The identified leads are responsible for compliance with the requirements
 36 specified below. The CSPPC may be the lead on any or all elements. If the Contractor identifies multiple leads, they must
 37 clearly identify the responsibilities of each.

38 **1-05.13(3)A CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL)**

39 The Contractor must assign a Certified Erosion and Sediment Control Lead (CESCL) to the Work and identify the
 40 responsible party at the preconstruction conference. The CESCL must be listed on the emergency contact list specified in
 41 Section 1-05.13(4).

42 The CESCL must have authority to act on behalf of the Contractor and must be available, on call, 24 hours per Day
 43 throughout the period of construction. The CESCL is responsible for ensuring the Contractor's compliance with all City of
 44 Seattle, other local jurisdictions, county, state, and federal erosion and sediment control and water quality requirements.

45 The CESCL must have, for the life of the Contract, a current certificate of training in Construction Site Erosion and
 46 Sediment Control from a course approved by the Washington State Department of Ecology or CPESC certification.

47 The Washington State Department of Ecology maintains a list of CPESC training and certification providers at:

48 <http://www.ecy.wa.gov/programs/wq/stormwater>

49 For additional information on the CPESC certification, go to: <http://www.ecy.wa.gov/programs/wq/stormwater/cescl.html>

50 **1-05.13(3)B TREE, VEGETATION AND SOIL PROTECTION LEAD**

51 The Contractor must assign a Tree, Vegetation and Soil Protection lead (TVSPL) to the Work and must identify the
 52 responsible party at the preconstruction conference. This individual must be listed on the emergency contact list specified in
 53 Section 1-05.13(4).

54 The TVSPL must be given the authority and must be responsible for ensuring compliance with Tree, Vegetation and Soil
 55 Protection, as specified in Sections 1-07.16 and Section 8-01.

1 **1-05.13(3)C SPILL PREVENTION AND RESPONSE LEAD**

2 The Contractor must assign a Spill Prevention and Response lead (SPRL) to the Work and must identify the responsible
3 party at the preconstruction conference. This individual must be listed on the emergency contact list as specified in Section 1-
4 05.13(4).

5 The SPRL must be given the authority and is responsible for ensuring compliance with Sections 1-07.15(1) and Section
6 8-01.

7 **1-05.13(3)D TEMPORARY DISCHARGE LEAD**

8 The Contractor must assign a Temporary Discharge lead, when temporary discharge of process water, groundwater, or
9 concentrated and collected stormwater is a component of the Work. The lead must be identified at the preconstruction
10 conference and must be listed on the emergency contact list as specified in Section 1-05.13(4).

11 The Temporary Discharge lead is responsible for ensuring compliance with applicable permits, requesting permits, and
12 complying with Sections 1-07.6 and Section 8-01, preparing and updating the Temporary Discharge Plan, measuring flow,
13 performing and coordinating water quality testing, preparing reports and record keeping as required by permits.

14 **1-05.13(3)E TEMPORARY DEWATERING LEAD**

15 The Contractor must assign a Temporary Dewatering lead, when dewatering is a component of the Work. The lead must
16 be identified at the preconstruction conference. The lead must be listed on the emergency contact list as specified in Section
17 1-05.13(4).

18 The Temporary Dewatering lead is responsible for dewatering as specified in Section 2-08.

19 **1-05.13(4) EMERGENCY CONTACT LIST**

20 The Contractor must submit an emergency contact list to the Engineer no later than 5 Calendar Days after the date the
21 Contract is executed. The list must include, at a minimum, the Contractor's Project Manager, or equivalent, the Contractor's
22 Project Superintendent, the Traffic Control Supervisor, and the individuals fulfilling the lead requirements as specified in
23 Section 1-05.13(3). The list must identify a representative with delegated authority to act as the emergency contact on behalf
24 of the Contractor and include 1 or more alternates. The emergency contact must be available upon the Engineer's request
25 except during normal working hours. The emergency contact list must include 24-hour telephone numbers for all individuals
26 identified as emergency contacts or alternates.

27 **1-05.14 COOPERATION WITH OTHER CONTRACTORS**

28 The Owner may perform other work at or near the Project Site, including Material sites, with forces other than those of
29 the Contractor. This work may be done with or without a Contract. Should such Work be underway or subsequently
30 undertaken within or adjacent to this project, the Contractor must cooperate with all other Contractors or other forces, and
31 conduct the Work so that the operations of both suffer the least interference and delay. Should there be disagreement
32 between the Contractors, or the Contractor and the Engineer, as to the manner and order of performing Work, such
33 disagreement will be resolved by the Engineer. The Engineer's decision in these matters is final, as provided in Section 1-05.1.

34 If the Contract provides notice of other work that may affect the Work, or other work is apparent from the Project Site
35 investigation specified in Section 1-02.4, the Contractor must account for coordinating the Work, and any resulting cost must
36 be included in the various Contract Bid Items that make up the Work.

37 **1-05.15 METHODS OF SERVING NOTICES**

38 All notices must be in writing and are considered delivered and service complete when:

- 39 1. Delivered by certified or registered mail to the other party at their last provided address;
- 40 2. Delivered in person to the other party; or
- 41 3. Delivered to an authorized representative of the other party at the Project Site.

42 **1-05.16 WATER AND POWER**

43 The Contractor must make necessary arrangements, and must bear the costs, for power and water necessary for the
44 performance of the Work. See the exception for water in Section 2-12.

45 **1-05.17 ORAL AGREEMENTS**

46 No oral agreement or conversation with any officer, agent, or employee of the Owner, either before or after Execution of
47 the Contract, affects or modify any of the terms or obligations contained in the Contract. Such oral agreement or conversation
48 is considered as unofficial information and in no way binding on the Owner, unless put in writing.

49 **SECTION 1-06 CONTROL OF MATERIALS**

50 **1-06.1 APPROVAL OF MATERIALS BEFORE USE**

51 The City encourages the use of environmentally friendly Materials and recycled material when applicable.

1 Before use, the Contractor must notify the Engineer of all proposed Materials. The Contractor must use the Request for
2 Acceptance of Material Sources (RAMS) form to identify the source for all Materials proposed for use on the project.

3 All equipment, Materials, and articles incorporated into the permanent Work:

- 4 1. Must be new, unless the Contract allows otherwise;
- 5 2. Must comply with the requirements of the Contract and be accepted by the Engineer as specified in Section 1-05.3;
- 6 3. May be inspected or tested at any time during their preparation and use;
- 7 4. Must not be used in the Work if they become unfit after being previously approved; and
- 8 5. Must be verifiable by shipping invoice, certification, load tickets, or other means acceptable to the Engineer.

9 **1-06.1(1) NAMED PRODUCTS**

10 Specified products are occasionally called for by manufacturer or name in the Contract to establish a basis for certain
11 Materials, equipment, or processes. Wherever products are specified by name, the Specification will be treated as if the
12 phrase "or equal" appears after the named product whether "or equal" is indicated or not, unless indicated as without
13 substitution per Section 1-06.1(3). The phrase "or equal" does not imply the availability of such "or equal" products. The terms
14 "or equal" and "or approved equal" are considered synonymous.

15 When a product is mentioned by name, it includes products that will measure up to the designated standards of the
16 named product mentioned as an equal. The Contractor is responsible for demonstrating that the proposed product is equal.
17 The proposed equal product must comply with the essential requirements of the Contract and items 2. to 5., as specified in
18 Section 1-06.1(2). The Engineer's review of the proposed product for as equal status will be final.

19 **1-06.1(2) REQUEST FOR SUBSTITUTION OF MATERIAL**

20 If the Contractor prefers to substitute a different Material than what has been specified, the Contractor must obtain the
21 written approval of the Engineer before incorporating the substitute product into the Work. In making a request for substitution
22 of Materials, the Contractor's submittal must demonstrate the substitution meets the essential requirements of the Contract
23 and:

- 24 1. Is equal and shows a cost savings to the Owner, or superior without a cost increase to the Owner;
- 25 2. Is equal or superior in all respects to the Material, equipment, or process specified;
- 26 3. Is of equal or superior value in the essential and material requirements;
- 27 4. Is equal or superior in functionality and at a minimum qualitatively equal or identical; and
- 28 5. Has the same or better guarantee or warranty as the item specified.

29 The Engineer may deny requests for substitution if the substitution is not in the best interest of the Owner, or if time or
30 resources are not available for review. The Engineer's decision will be final. The Contractor must Bid according to the Material
31 specified in the Contract. See Section 1-05.3 for submittal requirements.

32 The Contractor will not be granted any time extension for review of substitution proposals. The Contractor is responsible
33 for the performance of substituted Materials. The Engineer may revoke the use of substituted Materials at any time. No time or
34 cost will be granted related to the substitutions.

35 **1-06.1(3) MATERIALS WITHOUT SUBSTITUTION**

36 If a Material, product, equipment, or processes is specified "without substitution" or "no substitution," there will be no
37 consideration of substitution.

38 **1-06.2 SAMPLES AND TESTS FOR ACCEPTANCE OF MATERIALS**

39 The Contractor must deliver representative samples, from the Contractor, producer, manufacturer, or fabricator, to the
40 Engineer without charge before incorporating Material into the Work. Samples, not already provided for testing as specified in
41 Section 1-03.1(4) item 8.a, must be provided in sufficient time and quantities to allow testing by the Engineer before use. The
42 Engineer may require samples be submitted at any time. The Contractor, including Subcontractor at any tier, must allow the
43 Engineer full and unrestricted access to its facilities for inspection, observation, sampling and testing purposes. Samples not
44 taken by or in the presence of the Engineer's representative will not be accepted for test, unless so permitted by the Engineer.

45 Material testing must comply with any specified methods of testing set forth in the Contract, the Washington State
46 Department of Transportation Materials Manual, or applicable designated, recognized standards of national organizations. See
47 Section 1-01.2(1) for the standard acronyms of designated recognized standards organizations used throughout the Contract.
48 This will apply to field tests, as well as to Laboratory tests. The designated, recognized standard in effect on the Day of the
49 Advertisement for Bids for the Work will apply in each case unless the Contract references a standard with a specific
50 publication date differing from the current edition.

51 **1-06.3 MANUFACTURER'S CERTIFICATE OF COMPLIANCE**

52 The Engineer may accept certain Materials based on a manufacturer's certificate of compliance as an alternative to
53 Material inspection and testing when these Materials are specifically identified in the Contract. Unless the Contractor requests
54 and obtains written authority from the Engineer for an exception to do otherwise, the manufacturer's certificate of compliance
55 must be submitted before use of the Material. No payment will be made for Work incorporating Material without an acceptable

1 manufacturer's certificate of compliance. If, for any reason, the Contractor has not provided an acceptable manufacturer's
2 certificate of compliance for the Materials specified in the Contract by the Completion Date, the Engineer may process the final
3 payment as provided by Section 1-09.9 without paying for the Work performed on such a basis.

4 Where Materials are specified to conform to industry or technical society reference standards of designated recognized
5 standards organizations, such as ASTM or AASHTO or ACI or AWWA, the manufacturer's certificate of compliance must
6 indicate such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. Instead
7 of the label or listing, the manufacturer's certificate of compliance must contain a statement from a testing laboratory stating
8 that the Material or Material property specified has been tested per the specified organization's test methods and that the item
9 complies with specified organization's reference standard, or that the Material property complies with the specified property of
10 the specified organization's reference test standard, see Section 1-06.5.

11 The manufacturer's certificate of compliance must identify the manufacturer, the type, and quantity of Material being
12 certified, and compliance with the applicable standards. Where Specifications require additional information be provided, the
13 Contractor must provide the additional information. Include the signature of a responsible corporate official of the manufacturer
14 and supporting mill tests or documents. A manufacturer's certificate of compliance must be furnished with each lot of Material
15 delivered to the Work unless the Contract specifies otherwise. The certified lot must be clearly identified in the manufacturer's
16 certificate of compliance.

17 All Material used based on a manufacturer's certificate of compliance may be sampled and tested at any time. Any
18 Material not conforming to Contract requirements will be subject to rejection whether in place or not. The Engineer may refuse
19 to accept Material based on its manufacturer's certificate of compliance.

20 **1-06.4 HANDLING AND STORAGE OF MATERIALS**

21 Materials used in the Work must be handled and stored using methods that prevent damage, exposure to elements,
22 mixing with foreign materials, or deterioration from any other cause. The Engineer will not accept or sample for testing,
23 Materials that are improperly handled or stored.

24 The Contractor must repair, replace, or make good all Owner provided Materials that are damaged or lost due to the
25 Contractor's operation or while in the Contractor's possession, at no additional cost to the Owner.

26 **1-06.5 REQUIREMENTS FOR TESTING AND TEST RESULTS FROM PRIVATE LABORATORIES AND**
27 **INDIVIDUALS**

28 When testing is required by a private laboratory or individual, whether by Specification or by condition of Street Use
29 Permit, that laboratory or individual must be accredited or certified by an AASHTO or ASTM or A2LA (American Association
30 for Laboratory Accreditation) or other designated recognized standards organization with recognized accreditation authority or
31 certification authority. Such accreditation or certification must be current during such testing or for the life of the Contract,
32 whichever is greater.

33 Every test must be performed with testing equipment calibrated as recommended by the equipment manufacturer, and at
34 the calibration frequency recommended either by the test equipment manufacturer or the applicable test standard, whichever
35 is most frequent.

36 Personnel performing tests must be qualified by certification from a designated recognized standards testing organization
37 to perform the required test.

38 Sample preparation, installation of sample in test equipment or equipment installation in sample or inspection or as may
39 apply, equipment operation, test data acquisition, test data reduction, and test data summary must be performed per the
40 specified test standard unless required otherwise in the Contract.

41 Unless the Contract specifies otherwise, results of testing must be reviewed, approved, and stamped by a Professional
42 Engineer with current license under RCW 18.43, or by other certifying individual, who is qualified to review and approve such
43 results or perform such testing. The testing must be performed to the satisfaction of the Engineer, per the designated
44 recognized standards organization's test.

45 The Contractor and the testing laboratory must allow the Engineer to visit the laboratory to observe the Work for the
46 purposes of reviewing and observing the laboratory's quality system, the testing, the technician, the sample preparation,
47 accreditation, personnel certifications and qualifications, test data administration, and as may be required by the Engineer or
48 by the Contract.

49 All test results submitted to the Engineer by private testing laboratory must be accompanied with the following
50 information:

- 51 1. A manufacturer's certificate of compliance by Professional Engineer or certified individual as may apply, listing the
52 test standard used and that the testing was in compliance with the Contract.
- 53 2. The name of the testing laboratory including the accrediting agency, date of accreditation, principal in charge of
54 testing, name of personnel doing testing if different including qualifications, address, phone number, and e-mail
55 address.
- 56 3. The results of the test presented in the format required by the designated recognized test standard unless the
57 Contract specifies otherwise.
- 58 4. Where and how the sample was obtained, any care provided to the sample, and any care provided in preparing the
59 sample not specified in the test standard, any deviations from the testing standard used in testing.

5. Any other information required by the Contract.

1-06.6 SIEVES FOR TESTING

Sieves for testing must be as specified in Section 9-03.13

SECTION 1-07 LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC

1-07.1 LAWS TO BE OBSERVED

1-07.1(1) GENERAL

The Contractor is responsible for knowing and complying with all federal, state, tribal, county, and city laws, ordinances, and regulations that are applicable to the Work. All references to laws, ordinances, and regulations include all laws, ordinances, or regulations as adopted or amended after the Contract Date, to the extent that the same are later modified and retroactively applicable.

Without usurping the authority of other agencies, the Engineer will cooperate with them in their efforts to enforce legal requirements. Upon awareness of any violation of a legal requirement, the Engineer will notify the Contractor in an effort to achieve compliance. The Engineer may also notify the agency responsible for enforcement if the Engineer determines that action is necessary to achieve compliance with legal requirements. The Engineer may also assist the enforcement agency with Contractor compliance to the extent such assistance is consistent with the provisions of the Contract.

For payment related to law or taxes occurring after the Bid Opening Date, see Section 1-09.4(2).

1-07.1(2) SAFETY RULES AND STANDARDS

The Contractor is solely responsible for:

1. The safety, efficiency, and adequacy of the Contractor's facilities, equipment, Materials and methods;
2. Any damage or injury resulting from the failure, or improper maintenance, use, or operation of the Contractor's facilities, equipment, and methods; and
3. Conditions of the Project Site, including safety of all persons and property during performance of the Work.

These requirements apply continuously and are not limited to normal working hours. The Engineer's review of the Contractor's performance does not include review or a determination of the adequacy of the Contractor's safety measures in, on, or near the Project Site.

The Contractor must establish, maintain, and supervise a safe and healthy working environment, an accident prevention program, and training programs to improve the skill and competency of all employees with respect to occupational safety and health.

The Washington State Department of Labor and Industries (L&I) is the sole and paramount administrative agency responsible for the administration of the provisions of the Washington Industrial Safety and Health Act of 1973 (WISHA), as amended.

The Contractor must comply with the Federal Occupational Safety and Health Act of 1970 (OSHA), including all revisions and amendments thereto; the provisions of WISHA, as amended; and as a minimum, the requirements of Title 296 WAC, L&I.

In addition, the Contractor must comply with the requirements of the National Electric Safety Code, when applicable.

In cases of conflict between different safety regulations, the regulation containing the more rigorous safety standard applies.

The Contractor must maintain at the Project Site office or other well-known and readily accessible place at the Project Site, all articles necessary for providing first aid to the injured. The Contractor must establish, publish, and make known to all employees a Health and Safety Plan including procedures for ensuring that employees who may be injured on the Project Site are immediately removed to a hospital or doctor's care. Employees are not permitted to work on the Project Site before the Contractor has established and made known procedures for removal of injured persons to a hospital or a doctor's care.

1-07.1(3) NON-SKID SURFACE

Where specified in the Contract, a new non-skid, or slip resistant, surface must have the following minimum static coefficient of friction per ASTM test method C 1028-96 on a dry surface:

1. .80 on ADA curb ramps
2. .60 on any other ADA accessible route
3. .50 all other non-skid surfaces

1-07.2 STATE TAXES

1-07.2(1) GENERAL

The Washington State Department of Revenue has issued special rules designed to assist the Contractor in accurately reporting to the Department of Revenue the Contractor's tax liability. Although information may be included in the Contract regarding the application of State taxes to a particular Contract, Bid Item or included on the Bid Form, the Contractor is responsible for applying the correct interpretation of the laws and regulations relating to such taxes.

1 No adjustments will be made to the amount to be paid by the Owner under the Contract because of any
 2 misunderstanding by the Contractor as to the Contractor's liability for, or the amount of, any taxes. If in doubt as to the tax
 3 procedures in any particular case, the Contractor must consult with the Washington State Department of Revenue.

4 **1-07.2(2) STATE SALES TAX RULE 171**

5 WAC 458-20-171 and its related rules apply to building, repairing, or improving streets and roads, that are owned by a
 6 municipal corporation, or political subdivision of the State, or by the United States, and that are used, primarily, for foot or
 7 vehicular traffic. For Work performed in such cases, labor and service charges are not subject to the retail sales tax and no
 8 such tax on labor and service charges must be included in Bid prices and other Contract amounts. The Contractor is
 9 responsible for paying retail sales tax on Materials, equipment, and Supplies used or consumed in doing the Work or used in
 10 such projects, and must pay retail sales tax on the purchase of such Materials. The Contractor must include such retail sales
 11 taxes on Materials, equipment, and Supplies in the various Bid Item prices and other Contract amounts.

12 **1-07.2(3) STATE SALES TAX RULE 170**

13 WAC 458-20-170, and its related rules, applies to the constructing and repairing of new or existing buildings, or other
 14 structures, on Real Property. For Work performed in such cases, the Contractor must collect from the Owner retail sales tax on
 15 the full Contract price. The Owner will automatically add this sales tax to each payment to the Contractor. For this reason, the
 16 Contractor must not include the retail sales tax in the Bid Item prices, or in any other Contract amount subject to Rule 170,
 17 except as provided below.

18 The Owner will not add in sales tax for a payment the Contractor or a Subcontractor makes on the purchase or rental of
 19 tools, machinery, equipment, or consumable Supplies not integrated into the project. Such sales tax must be included in the
 20 Bid Item prices or in any other Contract amount.

21 **1-07.2(4) SERVICES**

22 The Contractor must not collect retail sales tax from the Owner on any Contract wholly for professional or other services
 23 as defined in State Department of Revenue Rules 138 and 224.

24 **1-07.3 MANAGEMENT AND DISPOSAL OF WASTE**

25 **1-07.3(1) GENERAL**

26 All waste generated or encountered under this Contract must be managed per all applicable local, state and federal
 27 regulations and law. Unless otherwise specified in the Contract, the Contractor is responsible for arranging and implementing
 28 the proper handling, management, segregation, storage, transport, and disposal of all wastes that are not Dangerous
 29 Waste(s), including processing and maintaining required documentation. This includes, but is not limited to:

- 30 1. Identifying, proposing, and contracting with disposal sites that can legally accept the types of identified or
 31 characterized wastes in performing the Work;
- 32 2. Identifying, proposing, and contracting with waste transporters qualified and licensed to transport these types of
 33 identified or characterized wastes;
- 34 3. Obtaining waste clearances or other waste acceptance approvals through Public Health - Seattle & King County
 35 (PHSKC) or other agencies as appropriate and as required;
- 36 4. Creating and processing all necessary documentation, such as Certificates of Disposal or Recycling, sampling and
 37 analysis reports, waste clearance forms, waste acceptance forms, bills of lading, scale tickets, waste receipts, and
 38 others as applicable;
- 39 5. Providing the Engineer timely notice for reviewing documentation before transporting, see Section 1-05.3; and
- 40 6. Providing the Engineer copies of all documentation pertaining to waste generation, recycling and disposal.

41 Contract-related documents may identify Contaminated Material(s) or Dangerous Waste(s) that the Owner has
 42 documented on the Project Site. For all Contaminated Material(s) and Dangerous Waste(s) generated or encountered in
 43 connection with the Contract or Project Site, the Contractor must comply with Section 1-07.29.

44 The Waste Clearance Program Instructions and forms for PHSKC may be provided in the Appendix of the Project
 45 Manual or requested from the Engineer. This information is provided for the convenience of the Contractor and the Contractor
 46 is solely responsible for verifying that the information is current. Additional copies of the forms or information regarding the
 47 forms may be obtained by calling PHSKC at (206) 296-4633.

48 Private disposal companies and waste sites outside of King County may require other documentation, and Laboratory
 49 analysis of waste material may be required to obtain waste clearance or acceptance. Copies of all waste clearance or
 50 acceptance forms along with any associated Laboratory data must be provided to the Engineer.

51 Disposal sites used under the Contract must comply with all applicable rules, ordinances, codes, regulations and law,
 52 and must have all required authorizations for the waste to be disposed.

53 Waste sites located within the City limits of Seattle are subject to the rules and regulations set forth in Seattle's
 54 Stormwater Code and Grading Code, which are SMC Chapters 22.800 – 22.808 and 22.170, respectively, and as otherwise
 55 provided in the SMC, and must at minimum require a grading permit issued to the property owner by the Director of the Seattle
 56 Department of Construction and Inspections.

1 Waste sites located outside the City limits of Seattle but within unincorporated King County are subject to the rules and
2 regulations set forth by current King County grading requirements. Sites located outside the City limits of Seattle or
3 unincorporated King County may also be subject to rules and regulations of the local governmental authority having
4 jurisdiction.

5 Disposal must comply with SMC Chapter 21.36, which provides in part that no wastes of the types identified in SMC
6 21.36.112 and generated within the City of Seattle must be disposed of at a facility owned or operated by King County, unless
7 specifically agreed by the City and King County.

8 Options for the disposal of woody debris from clearing and grubbing include on-site grinding for use as mulch or delivery
9 to facilities that compost or recycle woody debris into soil amendment or mulch end products. Any action required to comply
10 with any permit and/or any approval requirements at a Contractor-provided disposal site must be performed by the Contractor
11 at no additional cost to the Owner.

12 The selection of waste sites and their use is subject to Engineer approval.

13 **1-07.3(2) SUBMITTALS**

14 At or before the preconstruction conference, the Contractor must submit a list of proposed disposal and recycle sites that
15 allow the types of wastes and recyclable Materials that can be reasonably expected from examination of the Bid Documents
16 and Project Site including those Materials supplied by the Contractor to perform the Work.

17 The submittal must:

- 18 1. Identify each disposal site and recycle site, and the estimated quantities and type of material to be disposed of or
19 recycled at each site.
- 20 2. Identify the proposed transporter to be used for each type of waste or recyclable material and applicable licenses that
21 may be necessary for transporting the identified or characterized waste.
- 22 3. Specifically identify any Contaminated Material(s) Not Designated as Dangerous Waste(s) or TSCA Waste(s) that the
23 Contractor proposes to dispose or recycle.
- 24 4. Provide a management plan for any wastes that are to be stored on the Project Site before recycling or disposal. The
25 management plan must provide procedures to ensure that wastes are stored in a safe, secure manner that does not
26 allow for leakage or other releases of waste.
- 27 5. Unless otherwise specified in the Contract, provide adequate details indicating where such waste storage is proposed
28 and the proposed controls at each location including required signs, placards, labels, or other identifying marks.
29 Waste storage areas must be inspected at least daily. See Section 1-07.15 regarding spill prevention and control.

30 For additional or alternate disposal and recycle sites and transporters during the life of the Contract Time, the locations
31 and information for each additional site, and qualifications and licenses of transporters, must be submitted to the Engineer for
32 approval at least 10 Working Days before their use.

33 The Contractor must not dispose or recycle Dangerous Waste(s) or TSCA Waste(s) without prior and specific written
34 approval from the Engineer.

35 **1-07.3(3) CONTRACTOR FOLLOW-UP DOCUMENTATION REQUIRED FOR THE ENGINEER**

36 The Contractor must submit to the Engineer within 10 Working Days of receipt by the disposal site, 2 copies of each
37 shipment list, also known as bill of lading or transmittal document, listing the waste material shipped from the Project Site and
38 deposited at the waste disposal site. The submitted shipment list must have the waste site operator's confirmation of receipt of
39 the waste, and the name of the waste transporter.

40 The Contractor must also provide the Engineer with copies of these documents:

- 41 1. Documentation of disposal as applicable
- 42 2. Waste sampling and analysis reports as applicable
- 43 3. Waste clearance or acceptance forms

44 **1-07.3(4) RECYCLABLE MATERIALS**

45 The City of Seattle requires the recycling of readily recyclable construction and demolition waste materials per SMC
46 21.36.089 and subsequent SPU Director's Rules related to construction materials disposal bans. In 2014 such materials
47 include concrete, cement concrete, bricks, asphalt paving, ferrous and non-ferrous metal, cardboard, and new construction
48 gypsum scrap. In 2015 the materials targeted for recycling will include not only those listed previously but also plastic film
49 wrap, carpet, unpainted and untreated wood, and tear-off asphalt roofing shingles.

50 The Contractor is solely responsible for any revenue obtained or expense incurred for recycling. Materials identified in
51 the Contract as salvage materials are excluded from the provisions of this Section.

52 **1-07.4 SANITATION**

53 The Contractor must provide and maintain in a clean, neat, and sanitary condition, any accommodations for the
54 Contractor and Owner employees that are necessary to comply with the requirements and regulations of the State of
55 Washington Department of Social and Health Services and other agencies. The Contractor must commit no public nuisance
56 and at all times dispose of all waste in a proper manner.

1 **1-07.5 PREVENTION OF ENVIRONMENTAL POLLUTION AND PRESERVATION OF NATURAL RESOURCES**

2 **1-07.5(1) GENERAL**

3 During the life of the Contract, the Contractor must comply with all provisions of federal, state and local statutes, city
4 ordinances and any regulations pertaining to the prevention of environmental pollution and the preservation of public natural
5 resources. Under RCW 39.04.120 such provisions as are reasonably obtainable are set forth below.

6 **1-07.5(2) WATER QUALITY**

7 The Contractor must comply with city ordinances, state, and federal laws and other regulations or rules applicable to
8 water pollution occurring in waters of the State and in interstate waters. The Contractor must:

- 9 1. Exercise precautions throughout the life of the Contract to prevent contamination, pollution, erosion, siltation,
10 sedimentation, and pollution of groundwater and surface waters; and to prevent damages to drainage systems, public
11 and private property.
- 12 2. Provide for the flow of all watercourses, including but not limited to, streams, ditches, Sewers, and Storm Drains
13 intercepted during the progress of the Work.
- 14 3. Completely restore disturbed watercourses to original or better condition, as the Contract may provide.
- 15 4. Not obstruct the gutter of any street.
- 16 5. Use all proper measures to provide for the free passage of surface water.
- 17 6. Remove and properly dispose of all surplus water, mud, silt, slicking, or other run offs pumped from excavations or
18 resulting from sluicing or pavement cleaning or other operations.
- 19 7. Make all applicable notifications specified in Section 1-07.28.

20 The Contractor must comply with the water quality criteria required by the Department of Ecology and regulations of:

- 21 a. The Washington State Department of Fish and Wildlife.
- 22 b. Federal statutes on oil spills enacted under the Federal Water Pollution Control Act Amendments of 1972, a copy of
23 which may be obtained from the U.S. EPA.
- 24 c. The water quality standards of the State of Washington as set forth in WAC Chapters 173-200 and 173-201A.
- 25 d. The City of Seattle Stormwater Code, SMC Chapters 22.800-22.808.
- 26 e. Any local statute, regulation, ordinance, or rules that stipulate the various type of discharge prohibited in public Sewer
27 systems, Storm Drains or any drainage ditch in the local jurisdiction.

28 State statutes on water pollution covering liability of the Contractor, penalty for violation, and liability and damages for
29 injury or death of fish, animals, or vegetation are set forth in RCW Chapter 90.48. As an aid to the Contractor, some of the
30 rules set forth by the various State departments are summarized below. The Contractor is cautioned, however, that each
31 Department of the State may add other restrictions, as they deem necessary, to protect fish and to prevent air or water
32 pollution.

33 **1-07.5(2)A STATE DEPARTMENT OF FISH AND WILDLIFE**

34 In doing the Work the Contractor must:

- 35 1. Not degrade water quality in a way that would harm fish. The Washington State Water Quality Regulations are in
36 addition to other water quality criteria specified in the Contract for the Work.
- 37 2. Promptly notify the Engineer if any fish are stranded by the Work.
- 38 3. Replant the disturbed area with trees and other vegetation species selected compatible with area conditions as
39 determined by the Engineer, if the Work has disturbed the vegetative cover of any stream bank or shoreline areas.
- 40 4. Provide an open water channel at the lowest level of any isolated water location in the channel remaining when the
41 Work is complete.
- 42 5. Protect fish by preventing additional siltation build-up on the bed or bottom of any body of water.
- 43 6. Allow stream flow to continue for fish passage including use of bypass as the Work may require.
- 44 7. Keep all equipment out of any flowing stream or other body of water, except when the Work requires.
- 45 8. Not remove gravel or other bottom material from within the high water flow channel bed of any stream nor from the
46 bottom of any other body of water, unless permitted in the Contract.
- 47 9. Properly dispose of any debris generated by the Work.

48 **1-07.5(2)B WASHINGTON STATE DEPARTMENT OF ECOLOGY**

49 In doing the Work, the Contractor must:

- 50 1. Obtain a waste discharge permit from the Washington State Department of Ecology before washing aggregate and
51 before discharging water into a ground or surface waterway from pit sites or excavations when the water contains
52 turbidity, silt, or foreign materials.
- 53 2. Provide the Engineer with a copy of each waste discharge permit before starting the Work.

- 1 3. Control drainage and erosion to minimize the pollution of any waterway.
- 2 4. Properly dispose of all contaminants including creosote, oil, cement, concrete, and water used to wash equipment in
- 3 ways that will prevent them from entering State waters.
- 4 5. Properly dispose of all debris, overburden, and other waste materials in ways that will prevent them from entering
- 5 State waters.

6 The Contractor must perform such temporary work as may be necessary to prevent water pollution, erosion, and related
7 damage within the Project Site and that may be necessary at locations outside the Project Site used in support for the Work.

8 If Work is suspended for an extended period of time, the Contractor is responsible for controlling erosion, pollution,
9 sedimentation, and runoff during the suspended period.

10 In addition to other requirements in the Contract, this temporary work includes these water quality considerations:

- 11 a. Diversion of Storm Water: Storm water must be diverted around the Project Site to prevent pickup of silt, clay, and
12 other fine particles. This may be accomplished by pumping; improvising ditches; lining channels or by placing metal,
13 plastic or concrete gravity pipe; or constructing ditches, berms, and Culverts to control surface water; or constructing
14 dams, settling basins, or energy dissipaters to control impacts of flow.
- 15 b. Surfacing Ground Water: Surfacing ground water must be intercepted and either routed around the areas of Work in-
16 progress or, when impossible, routed through areas of Work in-progress, each with appropriate ESCBMPs to prevent
17 erosion and control sediment.
- 18 c. Discharging Ground Water: When ground water is encountered in an excavation, if it meets State Water Quality
19 standards, it may bypass treatment facilities and be routed directly to its normal discharge point. Discharging turbid
20 ground water must comply with the requirements described below in number (i).
- 21 d. Turbid Water Treatment Before Discharge: Determination of turbidity is at the discretion of the Engineer. The
22 Contractor is responsible for ensuring any water discharged from the Project Site or from Work performed at the
23 Project Site does not exceed these standards for turbidity, unless otherwise allowed per State Surface Water Quality
24 Standards (WAC 173-201A-200).
- 25 e. Discharges to a State waterway caused by aggregate washing, drainage from aggregate pit sites and stockpiles,
26 dewatering of pits and excavations, and other discharges must not increase the existing turbidity of the receiving
27 waters. Turbid water from the Project Site must be treated before being discharged into streams or other State
28 waters.
- 29 f. Turbidity is measured in Nephelometric Turbidity Units (NTUs) and measured with a turbidimeter. Turbidity reports
30 must be accompanied by a manufacturer's certificate of compliance indicating laboratory accreditation and
31 turbidimeter calibration as specified in WAC 173-50.
- 32 g. Receiving waters with 50 NTU or less as background turbidity must not exceed 5 NTU over background conditions.
- 33 h. Receiving waters with more than 50 NTU as background turbidity must not exceed a 10 percent increase in turbidity
34 over background conditions.
- 35 i. Water discharged to a Storm Drain must comply with State Water Quality standards and the Contractor must obtain
36 written permission, including any required permits, from the local jurisdiction, which is SPU when within the City of
37 Seattle.
- 38 j. Water discharged to a sanitary or combined Sewer requires the Contractor to obtain written permission, including any
39 required permits, from the local jurisdictions, meeting water quality requirements for both SPU and King County
40 Industrial Waste Division for Work within the City of Seattle.
- 41 k. The Contractor is responsible for all testing and monitoring required to ensure the water meets water quality
42 requirements before discharge to the Storm Drain system, or the sanitary or combined Sewer system.
- 43 l. Erosion and Sediment Control: General requirements to manage, prevent, and control erosion and to treat sediment
44 are specified in Sections 1-07.15 and Section 8-01.
- 45 m. Chlorine Residual: Water containing chlorine residual must be dechlorinated to a concentration of 0.1 ppm or less, or
46 must not be discharged directly into Storm Drains, streams, or State waters. Chlorine water may be discharged into
47 sanitary Sewers or disposed on land for percolation. Chlorine residual may be reduced chemically with a reducing
48 agent such as sodium thiosulphate or vitamin C. Water must be periodically tested for chlorine residual.
- 49 n. Vehicle and Equipment Washing: Water used for washing vehicles and equipment must not enter Storm Drains,
50 streams or other State waters. Separation of petroleum products, fresh concrete products or other deleterious
51 material from wash water is required before discharge. Detergent solution may only be discharged into sanitary
52 Sewers, or held on the ground for percolation. A recirculation system for detergent washing is recommended. Steam
53 cleaning units must provide a device for oil separation.
- 54 o. Oil and Chemical Storage and Handling: Do not handle or store oil and chemicals adjacent to surface waters. Storage
55 must be in diked tanks and barrels with drip pans provided under the dispensing area. Tanks must have shut off and
56 lock valves. Hoses must have shut off nozzles. Oil and chemicals must only be dispensed during daylight hours
57 unless the dispensing area is properly lighted. Should an oil or chemical spill occur, the Contractor must promptly
58 make the notification specified in Section 1-07.28, item 10), stop the spilling, contain the spill, and then clean up any
59 spilled materials. Fencing is required around oil storage. Locks are required on valves, pumps, and tanks.

- p. Sewage: If a pipe carrying sewage is encountered and repair or relocation work is required, the Contractor must provide blocking and sealing of the pipe. Sewage must be pumped out, collected, and conveyed or pumped directly to a sanitary or combined Sewer system maintenance hole for discharge. Existing sewerage must be maintained by the Contractor without interruption of service by the use of temporary Sewer bypasses. In addition, the excavated materials adjacent to and around a rupture of any pipe containing sewage must be removed to a disposal site. Equipment and tools in contact with the above materials must be washed by pressure water lines and the attendant wash water discharged into a sanitary or combined Sewer for transmission to a sewage treatment facility.
- q. Sawcutting, Planing, and Grinding By Products: Take special precautions to assure that concrete, asphalt, concrete by products, or asphalt by-products from, or used in, the drilling, sawcutting, grinding, or planing of asphalt cement or cement concrete pavements, sidewalks or curbs do not enter any Storm Drain, surface water, and natural drainage system. In as much as sawcutting by products increase the pH of the wastewater, filtering before discharge is not acceptable. Provide a means for collecting, for on-site temporary storing as necessary, and for properly disposing of these by-products. Surfaces contaminated with these by-products must be power washed and vacuum swept clean at least daily, and more frequently during wet weather.
- r. Gutters and other Surface Drainage Channels: Prevent all construction waste and stockpiling, and all byproduct, from entering gutters and other drainage channels inlets, catch basins, and other drainage Structures and features. Material must be removed from drainage channels on a regular basis. Temporary filters or filter materials must be placed and timely maintained by the Contractor in drainage channels to prevent the passage of said material.

1-07.5(3) AIR QUALITY

The Contractor must maintain air quality within the National Emission Standards for Hazardous Air Pollutants. Air pollutants are defined as that part of the atmosphere to which no ambient air quality standard is applicable and which, in the judgment of the Administrator of the Environmental Protection Agency Clean Air Act, may cause or contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness.

1-07.5(4) NOISE POLLUTION

The Work must be performed consistent with the applicable noise control levels: in the City of Seattle, SMC Chapter 25.08 ;outside the City limits and in King County, Chapters 12.86 through 12.100 of the King County Code and the requirements of local jurisdictions; outside King County, the requirements of local jurisdictions. Noise control includes all reasonable measures for the suppression of noise resulting from Work operations including the equipping of engine driven equipment with exhaust and air intake silencers designed to achieve the reasonable degree of silencing determined by Owner.

1-07.5(5) ARCHAEOLOGICAL AND HISTORIC PRESERVATION

Should the Contractor discover during any construction activity or in any other way discover any artifacts, skeletal remains, or other archaeological resources (as defined under RCW 27.53.040) at the Project Site, immediately stop construction activity at the discovery site and surrounding area, and promptly notify the Engineer. In the event that human skeletal remains are encountered, per RCWs 68.50.645, 27.44.055, and 68.60.055, the Contractor must also notify the county coroner and local law enforcement.

If ordered by the Engineer, the Contractor must suspend construction activity that, in the opinion of the Engineer, would be in violation of State Law. Suspension of this construction activity must remain in effect until the Engineer has obtained permission to proceed from the State Historic Preservation Officer or from other authority.

The Contractor and all Subcontractors must comply with regulations regarding archaeological resources including, but not limited to:

- 1. Archaeological Sites and Resources (RCW 27.53)
- 2. Indian Graves and Records (RCW 27.44)
- 3. Archaeological Site Public Disclosure Exemption (RCW 42.56.300)
- 4. Discovery of Human Remains (RCW 27.44)
- 5. Archaeological Excavation and Removal Permit (WAC 25-48)
- 6. Abandoned and Historic Cemeteries and Historic Graves (RCW 68.60)
- 7. SEPA Environmental and Historic Preservation Polices (SMC 25.05.660-.675)

1-07.5(6) THREATENED AND ENDANGERED SPECIES

The Contractor must prevent the harming of threatened and endangered species, and all critical habitat associated with threatened and endangered species as required by the Federal Endangered Species Act.

1-07.5(7) CONSTRUCTION WITHIN AND ADJACENT TO WATER

In addition to other specifications in Section 1-07.5, the Contractor must comply with the Rivers and Harbors Act, the Clean Water Act, and the Water Resources Development Act.

1 1-07.5(8) WETLANDS

2 Wetlands are defined as those areas inundated or saturated by ground or surface water at a frequency and duration
3 sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include
4 swamps, marshes, bogs, and similar areas.

5 Wetland impacts, including disposal of material within a wetland area, is not allowed without a Clean Water Act Section
6 404 permit issued by the U.S. Army Corps of Engineers and approval by the local agency with jurisdiction over the wetland.
7 Impacts to areas considered wetland buffers may require approval by the local agency with jurisdiction.

8 1-07.5(9) LIABILITY AND PAYMENT

9 The Contractor is liable for the payment of all fines and penalties resulting from failure to comply with the federal, state
10 and local pollution control regulations. Except as otherwise provided for in the Contract, costs pertaining to the prevention,
11 containment, or cleanup of environmental pollution and the preservation of public natural resources as outlined in the Contract
12 are considered incidental to the Work and are at the Contractor's sole expense.

13 1-07.6 PERMITS

14 The Contractor must comply with all issuing agency requirements and hold the Owner harmless for any Work-related
15 liability incurred under any permit obtained to perform Work under the Contract. If the Contractor finds any ambiguity or conflict
16 between the Contract and the permit, the Contractor must promptly notify the Engineer no later than 2 Working Days from the
17 date of discovery.

18 Information on Street Use Permits: http://www.seattle.gov/transportation/stuse_permits.htm

19 1-07.6(1) CONTRACTOR OBTAINED PERMITS

20 Unless otherwise specified in the Contract, the Contractor must obtain all required permits for the performance of the
21 Work, must provide any notices such permits may require, and must not proceed with any portion of the Work until the
22 requisite permit has been obtained and a copy delivered to the Owner. The costs of permits obtained by the Contractor must
23 be included in the Bid Item prices for the Work.

24 Information on electrical and side Sewer permits: <http://www.seattle.gov/dpd/permits>.

25 1-07.6(2) OWNER OBTAINED PERMITS

26 Permits obtained by the Owner will be referenced or included in the Contract.

27 The Contractor may request in writing that the Owner obtain a temporary operating permit in the Owner's name if:

- 28 1. A local rule or an agency policy prevents issuing the permit to a private firm;
- 29 2. The Contractor takes all actions necessary to support the Owner to obtain the permit;
- 30 3. The permit will serve the public interest, including expediency;
- 31 4. The permit applies only to Work under the Contract; and
- 32 5. The Contractor reimburses the Owner for all fees.

33 1-07.7 LOAD LIMITS**34 1-07.7(1) GENERAL**

35 While moving equipment and Materials on any public Right of Way, the Contractor must comply with all laws and
36 regulation affecting motor vehicle traffic and limits loads. The Contract does not exempt the Contractor from such laws nor
37 does it license overloads. Upon request, the Contractor must provide any information needed to determine the weight of
38 equipment on the roadway.

39 The Contractor is responsible for any damage to any public Right of Way caused by overweight equipment, whether
40 under permit or otherwise.

41 1-07.7(2) LOAD LIMIT RESTRICTIONS

42 The following load limits apply to:

- 43 1. Structures Designed for Direct Bearing of Live Loads: On these Structures, the gross or maximum load on each
44 individual vehicle axle must not exceed the legal load limit by more than 35 percent. No more than 1 vehicle can
45 operate over any Structure at 1 time.
- 46 2. Underpasses and Reinforced Concrete Box Culverts Under Embankments: Over these Structures, maximum loads
47 are 24,000 pounds on a single axle and 16,000 pounds each on tandem axles spaced less than 10 feet apart,
48 provided that:
 - 49 a. The embankment has been built as specified in Section 2-10; and
 - 50 b. The embankment has reached at least 3 feet above the top of the underpass or Culvert.

51 When the embankment has reached 5 feet above the top of the Culvert or underpass, the Contractor may increase
52 axle loads up to 100,000 pounds each if outside wheel spacing is at least 7 feet on centers on the axle.

3. Pipe Culverts and Sewer Pipes: Loads over pipe Culverts and Sewer pipes must not exceed 24,000 pounds on a single axle and 16,000 pounds each on tandem axles spaced less than 10 feet apart. These limits are permitted only if:

- a. The Culvert or pipe has been installed and backfilled to Specifications; and
- b. The embankment has reached at least 2 feet above the top limit of pipe compaction.

When the embankment has reached 5 feet above the top limit of pipe compaction, the Contractor may increase per-axle loads up to 100,000 pounds if outside wheel spacing is at least 7 feet on centers on the axle centers, except that:

- 1) For Class III reinforced concrete pipes, the embankment must have risen above the top limit of compaction at least 6 feet.
- 2) For Class II reinforced concrete pipes, the maximum load for each axle is 80,000 pounds if outside wheel spacing is at least 7 feet on axle centers. In this case, the embankment must have risen above the top limit of compaction at least 6 feet.

1-07.8 HIGH-VISIBILITY APPAREL

The Contractor must require all personnel under their control including service providers, Subcontractors, and lower tier Subcontractors that are on foot in the work zone and are exposed to vehicle traffic or construction equipment to wear the high-visibility apparel described in this Section.

The Contractor must ensure that a competent person as identified in the MUTCD selects the appropriate high-visibility apparel suitable for the Job Site conditions.

High-visibility garments must always be the outermost garments.

High-visibility garments must be in a condition compliant with the ANSI 107-2004 and must be used per manufacturer recommendations.

1-07.8(1) TRAFFIC CONTROL PERSONNEL

All personnel performing the Work described in Section 1-10 including traffic control supervisors, flaggers, spotters, and others performing traffic control labor of any kind must comply with the following:

- 1. During daylight hours with clear visibility, workers must wear a high-visibility ANSI/ISEA 107-2004 Class 2 or 3 vest or jacket, and hardhat meeting the high-visibility headwear requirements of WAC 296-155-305.
- 2. During hours of darkness (1/2 hour before sunset to 1/2 hour after sunrise) or other low-visibility conditions such as snow or fog, workers must wear a high-visibility ANSI/ISEA 107-2004 Class 2 or 3 vest or jacket, high-visibility lower garment meeting ANSI/ISEA 107-2004 Class E, and hardhat meeting the high-visibility headwear requirements of WAC 296-155-305.

1-07.8(2) NON-TRAFFIC CONTROL PERSONNEL

All personnel, except those performing the Work described in Section 1-10 must wear high-visibility apparel meeting the ANSI/ISEA 107-2004 Class 2 or 3 standard.

1-07.9 WAGES

1-07.9(1) PREVAILING WAGE RATES

1-07.9(1)A GENERAL

The Work is subject to the wage requirements of RCW 39.12 (Prevailing Wages on Public Works), RCW 49.28 (Hours of Labor), and to RCW 49.46 (Minimum Wage Act) as amended or supplemented. The Contractor, any Subcontractor, and all individuals and firms required to pay prevailing wages under WAC 296-127-010, must pay all laborers, workers, or mechanics no less than the applicable prevailing hourly wage rate and fringe benefits appropriate to the worker's classification. Higher wages and benefits may be paid at the option of the employer.

The Contractor is responsible for assigning the appropriate classification to all laborers, workers, or mechanics that perform any Work under this Contract, under the scope of work descriptions established by the L&I Industrial Statistician. Laborers, workers, and mechanics must be paid in full at least once each week and in lawful money of the United States. If the Contractor assigns the wrong prevailing wage classification, the Contractor is responsible for and must pay the amount of the corrected prevailing wage. The difference is not subject to an equitable adjustment or Change Order.

The Contractor must ensure that all Subcontractors, and all other individuals and firms as applicable, comply with all prevailing wage requirements including payroll reporting requirements and payment of prevailing wages. The Contractor is responsible for any violations of prevailing wage requirements by Subcontractors, individuals, or firms, and The Owner will take enforcement action against the Contractor to remedy any violations and achieve compliance with prevailing wage requirements

1-07.9(1)B APPLICABILITY OF FEDERAL PREVAILING WAGE RATES

On projects funded in whole or part from federal monies, federal wage laws and rules also apply. If the Work is subject to both the provisions of the State (RCW 39.12) and federal (Davis Bacon and Related Acts, DBRA) prevailing wage requirements, the Contractor and every Subcontractor must pay the higher prevailing wage rate for the classification.

1-07.9(1)C WAGE RATES

Any listing of wages and fringe benefits in the Project Manual for any classification is intended only as a guideline for the Contractor and does not necessarily reflect the most recent classification or prevailing wage rate. Prevailing wage rates will be determined by L&I and published on the first Business Day of February and the first Business Day of August of each year. All prevailing wage rates become effective 30 Days after they are published. Current prevailing wage information may be obtained online:

Washington State Department of Labor and Industries

<http://www.lni.wa.gov/TradesLicensing/PrevWage/WageRates/default.asp>

For projects funded in whole or part with federal monies, current federal prevailing wage information may be obtained upon request from the:

U.S. Department of Labor

<https://www.dol.gov/whd/govcontracts/dbra.htm>

By including wage and fringe benefit rates in the Project Manual, the Owner does not imply that the Contractor will find labor available at those rates. The Contractor must calculate any amount above the minimums that have to be paid.

If the Contractor employs labor in a classification not covered by WAC 296-127, the Contractor must request the Industrial Statistician at L&I determine the correct prevailing wage rate for that classification and locality. If the project is federally funded, the Contractor must request the Secretary of the U.S. Department of Labor (US DOL) determine a federal prevailing wage rate for that classification and locality in addition to requesting the State prevailing wage rates. In such case, the Director of L&I's, and if applicable the Secretary of US DOL's, decision regarding the rates is final, conclusive, and binding on all parties. If the state and federal wage rates differ, the Contractor must pay the higher wage rate.

1-07.9(1)D OVERTIME

Pursuant to the provisions of RCW 49.28 and WAC 296-127-022, Work performed on public works contracts will not require the payment of overtime rates for the first 2 hours worked in excess of 8 hours per Day when the employer and employee voluntarily enter into a written agreement wherein the employee will work up to 10 hours per Day in a 4-Day week to accomplish 40 hours of work. Working more than 10 hours on any Calendar Day on a public works project is prohibited except in cases of extraordinary emergency, such as danger to life or property. The Contractor must refer to the Benefits Code Key attached to the Prevailing Wage Schedule for specific overtime rates.

1-07.9(1)D1 WRITTEN OVERTIME AGREEMENT

Recognizing that there may be Days when a full 10 hours of work is not available, the remainder of the forty hours may be made up on another work Day or Days within the same work week. However, work performed on Saturdays, Sundays, and Holidays is subject to the established prevailing overtime provisions for a given trade or occupation, as provided in RCW 39.12.

For the purpose of this Section, an agreement must:

1. Have been authorized by employees who bargained collectively with their employers through representatives of their own choosing; or
2. Be obtained in writing, signed, and dated by both parties;
3. Be entered into individually with each employee;
4. Be entered into separately for each public works project, except that an employer, at its option, may obtain an annual authorization;
5. State the name of the public works project with specificity; and
6. Be entered into voluntarily by the employer and employee.

Each employer must retain copies of individual employee authorization agreements for 3 years from the Completion Date of the Work. Absence of an authorization record for an employee will be deemed per se evidence of lack of that employee's authorization. Such records are payroll records, subject to the requirements of WAC 296-127-320.

For any overtime work performed on a federally funded project per the agreements referenced above, the Contractor, Subcontractor, and all other individuals or firms required to pay prevailing wages must submit a copy of such authorization agreement for each affected employee to CPCS, either in person or by mail.

Physical address:

Seattle Municipal Tower

700 Fifth Avenue, Suite 4112

Seattle, WA 98104

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Mailing address:
CPCS
P.O. Box 94687
Seattle, WA 98124-4687

1-07.9(2) PAYROLL REPORTS

Payroll reports for the Contractor, every Subcontractor, and all other individuals or firms required to pay prevailing wages for Work performed must be submitted weekly via an online reporting portal: <http://www.LCPtracker.net>. The Contractor is responsible for approving electronically the payrolls submitted by all Subcontractors. Payroll reports must contain the following information:

1. Name and residence address of each worker
2. Classification of work performed by each worker. The classification must be specific and match the classification categories listed in the applicable wage schedule
3. Total number of hours employed each Day
4. Total number of hours employed during the payroll period.
5. Straight time and overtime hourly rate of wages paid to each worker
6. Total or gross amount earned by each worker.
7. Deductions for medical insurance, FICA, federal withholding tax, and any other deductions taken.
8. Net amount paid each worker
9. Contractor's or Subcontractor's name and address
10. All Days during the pay period
11. Date of final Day of pay period
12. Whether fringe benefits were paid to each worker as part of the hourly wage rate or whether fringe benefits were paid into an approved plan, fund, or program; and the hourly rate of fringe benefits paid, if any.

For federally-funded projects, payroll reports may be submitted on federal payroll form WH 347 or equivalent, which may be obtained by accessing their website: <https://www.dol.gov/WHD/forms/index.htm> . The reverse side of the form contains an Affidavit that must be filled out and signed. If the Contractor's payroll reports are computerized, the computerized reports may be submitted along with a Statement of Compliance Affidavit form, which may be photocopied from the sample in the Project Manual.

The first payroll submitted for the Work for both the Contractor and each Subcontractor must be labeled Initial. The last payroll submitted for the Work for both the Contractor and each Subcontractor must be labeled Final. If no work is performed for the week, the Contractor must submit a certified payroll noting that no work has been performed.

1-07.9(3) ENFORCEMENT

The Contractor, every Subcontractor, and all other individuals or firms required to pay prevailing wages for Work performed on this Contract are subject to investigation by CPCS and L&I in regards to payment of the required prevailing wage to workers, laborers, and mechanics employed on the project.

If the investigations result in a finding that an individual or firm has violated the requirement to pay the prevailing rate of wage, the unpaid wages will constitute a lien against the Contractor's Bond and retainage. The Owner may also withhold payments to the Contractor specified in Section 1-09.9(3). Per RCW 39.12.065 and 39.12.050, the Contractor or Subcontractor may also be subject to civil penalties and may be prohibited from bidding on any public works contract within the State of Washington for the period specified by law. The Owner may consider such violations in preparing performance evaluations specified in Section 1-05.13(2), in determining whether a Contractor or Subcontractor is a responsible Bidder specified in Section 1-02.2, and under debarment proceedings per SMC 20.70.

1-07.9(4) POSTING NOTICES

The Contractor must post in a location acceptable to L&I and in compliance with the requirements of RCW 39.12.020:

1. One copy of the approved Statement of Intent to Pay Prevailing Wages for the Contractor, each Subcontractor regardless of tier, and any other individual or firm required to pay prevailing wages per WAC 296-127-010.
2. A copy of the prevailing wage rates for the project.
3. The address and telephone number of the L&I Industrial Statistician along with notice that complaints or questions about wage rates may be directed there.

1-07.9(5) PREVAILING WAGES FOR APPRENTICES

An apprentice is defined as a laborer, worker, or mechanic employed to perform the Work for whom an apprentice agreement is established through a Training Program that is registered and approved by the Washington State Apprenticeship and Training Council (WSATC). Per RCW 39.12.021 and RCW 49.04, apprentices must be paid the applicable prevailing

1 hourly rate for an apprentice of that trade. If the Contractor or Subcontractor of any tier makes use of an apprentice on work
2 also governed by federal wage rates and regulations, the Contractor must present to the Owner written evidence of
3 registration of such employees in a program approved by the WSATC. On any project that is federally funded and where
4 submission of payroll reports is required, such evidence must be submitted with the first payroll on which the name of the
5 employee appears.

6 **1-07.9(6) PREVAILING WAGE DISPUTES**

7 Prevailing wage disputes are not subject to the dispute resolution process specified in Section 1-04.4. For purposes of
8 prevailing wage disputes the following applies:

9 If there is a dispute regarding prevailing wages, CPCS and the Contractor must attempt to resolve the dispute and to
10 receive corrected prevailing wage documents such as amended certified payrolls and other supporting documents as
11 requested. If the Contractor does not make good faith efforts to resolve the dispute within 30 Calendar Days of receiving
12 notification, CPCS may conduct its own investigation or refer the dispute at any time thereafter to L&I and/ or US DOL as
13 applicable. If CPCS determines that it will conduct an investigation, CPCS will provide written notice of the investigation to the
14 Contractor and after its investigation is complete, CPCS will furnish its written determination to the Contractor including the
15 identification of any or all enforcement actions specified in Section 1-07.9(3). The Contractor may appeal this determination in
16 writing to the Director of CPCS. The Director will provide a written response to the Contractor regarding the appeal. Nothing in
17 this process precludes other interested parties from filing complaints or disputes with L&I or US DOL or taking other legal
18 action.

19 In the event that after exhausting the foregoing process, the Contractor disagrees with the Owner's final determination of
20 a prevailing wage dispute involving a state prevailing wage rate, the matter will be referred to the Director of L&I. In such
21 cases, the Director's decision is final, conclusive, and binding on all parties. If the dispute involves a federal prevailing wage
22 rate, the matter will be referred to the Secretary of U.S. DOL for a decision. In such case, the Secretary's decision is final,
23 conclusive, and binding on all parties.

24 When the Work is subject to both state and federal prevailing wage requirements, the Contractor and every
25 Subcontractor must pay whichever rate is higher.

26 **1-07.9(7) REQUIRED DOCUMENTS**

27 Before payment is made by the Owner of any sums due under this Contract, the Contractor and each Subcontractor
28 regardless of tier must have a Statement of Intent to Pay Prevailing Wages (form F700 029 000), approved by L&I. Wage rates
29 listed on an approved Statement of Intent to Pay Prevailing Wages may not comply with federal prevailing wage requirements.

30 Each progress estimate submitted for payment must include an Owner-provided form listing all Subcontractors and
31 Suppliers, who performed Work on the project during that pay period, including but not limited to, Subcontractor Name, UBI
32 Number, Intent Number and Affidavit Number as applicable, along with a statement completed and signed by an authorized
33 representative of the Contractor certifying the prevailing wages have been paid per RCW 39.12.040.

34 Upon Physical Completion and before final progress payment and funds retained under RCW Chapter 60.28 can be
35 released to the Contractor, the Contractor and each Subcontractor regardless of tier must have an Affidavit of Wages Paid
36 (form L700 007 000) approved by L&I, see Section 1-09.9.

37 The Contractor or Subcontractor, as applicable, is responsible for payment of fees for each Statement of Intent to Pay
38 Prevailing Wages and Affidavit of Wages Paid and must submit all forms directly to L&I for approval. The cost of these fees is
39 included in the Bid Item prices that comprise this Contract. Intent and Affidavit forms may be obtained from L&I at the following
40 website: <http://www.lni.wa.gov/TradesLicensing/PrevWage/default.asp>

41 **1-07.9(8) AUDITS**

42 Payroll, wage, and cost records must be retained, and may be audited or inspected, as specified in Section 1-09.10.

43 **1-07.10 RESERVED**

44 **1-07.11 SOCIAL EQUITY IN CONTRACTING**

45 The City provides assistance to Contractors that desire to Bid on, or have been Awarded a City Contract, to comply with
46 equal opportunity, non-discrimination, Affirmative Efforts, and Apprenticeship provisions. Should a Contractor desire
47 assistance or information in recruiting, tutoring, and training or otherwise preparing potential employees and Subcontractors, a
48 Contractor may contact CPCS at (206) 684-0444. For projects with an Engineer's Estimate of \$2 Million or more, the
49 Contractor must name a person or firm that has been qualified by the City to act as the Bidder's WMBE expert for Affirmative
50 Efforts. Direct all questions, reports, or other submittals regarding the requirements of this Section to CPCS. Telephone: (206)
51 684-0444.

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53 Physical Address:
54 Seattle Municipal Tower
55 700 Fifth Avenue, Suite 4112
56 Seattle, WA 98104

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Mailing Address:
CPCS
P.O. Box 94687
Seattle, WA 98124-4687

1-07.11(1) EQUAL BENEFITS

The Contractor must comply with SMC Ch. 20.45 and the Equal Benefits Program Rules implementing such requirements, under which the Contractor is obligated to provide the same or equivalent benefits (equal benefits) to its employees with domestic partners as the Contractor provides to its employees with spouses. At the Owner's request, the Contractor must provide complete information and verification of compliance with SMC Ch. 20.45.

For further information about SMC Ch. 20.45 and the Equal Benefits Program Rules, call (206) 684-0444 or refer to: <http://www.seattle.gov/contracting/equalbenefits.htm>

Evaluation of the Contractor's compliance with the Equal Benefits requirement will be based on these criteria:

1. A domestic partner is a person, either same sex or opposite sex partner, whose domestic partnership is registered either with the employer's internal registry or with a local government entity, per State or local law.
2. Any and all benefits must be provided equally to spouses and domestic partners, including but not limited to health insurance, dental insurance, vision insurance, pension, company discounts, and credit union membership.
3. The conditions for use of benefits including but not limited to bereavement leave, family medical leave, childcare leave, employee assistance programs, and relocation and travel benefits, must be applied equally with respect to spouses and domestic partners.
4. Equal benefits must be offered to all employees at all offices where substantive Work on the Contract with the City of Seattle is being performed.

Reporting Requirements: The apparent low Bidder must submit the Equal Benefits Compliance Declaration to the CPCS representative within 3 Business Days after request.

Any violation of this Section is a material breach of Contract for which the City may:

- a. Require the Contractor to pay actual damages for each Day that the Contractor is in violation of SMC Ch. 20.45 during the term of the Contract;
- b. Terminate the Contract;
- c. Debar the Contractor from bidding on or being Awarded a City Contract for a period of up to 5 years under SMC 20.70; or
- d. Impose such other remedies as specifically provided for in SMC Ch. 20.45 and the Equal Benefits Program Rules promulgated there under.

1-07.11(2) LABOR STANDARDS

As noted in SMC 14.16-20, the Owner has adopted a comprehensive set of wage theft prevention and labor harmonization standards to better protect those individuals who conduct business within the City limits. These protections include Paid Sick and Safe Time, Fair Chance Employment, Minimum Wage and Wage Theft. Contractors who conduct business inside the City limits, including attending meetings, must comply with SMC 14.16-20. See <http://www.seattle.gov/laborstandards/ordinances>, for more information.

1-07.11(3) WOMEN AND MINORITY BUSINESSES AND NON-DISCRIMINATION REQUIREMENTS

As noted in SMC 20.42.010, the Owner has found that minority and women owned businesses (WMBE) are significantly under-represented and have been underutilized on City of Seattle contracts. The Owner does not intend to enter into agreements with businesses that discriminate in employment. The Owner intends to provide the maximum practicable opportunity allowed for increased participation by minority and women owned businesses, as long as such businesses are underrepresented, and to ensure that the Owner's contracting practices do not support discrimination in employment when the Owner procures public works, goods, and services from the private sector. The Owner will not enter into contracts with Contractors that do not agree to use Affirmative Efforts to employ or contract with women and minority group members as required under SMC 20.42 or who violate any provisions of that chapter, or those requirements set forth below.

In addition, the Contractor must comply with RCW 35.22.650, which provides:

"Contractor agrees that the Contractor shall actively solicit the employment of minority group members. Contractor further agrees that the Contractor shall actively solicit bids for the subcontracting of goods or services from qualified minority businesses. Contractor shall furnish evidence of the Contractor's compliance with these requirements of minority employment and solicitation. Contractor further agrees to consider the grant of subcontracts to said minority bidders on the basis of substantially equal proposals in the light most favorable to said minority businesses. The Contractor shall be required to submit evidence of compliance with this section as part of the bid."

1-07.11(3)A AFFIRMATIVE EFFORTS

The Contractor must use Affirmative Efforts to solicit and contract with WMBEs on subcontracting and supply opportunities within the project.

1. Affirmative Efforts must include efforts to achieve the activities specified in the Inclusion Plan the Contractor submitted as specified in Section 1-02.9(4). The Contractor is solely responsible for any efforts made and costs incurred to comply with WMBE Goals.
2. Reporting Requirements:
 - a. If applicable, the Contractor must submit an Inclusion Plan as specified in Section 1-02.9(4).
 - b. If applicable, the Contractor must submit a Social Equity Plan before the preconstruction conference.
 - c. The Contractor must submit Subcontractor Payment Reports electronically through B2Gnow: <https://seattle.diversitycompliance.com/>.
 - 1) The first Subcontractor Payment Report must be submitted by the 15th Day of the first month after the date specified in the Notice to Proceed.
 - 2) Subsequent monthly Subcontractor Payment Reports must be submitted by the 15th Day of every month thereafter. When no work is performed during a reporting period, the Contractor must submit monthly reports indicating that no work was performed.
 - 3) The last Subcontractor Payment Report must be marked as Final and must be submitted no later than 30 Days after the Physical Completion Date. The final report must list the name of and dollar amount paid to each Subcontractor and Supplier used by the Contractor. The Owner will not establish the Completion Date until the completed final Subcontractor Payment Report Form has been received.
 - 4) A sample of the form may be included in the Appendix section of the Project Manual but this form is submitted through an online reporting website listed above.
 - 5) Subcontractors and Suppliers must register on the City's Business Registration website, if not currently registered; this is a one-time registration process for each Subcontractor and Supplier. <http://www2.ci.seattle.wa.us/VendorRegistration/>.
Contractors may use this website to look up whether the Subcontractors or Suppliers are registered or not. The Subcontractors and Suppliers must register themselves.
3. Changes to named Subcontractors or Suppliers:
 - a. A named Subcontractor or Supplier includes any WMBE firm or business named on the Inclusion Plan or the Social Equity Plan as a WMBE guarantee.
 - b. Any named Subcontractor that the Contractor wishes to substitute during the project must request the Engineer's consent through a Change Order and demonstrated "good cause." "Good cause" includes:
 - 1) Failure of the Subcontractor to execute a written contract after a reasonable period of time;
 - 2) Bankruptcy of the Subcontractor;
 - 3) Failure of the Subcontractor to provide the required bond;
 - 4) The Subcontractor is unable to perform the Work because they are debarred, not properly licensed, does not comply with the Subcontractor approval criteria, or in some other way is ineligible to work;
 - 5) Failure of the Subcontractor to comply with a requirement of law applicable to subcontracting;
 - 6) The death or disability of the Subcontractor if the Subcontractor is an individual;
 - 7) Dissolution of the Subcontractor if the Subcontractor is a corporation or partnership;
 - 8) If there is a series of failures by the Subcontractor to perform as specified in previous contracts; or
 - 9) Failure or refusal of the Subcontractor to perform the Work.
 - c. If the Contractor is making a change to a WMBE guarantee, then the Contractor must use good faith efforts to recruit another WMBE Subcontractor to do the Work.

1-07.11(4) EMPLOYMENT NON-DISCRIMINATION REQUIREMENTS

The City encourages Contractors to employ a workforce reflective of the region's diversity. The Contractor must include a requirement in every subcontract that Subcontractors must comply with the non-discrimination requirements as set forth in federal, state, and city laws and regulations.

The Contractor must not discriminate against any employee or applicant for employment, and will make Affirmative Efforts to solicit and employ women and minorities, and to ensure that applicants are treated during employment without regard to race, color, age, sex, marital status, sexual orientation, gender identity, political ideology, creed, religion, ancestry, national origin; or the presence of any sensory, mental or physical handicap, unless based upon a bona fide occupational qualification. Such Affirmative Efforts include: employment, upgrading, promotion, demotion, or transfer; recruitment or recruitment advertising, layoff or termination, rates of pay, or other forms of payment and selection for training, including apprenticeship.

1 The Owner may audit the Contractor's non-discrimination policies and practices, including Affirmative Efforts to employ
2 women or minority employees.

3 Equal Employment Opportunity Officer: The Contractor must have a designated Equal Employment Opportunity Officer
4 (EEO Officer).

5 The Contractor must ensure that all employees, particularly supervisors, are aware of, and comply with their obligation to
6 maintain a working environment free from discriminatory conduct, including, but not limited to, harassment and intimidation of
7 minorities and women, or WMBE businesses.

8 **1-07.11(5) RECORDS**

9 The Contractor must provide evidence of compliance with SMC 20.42, including the Inclusion Plan, to the CPCS, on
10 request and on such form as may be provided. The Contractor must allow access to its records of employment, bidding, and
11 subcontracting, and other pertinent data requested by the City to determine compliance with these requirements. Records
12 must be available at reasonable times and places for inspection by authorized representatives of the Owner.

13 The Contractor must maintain relevant records and information necessary to document the Contractor's Affirmative
14 Efforts to use WMBEs and other businesses as Subcontractors and Suppliers under the Contract, for at least 24 months after
15 the Completion Date. The Owner has the right to inspect and copy such records. The Contractor must also require of its
16 Subcontractors that the records of the Subcontractors be retained and open to similar inspection and copying for the same
17 period of time.

18 **1-07.11(6) APPRENTICE UTILIZATION**

19 The following Apprenticeship requirements apply to projects with an Engineer's Estimate of \$1 Million or more.

20 **1-07.11(6)A GENERAL**

21 The Owner has determined that there is a need for increased training and apprenticeship opportunities in the
22 construction industry and that a diverse and well trained workforce is critical to the economic and social vitality of the region. In
23 establishing requirements for the use of apprentices on the Project, it is the Owner's intent to encourage the training and
24 promotion of apprentices to journey level status.

25 **1-07.11(6)B APPRENTICE UTILIZATION REQUIREMENTS AND GOALS**

26 The Contractor must ensure that 15 percent of the total Contract Labor Hours used on the project are performed by
27 apprentices registered with the WSATC.

28 Total Contract labor hours include additional hours worked as a result of Change Orders, and exclude hours worked by
29 foremen, superintendents, supervisors, owners, and workers who are not subject to prevailing wage requirements. However, it
30 may be determined that they are subject to prevailing wage requirements under the following criteria of WAC 296-127-015: 2
31 supervisors (e.g. foreman, general foreman, superintendents) are entitled to receive at least the journey level prevailing rate of
32 wage for performing manual or physical labor:

- 33 1. For each hour spent in the performance of manual or physical labor if it is for more than 20 percent but less than 50
34 percent of their hours worked on a public works project during any given week.
- 35 2. For all hours worked in any given week if they perform manual or physical labor for 50 percent or more of their hours
36 worked on a public works project during such week.

37 The Contractor must include the apprentice utilization requirements of this Section in all subcontracts executed for the
38 Project, and ensure that all Subcontractors working on the project are notified of the apprentice utilization requirements. The
39 Contractor is responsible for meeting the apprentice utilization requirements of the Contract, including overall compliance on
40 all Contract labor hours worked by Subcontractors.

41 The Contractor must make good faith efforts to:

- 42 a. Ensure that apprentice hours worked are equally distributed in each trade/craft and consistent with the apprentice
43 utilization percentage requirement of the Contract.
- 44 b. Recruit and hire minority and women apprentices for the Project. Of the total apprentice utilization requirement
45 percentage, the Contractor must pursue a goal of using 21 percent labor hours performed by minority apprentices
46 and 20 percent labor hours performed by women apprentices.

47 The Contractor must ensure compliance with RCW 49.04, WAC 296-05, and the apprenticeship training standards for
48 each trade/craft classification used on the Project, as set forth by L&I.

49 **1-07.11(6)C APPRENTICE UTILIZATION PLAN**

50 On or before the date of the preconstruction meeting, the Contractor must submit to CPCS, as part of the Social Equity
51 Plan Form, a comprehensive plan outlining how the apprentice utilization requirements will be met on the total Contract labor
52 hours. The plan must be submitted on a form provided by the Owner or by accessing
53 <http://www.seattle.gov/contracting/apprentice.htm>

54 CPCS will provide assistance in directing the Contractor to available resources for hiring apprentices. The Contractor, the
55 Engineer, and CPCS must meet to discuss and change the plan as appropriate.

1-07.11(6)D CHANGES TO THE APPRENTICE UTILIZATION REQUIREMENT

If the Contractor determines that it will be unable to achieve the apprentice utilization percentage, the Contractor may make a written request to CPCS to reduce the required apprentice utilization percentage. The request must include documentation of the Contractor's good faith efforts to hire apprentices registered with WSATC approved programs. These documents must demonstrate:

1. That an inadequate number of apprentices are available to comply with the required apprentice utilization percentage or that there is a disproportionately high ratio of material costs to labor hours, which does not make the required minimum levels of apprentice participation possible for this Contract; and
2. That the Contractor has made good faith efforts to comply with the requirement.

CPCS will evaluate the request and, if appropriate, the Engineer will prepare a Change Order reducing the required utilization percentage. If CPCS determines that a reduction in the required utilization percentage is not justified, CPCS will communicate the decision in writing to the Contractor.

1-07.11(6)E APPRENTICE UTILIZATION REPORTING

The Contractor and every Subcontractor must submit a profile for each worker into LCP Tracker through an online portal at <http://www.lcptracker.net/> including but not limited to gender, ethnicity, and apprenticeship status of each worker.

The Contractor must submit other information as requested by the Owner to verify compliance with the apprentice utilization requirements of the Contract. The Owner may add, delete, or change the information required by the Contractor, as necessary.

1-07.11(6)F MONITORING

CPCS will verify the registration of each apprentice used on the project with the WSATC. CPCS will monitor the apprentice utilization data provided by the Contractor. The Owner will make routine visits to the Project Site for the purpose of confirming the use of apprentices.

1-07.11(7) VIOLATIONS

Any violation of the requirements of this Section or other local, state or federal non-discrimination laws, is a material breach of the Contract for which the Contractor may be subject to damages and sanctions, including but not limited to payment of full payment to employees entitled to receive equal benefits during the term of the Contract who did not receive such benefits, imposition of a civil fine or forfeiture under the Seattle Criminal Code as well as various civil remedies, suspension or termination of the Contract and/or the withholding of any funds due or to become due, or debarment per SMC Ch. 20.70.

1-07.12 RESERVED**1-07.13 CONTRACTOR'S RESPONSIBILITY FOR WORK AND DAMAGE****1-07.13(1) GENERAL**

Except as provided for otherwise in the Contract, the Work, including Change Order Work, is at the sole risk of the Contractor until the Completion Date. Damage to or destruction of either permanent or temporary portions of the Work, existing utilities, street improvements, Materials, or equipment and facilities must be promptly rebuilt, restored, repaired, corrected, or replaced by the Contractor, at the Contractor's expense, regardless of the cause of damage.

Exceptions to the above are limited exclusively to the following:

1. Damage to the permanent Work caused by acts of nature, such as earthquake, flood, or other cataclysmic phenomenon of nature.
2. An act of the public enemy or a government authority.
3. A slide occurring on a finished slope after the Physical Completion Date of the Work. This exception does not apply when damages are due to the Contractor's failure to comply with any contractual responsibilities or to perform sound engineering and construction practices in the conduct of the Work, or to take reasonable precautions under the circumstances.
4. Third party damage or vandalism occurring after the Physical Completion Date.

If Work is delayed as a result of damage by others not party to the Contract, an extension of time will be evaluated as specified in Section 1-08.8.

Damage qualifying under any of the exceptions listed in Section 1-07.13(1) must be corrected promptly upon request, and payment will be made as specified in Section 1-04.3. Where public safety is affected and an emergency exists, the Engineer may elect to accomplish repair by Owner or other forces as specified by Section 1-05.8.

The contents of this Section do not relieve the Contractor of responsibility for, or damage resulting from, the Contractor's, or Subcontractors, operations or negligence, nor is the Contractor relieved from full responsibility for making good any defective Work or unauthorized Work.

The Contractor is solely responsibility for:

- a. Damage to property located within or outside the Project Site limits as a result of the Contractor's construction operation; and

1 b. Any pollution of a river, stream, ground water, or other water that may occur as a result of the Contractor's
2 construction operation.

3 **1-07.13(2) RELIEF OF RESPONSIBILITY FOR COMPLETED WORK**

4 Upon written approval from the Owner, the Contractor may be relieved of the responsibility of maintaining and protecting
5 certain portions of the Work, as described in this Section that have been completed in all respects as specified in the Contract.
6 Such release will not affect any past, present, or future claims rights of the City. The Contractor is not relieved from damage
7 resulting from any flaw or defect in Materials incorporated into or workmanship of the completed Work or the ongoing
8 operations or negligence of the Contractor or any of its Subcontractors.

9 Portions of the Work for which the Contractor may be relieved of the responsibility of maintenance and protection as
10 provided in Section 1-07.13(1) include but are not limited to:

- 11 1. The completion of at least 2 city blocks, or approximately 1/4 mile, of roadway including the traveled way, shoulders,
12 drainage control facilities, planned roadway protection Work, lighting, and any required traffic control and access
13 facilities.
- 14 2. A bridge or other Structure of major importance.
- 15 3. A complete unit of a traffic control signal system or street lighting system.
- 16 4. A complete unit of permanent street protection Work.
- 17 5. A building that is functionally complete and open to the public.
- 18 6. Any Contract Bid Item.

19 **1-07.13(3) RELIEF OF RESPONSIBILITY FOR DAMAGE BY PUBLIC TRAFFIC**

20 When it is necessary for traffic to use a roadway facility during construction, the Contractor will be relieved of
21 responsibility for damage to permanent Work caused by traffic under the following circumstances:

- 22 1. The Work is as specified in the Contract or approved Drawings;
- 23 2. The Work is on a section of roadway required by the Contract to be opened to traffic; and
- 24 3. The traffic control is per the approved traffic control plans.

25 If traffic is relocated to another section of roadway, the Contractor must resume responsibility for the Work until the
26 section of roadway is again open to traffic or the Contractor submits a written request for Work that is completed to a point
27 where relief can be granted as specified in Section 1-07.13(2).

28 **1-07.13(4) REPAIR OF DAMAGE**

29 The Contractor must promptly repair all damage to either temporary or permanent Work as directed by the Engineer. For
30 damage qualifying for relief under Sections 1-07.13(2) or 1-07.13(3), payment will be made as specified in Section 1-04.3.
31 Payment will be limited only to repair of damaged Work. No payment will be made for delay or disruption to the Work.

32 The Engineer may elect to accomplish repair by its own forces or other means.

33 **1-07.14 RESERVED**

34 **1-07.15 TEMPORARY CONSTRUCTION STORMWATER POLLUTION PREVENTION**

35 During Work, the Contractor must incorporate practices that prevent erosion, or control erosion when erosion is
36 unavoidable, and must make every effort to maintain effective erosion and sediment controls throughout the Work including
37 implementing timely corrective actions as may be necessary. Sediment must not enter any surface water, drainage facility, and
38 natural drainage system, and must be prevented from transport beyond the Project Site. Work must comply with SPU Director
39 Rules 2009-004, based on SMC Chapters 22.800 through 22.808 and other codes addressing grading, stormwater control,
40 ground water control, and other construction controls. Existing Project Site trees, vegetation, and soil must be protected as
41 specified in Section 1-07.16. See Section 8-01 for Specifications related to the CSECP, TVSPP, and TDP.

42 The Stormwater Code is found at:

43 <http://www.seattle.gov/dpd/codesrules/codes/stormwater/default.htm>

44 The Construction Stormwater Control Technical Requirements Manual is found at:

45 <http://www.seattle.gov/dpd/codes/dr/DR2009-16.pdf>

46 **1-07.15(1) SPILL PLAN**

47 The Contractor must prepare a project specific SP to be used until the Physical Completion Date. The SP must be
48 submitted to the Engineer before the commencement of any Project Site construction activities as specified in Section 1-
49 05.3(5). Occupational safety and health requirements that may pertain to SP planning are contained in, but not limited to, WAC
50 296-824 and WAC 296-843. See Section 8-01 for SP requirements.

51 If potential Contaminated Material(s) or potential Dangerous Waste(s) are discovered during construction, see Section 1-
52 07.29.

1 1-07.16 PROTECTION AND RESTORATION OF PROPERTY**2 1-07.16(1) PRIVATE AND PUBLIC PROPERTY**

3 The Contractor must protect Real Property within or adjacent to the Project Site from damage or destruction, including
4 improvements thereto and fixtures found under or upon, and all personal property located within or adjacent to the Project Site
5 that is not designated for repair, replacement or removal. The Contractor must minimize interference with the use of such
6 property.

7 The Contractor must, at no additional cost to the Owner, provide and install safeguards acceptable to the Engineer to
8 protect public and private property. If public or private property is damaged or destroyed or its use interfered with by the
9 Contractor, the Contractor's agents, or the Contractor's employees, such interference must be terminated and damaged or
10 destroyed property repaired and restored immediately to its former condition by the Contractor at the Contractor's expense,
11 unless otherwise directed. Property owners, such as public and private utilities and railroads, that typically repair or maintain
12 their own property, reserve the right to repair all or part of the damage at the Contractor's expense. Should the Contractor
13 refuse or not respond promptly to a written request to restore damaged or destroyed property to its original condition, the
14 Engineer may have such property restored by other means at the Contractor's expense as specified in Section 1-05.8.

15 The Contractor must be aware that underground electrical transmission and distribution conduit and duct banks are
16 surrounded with cementitious fluidized thermal bedding that must not be disturbed.

17 The Contractor is alerted to the existence of cast iron Water Main and of thrust block for Water Main within the Right of
18 Way. Cast iron pipe joints have been known to develop leakage when disturbed by shifting earth, excessive vibrations, or
19 adverse impacts of any other construction excavation Work. Thrust blocks, typically placed against Water Main tees, bends,
20 and dead ends, provide resistance to forces within the Water Main to prevent separation or other conditions that may lead to
21 leakage of the Water Main. Thrust blocks typically extend beyond the Water Main and depend both on soil friction and on
22 passive soil resistance. The Contractor must take additional preventative measures both to eliminate adverse impact to cast
23 iron Water Main, and to not disturb existing Water Main thrust block and the soils surrounding the thrust block.

24 1-07.16(1)A MONUMENT PROTECTION

25 Do not perform Work under any circumstances that would remove, adjust, destroy, cover, or otherwise make a survey
26 point or monument no longer visible or readily accessible without the Department of Natural Resources (DNR) survey
27 monument permit. The Contractor must not remove or destruct any monument until the monument has been tied out and the
28 Contractor has provided the Engineer with a copy the DNR permit authoring the removal or destruction of the monument per
29 WAC 332-120. See Section 1-07.28 for contact information.

30 The Contractor must protect all monument tie out reference points and witness monuments until the monument has been
31 reset and the Contractor has completed the DNR report form, provided the Engineer a copy, and forwarded it to DNR per
32 WAC 332-120.

33 1-07.16(2) TREE, VEGETATION, AND SOIL PROTECTION

34 All trees, vegetation, and soil not designated for removal must be left in place and protected from damage. If a Bid Item is
35 provided on the Bid Form, the Contractor must develop a specific TVSPP. The TVSPP must show location of Best
36 Management Practices (BMPs) related to the protection of existing trees not designated for removal, new trees including roots,
37 vegetation, and soil, as specified in Section 8-01.

38 Tree and other vegetation not ordered or designated for removal that are destroyed or damaged by the Work must be
39 replaced or mitigated by the Contractor at no cost to the Owner, for the diameter inches of branch and/or root loss as
40 determined by the Engineer.

41 Unless otherwise required, replacements must be of the same species and, as nearly as possible, the same size as the
42 tree or vegetation to be replaced. The Contractor must allow at least 2 Working Days advance notice for inspection and
43 approval of replacement stock by the Engineer. Where physical limitations prevent full restoration vegetation to mitigate
44 damages, the Contractor will be assessed damages as the difference in the dollar value between the tree or vegetation being
45 replaced and the tree or vegetation material provided based on the Guide for Plant Appraisal prepared by the Council of Tree
46 and Landscape Appraisers, current edition, should such difference be determined by the Engineer. Damages assessed will be
47 deducted from moneys due or that may become due the Contractor.

48 Disturbed soils, including but not limited to any areas that had vehicle traffic, materials storage, or vegetation removal as
49 well as areas that have been graded, ripped, stripped, or trenched must be amended and restored as specified in Section 8-
50 02.

51 Tree trimming or removal in ROW frontage with overhead power lines and/or tree trimming or removal within 10 feet of
52 METRO or Streetcar overhead trolley wires requires the advance notification specified in Section 1-07.28.

53 1-07.16(3) FENCES, MAILBOXES, AND MISCELLANEOUS ITEMS

54 The Contractor must enclose the Project Site by installing and maintaining temporary fencing when Work is within
55 easements or abuts private property. The Contractor is liable for all damages arising from noncompliance with this Section.

56 The Contractor must comply with all requirements of the U.S. Postal Service for maintenance and relocation of postal
57 service, collection, and mail receptacles. Where U.S. Postal Service Structures need to be temporarily relocated, the
58 Contractor must make the notification specified in Section 1-07.28. Information to be provided to the Post Office includes the

1 Location I.D. Number included on the box label or, if no label, the street location; date needed for temporary relocation, and
2 approximate date the area impacted by construction will be completed. All U.S. Postal Service Structure relocation will be
3 done by the U.S. Post Office. Do not impair access to existing or temporarily relocated postal Structures. Upon completion of
4 the Work which required the relocation of mail receptacles, the Contractor must notify the U.S. Postal Service that the box may
5 be reinstalled.

6 Before any Work limits access to, or disturbs existing mail receptacles or newspaper boxes, the Contractor must make
7 the notifications specified in Section 1-07.28. The temporary location must not impair their accessibility and usefulness. As
8 soon as possible, the receptacles or boxes must be reinstalled at their original location, or at other locations directed by the
9 Engineer. New supports or boxes are not required unless the original boxes or posts were damaged by the Contractor.
10 Replacement or repairs to supports or boxes damaged by the Contractor are at the Contractor's expense. Mailbox height must
11 be per U.S. Postal Service requirements.

12 Where sprinkler systems are encountered in the planting strip, the Contractor must carefully remove the existing sprinkler
13 system for reinstallation by the Contractor after the Work in the planting strip is complete.

14 **1-07.16(4) SEATTLE MONORAIL**

15 Adjacent to the Seattle Monorail columns, excavation is restricted within the zone measured at street level, 5.5 ft. from
16 the center of each column, perpendicular to the column face, forming a rectangle around the column and extending outward
17 and downward at 45 degrees. Nearby excavations must be monitored to assure footing stability. Any Work to be performed in
18 or near the restricted area must have prior approval from the Seattle Center director. Excavations in the restricted area may
19 be possible provided a professional engineer designs a site specific support system and the Seattle Center gives written
20 approval.

21 At or above grade: The piers above ground level must not be moved, nor can any items such as lighting or signage be
22 attached to the piers without prior written consent from the Seattle Center director. Monorail piers must not be painted.
23 Landscaping must not occur adjacent to piers or within 10 feet of a Monorail structure without prior written consent of the
24 Seattle Center Director. Any construction activity in the area of the power rails must comply with OSHA guidelines and must
25 comply with WAC 296.45 for working around high voltage. Construction equipment must remain outside the 14-foot-
26 operational envelope from each side of the beam at all times except for permitted work windows when allowed by the Seattle
27 Monorail facilities.

28 Contractors must employ spotters and must provide a method to delineate the operational envelope when any
29 construction activity occurs within 25 feet of the beams.

30 For notification requirements for Work adjacent to Seattle Monorail facilities, see Section 1-07.28, item 5.

31 **1-07.16(5) PAYMENT**

32 All costs for the protection of property and for the repair or restoration of damaged or destroyed property, as specified in
33 Section 1-07.16, will be considered incidental to the Work. These costs will be included in the Bid Item prices for the various
34 Bid Items of Work listed in the Bid Form.

35 **1-07.17 UTILITIES AND SIMILAR FACILITIES**

36 **1-07.17(1) GENERAL**

37 Locations and dimensions shown on the Drawings for existing facilities and utilities are per available information obtained
38 without uncovering, measuring, or other verification.

39 The Contractor must protect private and public utilities, including appurtenances thereto, and other facilities encountered
40 during the Work from damage. Utilities include Sewer and Storm Drain systems; water transmission and distribution systems;
41 electrical transmission and distribution systems; natural gas distribution and transmission systems; telephone, telegraph,
42 telecommunications, and CATV systems; fiber optic systems; fire alarm systems; petroleum pipe lines; steam distribution
43 systems; traffic control systems; power lines; METROKOC trolley lines and feeders; rail transit infrastructure and
44 appurtenances; pipelines, pipeline systems, transmission pipelines, and underground facilities per RCW 19.122; and other
45 similar facilities and systems.

46 Cast iron Water Main and some Puget Sound Energy (PSE) gas distribution facilities are known to be sensitive to
47 excessive vibration, possibly resulting in leakage. The Contractor must exercise appropriate care when construction is near
48 such facilities and must cooperate with these facility owners in protecting infrastructure.

49 Public and private utilities, or their contractors, will furnish all Work necessary to adjust, relocate, repair, inspect, or
50 construct their facilities unless otherwise provided for in the Contract or as directed by the Engineer. Where it is necessary to
51 remove or relocate utilities and facilities to accommodate the Work, the removal or relocation may be accomplished in
52 advance of construction. If this removal or relocation is performed concurrently with the Work, the Contractor must coordinate
53 the Contract Work with that of the utilities' or facilities' owner or contractor so as to cause the least possible interference with
54 both kinds of work. Where a utility or facility has not been removed or relocated before the Contractor starts the Work at the
55 point affected, the Contractor must note the presence of the facility and immediately notify the Engineer in writing.

56 Attention is directed to the possible existence of underground utilities and facilities that are not shown on the Contract.
57 The Contractor must comply with all applicable laws and notify all necessary parties, including the one number locator service,
58 upon discovery of any utilities or facilities not shown on the Contract. When the relocation of these utilities or facilities is

1 necessary to accommodate the Work, the Engineer will provide for the relocation of these utilities or facilities by other forces,
2 or the relocation must be performed by the Contractor as extra Work under a Change Order.

3 The Contractor may encounter side Sewers during Work operations. Side Sewers typically extend from a tee or wye
4 connection on a Sewer or Storm Drain to a property. Beyond the property line, the side Sewer may be a single pipe or may
5 branch into multiple pipes. Up to date plats of as-built side Sewer constructions are maintained by the SPU geographic
6 information systems (GIS) staff. GIS mapping is at the Seattle Department of Construction and Inspections side Sewer and
7 Drainage counter at the Seattle Municipal Tower, 20th floor, or online at the SDCI website
8 <http://web1.seattle.gov/dpd/sidesewercardsv2/> or by e-mail request: sidesewerinfo@seattle.gov. It is the Contractor's
9 responsibility to locate and protect these existing side Sewers.

10 The Contractor is also alerted to the existence of RCW 19.122, an act relating to governing exposure of underground
11 utilities facilities and prescribing penalties for non-compliance. Section 1-07.28 prescribes certain notification to be made by
12 the Contractor; however, does not include all notification that may be necessary. Any cost or scheduling impact incurred by the
13 Contractor by reason of Contractor's required compliance with these statutory and contractual provisions is borne by the
14 Contractor. Excavation must not start until all known utilities and facilities near the excavation area have been located and
15 marked, and the Contractor has complied with all applicable provisions of RCW 19.122.

16 The right is reserved to the Engineer and the owner of utilities and facilities, or their authorized agents, to enter on the
17 Right of Way for the purpose of making changes, connections, inspections, or repairs to their facilities, and to monitor
18 construction on or near their utility or facility. The Contractor must cooperate with forces engaged in this work and must avoid
19 any unnecessary delay or hindrance to work or monitoring being performed by other forces. It is the Contractor's responsibility
20 to make all notifications and applications needed to effectively coordinate utility and Contractor Work.

21 Should the Contractor desire to have an adjustment in line or grade made on a utility or other improvement for the
22 Contractor's convenience and the rearrangement is in addition to, or different from, that specified in the Contract, the
23 Contractor must make all necessary notifications and applications with the owner of the utility or other improvement for such
24 rearrangement and bear all expenses in connection with that work, as specified in Section 1-05.3(6).

25 The Contractor may encounter private water service utilities during Work operations. The public portion of the water
26 service typically extends from the tap on a Water Main to the water meter and then to the union. Beyond the union, these
27 private water-service utilities may be either a single water-service utility from the water meter or a multiple water-service utility
28 from the water meter. Records of these utilities are not maintained by the Engineer and therefore do not appear on the
29 Drawings and will not be field located by Seattle Public Utilities. The locations of these private utilities can usually be
30 ascertained by relative meter location, residence location, or through discussion with various private property owners. It is the
31 Contractor's responsibility to locate and protect these private water services from damage.

32 The Contractor is responsible for providing, as necessary, temporary water supply connections to mitigate conflict with
33 private water services during construction, at no additional cost to the Owner.

34 In all cases, the Contractor must repair private water service lines it damages, at the Contractor's expense. The
35 Contractor must notify the Engineer immediately of any such damage and must start repairs immediately and work
36 continuously until water service is restored. Repair of damaged private water service lines will be inspected by Seattle Public
37 Utilities or applicable water utility before backfilling.

38 Except as otherwise provided in the Contract, all costs incurred by the Contractor in complying with Specifications of this
39 Section are included in the Bid Item prices for the various Bid Items of Work listed in the Bid Form. If others delay or otherwise
40 adversely affect the Work through late or improper removal or relocation or inspection of any utility or similar facility, the
41 Contractor's loss of time or increased cost, or both, may be adjusted as specified in Section 1-08.8.

42 **1-07.17(2) UTILITY CLEARANCES**

43 **1-07.17(2)A WATER MAIN CLEARANCES**

44 All utilities, both public and private, passing over, under, or parallel to existing Water Main within clearances specified in
45 Section 1-07.17(2)A must be coordinated with Water Operations at least 15 Working Days in advance of construction for
46 approval of, and coordination with, the Engineer. See Section 1-07.28, item 8) for required notifications. Provide a minimum of
47 5 feet separation horizontally from a ductile iron Water Main and 18 inches separation vertically under an existing Water Main.

48 Notifications regarding shutdowns of Water Mains or obstructions of hydrants and valves or not meeting clearance
49 requirements must be as specified in Section 1-07.28, item 8).

50 Except for gas utilities, specified in Section 1-07.17(2)D, and cast iron Water Main facilities, specified in Section 1-
51 07.17(2)A3, if a separation less than any specified clearance is unavoidable, the space between the Water Main and the other
52 non-gas utilities must be filled with polyethylene plastic foam material, as specified in Section 9-05.10, before backfilling.

53 **1-07.17(2)A1 WATER MAIN WITH SEWER, SIDE SEWER, STORM DRAIN, AND COMBINED SEWER**

54 Where possible, Sewer and Storm Drain must be laid at a lower invert elevation than Water Main. See Standard Plans.
55 286a and 286b.

56 All Water Main must be spaced apart horizontally from Sewer and Storm Drain a minimum of 10 feet, measured center to
57 center, except the spacing may be reduced to the following nearest point measurements:

- 58 1. Five feet horizontal when the Water Main is a ductile iron Water Main;

- 2. Less than 5 feet horizontal when the Water Main is ductile iron; and:
 - a. The Sewer is constructed of materials and with joints that are equivalent to Water Main standards, including pressure testing requirements for a 5-foot distance clear of Water Main.
 - b. The bottom of the Water Main is at least 18 inches above the top of the Sewer.

New Water Main crossing over Sewer and Storm Drain must be constructed of ductile iron and must be spaced to provide a minimum vertical separation of 18 inches between the bottom of the Water Main and the top of the Sewer and Storm Drain. In addition to the above requirements, protect Water Mains passing under Sewer and Storm Drain by providing:

- 1. A minimum vertical spacing of 18 inches between the bottom of the Sewer / Storm Drain, and the top of the Water Main.
- 2. Adequate support for the Sewer and Storm Drain to prevent excessive deflection of joints and settling on the Water Main.
- 3. The point of crossing centered between 2 successive joints of the Water Main pipe.

When the Water Main is existing and new side Sewer is being installed or reconnected, the following requirements of SMC Chapter 21.16 apply:

- a. Use ductile or cast iron pipe for all side Sewer crossing over Water Mains, for a perpendicular distance of at least 5 feet clear from the center of the Water Main.
- b. Side Sewer laid below Water Main must be laid at least 18 inches below and 5 feet horizontal, from all Water Main and water service line as measured from the nearest points, unless ductile or cast iron pipe is used for the side Sewer to at least 5 feet clear from the centerline of the Water Main.

1-07.17(2)A2 NEW WATER MAIN CLEARANCE WITH GAS MAIN

New Water Main to be installed crossing over or under existing gas facilities must comply with the minimum vertical clearance specified in Sections 1-07.17(2)D or 1-07.17(2)A, whichever is greater. New Water Main installed within the vertical clearance specified in Section 1-07.17(2)D must have a protective wrap and extend for the entire distance of all specified clearances.

New Water Main to be installed parallel to existing gas facilities must be at least 5 horizontal feet clear of the gas facility. If the minimum horizontal clearance is less than 5 feet but greater than 3 feet as specified in Section 1-07.17(2)D, provide a protective wrap on the Water Main.

The protective wrap must consist of either a split PVC pipe or PVC wrapping of at least 0.04 inches thickness, applied to all Water Main for a distance at least 5 feet clear of the gas facility.

1-07.17(2)A3 CAST IRON WATER MAIN

- Cast iron Water Main in Seattle’s Right of Way must be protected as specified in Section 1-07.16(1). Horizontal separation from cast iron Water Main must be at least 10 feet.

The clearances specified in Section 1-07.17(2)A1 also apply to all existing cast iron Water Main, water services, hydrants and hydrant connections, vaults, and chambers. Thrust blocks supporting cast iron water pipe typically at tees, bends, and dead ends. Standard thrust block applications are shown on Standard Plans 300a, 300b, 300c, 330a, 330b, 331a, 331b, 340a and 340b.

When smaller separations or clearances are unavoidable, the use of polyethylene plastic foam is not allowed, and the Contractor must notify the Engineer as specified in Section 1-07.28 item 8).

Where cast iron water distribution and transmission pipe line exists and any excavation approved by the Engineer is within the clearances specified in Section 1-07.17(2)A1, the Contractor’s protective system must be a support system as specified in Section 2-07. Shield systems are not allowed.

1-07.17(2)B CLEARANCES AMONG SEWER AND/OR STORM DRAIN

Whenever a new Sewer or Storm Drain clears an existing or new Sewer or Storm Drain by 6 inches or less, polyethylene plastic foam, as specified in Section 9-05.10, must be placed between the pipes as a cushion before backfilling.

1-07.17(2)C CLEARANCES WITH ELECTRICAL DISTRIBUTION AND TRANSMISSION SYSTEMS

Whenever a proposed excavation is within 15 feet of an underground electrical distribution or transmission facility of any kind, the Contractor must make the notification specified in Section 1-07.28.

See Section 1-05.2(2) for information regarding the Contractor’s obligations for Project Site safety and cooperation with SCL’s Electrical Safety Observer when excavation is near an underground electrical facility.

Proposals for tree planting, trimming, or removal near electrical distribution and transmission systems require the Contractor to make the applicable advance notification specified in Section 1-07.28, as follows:

- 1. Within 10 feet of overhead electrical lines less than 50Kv or within 16.5 feet of overhead power lines 50Kv or higher, .
- 2. Within 10 feet of METRO trolley wire, Streetcar overhead wires, or Sound Transit Link Light Rail wires.
- 3. Within 10 feet or more feet of varying voltage electrical transmission lines.

1 4. Within 15 feet of Seattle Monorail guideway.

2 Do not disturb the cementitious fluidized thermal backfill that surrounds underground electrical conduits and duct banks.

3 **1-07.17(2)D GAS MAIN CLEARANCES WITH HEAT GENERATING UTILITIES AND NON-HEAT GENERATING**
 4 **UTILITIES**

5 Heat generating facilities must include electrical distribution and transmission including grounds, steam facilities, and
 6 other heat generating sources.

7 Non-heat generating utilities clearance requirements:

8 1. For high-pressure gas main and service lateral, and for gas transmission line:

9 a. If a utility is parallel to the gas facility, then horizontal clearance must be at least 3 feet.

10 b. If a utility crosses over or under the gas facility, then vertical clearance must be at least 3 feet.

11 2. For non-high pressure gas main and service lateral except gas transmission line:

12 a. If a utility is parallel to the gas facility, then horizontal clearance must be at least 1 foot.

13 b. If a utility crosses over or under the gas facility, then vertical clearance must be at least 6 inches.

14 A utility must never make contact of any kind with a gas facility.

15 Heat generating utilities clearance requirements: For installing heat generating utilities within any gas facility clearance
 16 specified in this Section, the Contractor must make the notification specified in Section 1-07.28 and must come to agreement
 17 with the gas facility owner on protection to be provided before this construction starts.

18 The gas facility owner may require a protective split sleeve to surround the gas facility to a distance beyond specified
 19 clearances, and the Contractor must provide such protection.

20 **1-07.17(2)E TREE CLEARANCES**

21 Planting of new trees must comply with the tree clearance requirements shown on Standard Plan 030.

22 **1-07.17(2)F STANDARD LOCATION FOR UTILITIES – RESIDENTIAL STREET**

23 Utilities located on residential streets must comply with the location standards and clearances shown on Standard Plan
 24 030.

25 **1-07.18 INSURANCE**

26 **1-07.18(1) MINIMUM INSURANCE COVERAGE, LIMITS AND OTHER REQUIREMENTS**

27 Insurance must provide the minimum coverages and limits of liability and comply with all other requirements in this
 28 Section. Providing evidence of coverage for these stated minimum limits of liability does not relieve the Contractor, any
 29 Subcontractor of any tier, or their respective insurers from liability for claims in excess of such stated minimum limits of liability.

30 If Work is subcontracted, applicable minimum coverages and limits of liability may be evidenced by any Subcontractor as
 31 specified in Section 1-07.18(5) provided that such insurance fully meets the applicable requirements set forth herein and
 32 includes the City of Seattle as an Additional Insured as specified in Section 1-07.18(2).

33 **1-07.18(1)A COMMERCIAL GENERAL LIABILITY (CGL) INSURANCE**

34 CGL insurance must include coverage for:

35 1. Premises/Operations

36 2. Products/Completed Operations

37 3. Personal/Advertising Injury

38 4. Contractual

39 5. Independent Contractors

40 6. Stop Gap, unless insured as Employers Liability under Part B. of a Workers Compensation Insurance Policy

41 7. Per project aggregate per ISO CG 25 03 (Aggregate Limits of Insurance per project) or Equivalent

42 8. Blasting, if explosives are used in the performance of the Work

43 Such insurance must provide a minimum limit of liability of \$1 Million each Occurrence Combined Single Limit Bodily
 44 Injury and Property Damage (CSL) except \$1 Million each Offense Personal/Advertising Injury and \$1 Million each Accident/
 45 Disease - Policy Limit/ Disease - each Employee Stop Gap or Employers Liability.

46 **1-07.18(1)B AUTOMOBILE LIABILITY INSURANCE**

47 Automobile Liability for owned, non-owned, hired, and leased vehicles, as applicable, with a minimum limit of liability of
 48 \$1 million CSL. If pollutants are to be transported, MCS 90 and CA 99 48 endorsements are required on the Automobile
 49 Liability insurance policy unless the transportation pollution risk is covered under the Contractor's Pollution Liability insurance
 50 policy.

1 **1-07.18(1)C STATE OF WASHINGTON STATUTORY WORKERS' COMPENSATION INSURANCE**

2 The Contractor must comply with Workers' Compensation coverage per Title 51 RCW.

3 **1-07.18(1)D RESERVED**

4 **1-07.18(1)E RESERVED**

5 **1-07.18(1)F RESERVED**

6 **1-07.18(1)G RESERVED**

7 **1-07.18(1)H RESERVED**

8 **1-07.18(1)I RESERVED**

9 **1-07.18(1)J RESERVED**

10 **1-07.18(1)K RESERVED**

11 **1-07.18(1)L RESERVED**

12 **1-07.18(1)M RESERVED**

13 **1-07.18(1)N RESERVED**

14 **1-07.18(1)O RESERVED**

15 **1-07.18(1)P RESERVED**

16 **1-07.18(2) GENERAL REQUIREMENTS (DO NOT APPLY TO STATE OF WASHINGTON STATUTORY WORKERS'**
17 **COMPENSATION INSURANCE)**

18 No Work is to begin until documentation of insurance has been delivered to and approved by the Owner. The Contractor
19 must keep required insurance in force at all times during the term of the Contract. The term insurance includes but is not
20 limited to self-insurance, alternative risk transfer techniques, capital market solutions, or any other form of risk financing.

21 Each insurer must either be authorized to do business in the State of Washington and maintain A.M. Best's ratings of A-:
22 VII or higher, or procured as surplus lines per RCW Chapter 48.15 , except as otherwise approved by the Owner.

23 The City of Seattle must be included as an Additional Insured for primary and non-contributory basis with respect to
24 insurance coverages specified in Sections 1-07.18(1)A, 1-07.18(1)B, and if required, 1-07.15(1)G. For CGL insurance,
25 Automobile Liability, and Contractor's Pollution Liability Insurance, if required, such additional insured status must:

- 26 1. Be evidenced by an ISO endorsement form CG 20 10 or equivalent designated or blanket additional insured
- 27 endorsement or policy language;
- 28 2. Be primary and non-contributory as respects the Owner's insurance; and
- 29 3. Contain a separation of insureds provision.

30 ISO endorsement form CG 20 12 or equivalent endorsement or blanket additional insured language limiting additional
31 insured status to governmental permitting does not satisfy the requirements of this paragraph. For Automobile Liability
32 insurance, such additional insured status must be evidenced by ISO endorsement form CA 20 48 or equivalent designated or
33 blanket additional insured endorsement or policy language, must be primary and non-contributory for the Owner's insurance,
34 and must contain a separation of insureds provision.

35 Written notice of cancellation must be delivered or mailed to the Owner not less than 30 Days before the effective date of
36 any cancellation except for cancellation for non-payment of premium, which cannot be less than 10 Days before such date,
37 unless a longer period of written notice is required under RCW 48.18.290 for cancellation by insurer.

38 Notice under this paragraph must be issued to: City Purchasing and Contracting Services, Department of Finance and
39 Administrative Services, 700 Fifth Avenue, Suite 4112, P.O. Box 94687, Seattle, WA 98124-4687.

40 If emailed, send as a PDF or XLS format attachment to Judy.Keefe@Seattle.Gov.

41 Failure on the part of the Contractor to maintain the insurance as required constitutes a material breach of Contract, on
42 which the Owner may, after giving 5 Business Days notice to the Contractor to correct the breach, may immediately terminate
43 the Contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with
44 any sums so expended to be repaid to the Owner on demand, or at the sole discretion of the Owner, offset against funds due
45 the Contractor from the Owner.

46 Any self-insured retention (S.I.R.) in excess of \$25,000 that is not fronted by an insurer must be disclosed and is subject
47 to the Owner's approval. Upon request by the Owner, the Contractor must furnish financial information that the Owner may
48 reasonably require to assess the Contractor's risk bearing capacity, and must provide a written statement that the Contractor
49 will defend and indemnify the Owner against any claim within the Contractor's S.I.R. at least to the same extent that coverage
50 would be afforded to the Owner under the relevant insurance policy meeting the requirements stated herein. The Contractor is
51 responsible for the cost of any payments for defense and indemnity falling within the S.I.R.

1 The Contractor and/or any Subcontractor of any tier must comply with all of a railroad's risk management requirements
2 including purchasing Railroad Protective Liability Insurance before performing construction services work adjacent to or on a
3 railway's Right of Way and/or property.

4 All costs for insurance are incidental to and included in the unit or lump sum Bid Item prices of the Contract and no
5 additional payment will be made.

6 **1-07.18(3) SUBCONTRACTOR INSURANCE**

7 The Contractor must contractually require that each Subcontractor of every tier maintain at a minimum the insurance
8 coverages specified in Sections 1-07.18(1)A and 1-07.18(1)B for a value commensurate with their subcontract value, and
9 include the City of Seattle as an Additional Insured for primary and non-contributory limits of liability.

10 **1-07.18(4) NO LIMITATION OF LIABILITY; ADDITIONAL INSURED**

11 The limits of liability specified herein are minimum limits only. Such minimum limits of liability requirements are not
12 construed to limit the liability of the Contractor, that of any Subcontractor of any tier or of any of their respective insurers. Any
13 provision in any Contractor or Subcontractor insurance policy that limits available limits of liability to those specified in a written
14 agreement or contract does not apply and all insurance policies, with the exception of Professional Liability and Workers
15 Compensation, must include the City of Seattle as an additional insured for primary and non-contributory limits of liability for
16 the full valid and collectible limits of liability maintained by the Contractor or Subcontractor, whether such limits are primary,
17 excess, contingent or otherwise. This provision applies regardless of whether limits maintained by the Contractor are greater
18 than those required by this Contract, and regardless of whether the certification of insurance provided by a Subcontractor of
19 any tier under Section 1-07.18(3) specifies lower minimum limits than those specified for or maintained by the Contractor.

20 **1-07.18(5) EVIDENCE OF INSURANCE (DOES NOT APPLY TO STATE OF WASHINGTON STATUTORY 21 WORKERS' COMPENSATION)**

22 The Contractor must provide the Owner documentation of insurance meeting these requirements before Execution. The
23 documentation must include the following:

- 24 1. An ACORD certificate or equivalent form fully disclosing all coverages and limits of liability maintained.
- 25 2. A copy of the additional insured endorsement or blanket additional insured language to the Commercial General
26 Liability and, if required, Pollution Liability insurance documenting that the City of Seattle is an additional insured for
27 primary and non-contributory limits of liability and, if required, Products and Completed Operations Additional Insured;
28 a statement of additional insured status on an ACORD or other form of certificate of insurance will not satisfy this
29 requirement.
- 30 3. A copy of each policy's Declarations page and schedule of forms and endorsements.
- 31 4. Any other policy language or endorsements that documents compliance with these requirements, including CA 99 48
32 and MCS 90 endorsements, if required.
- 33 5. An All Named Insured Endorsement is required if the Contractor's name on the ACORD certificate, Declaration
34 Page(s), or Schedule of Forms is different from the legal name of the Contractor on the Bid Form.

35 Should any insurance policy neither be issued nor delivered to the named insured Contractor at the time it delivers the
36 signed Contract for the Work, the Contractor must deliver and maintain on file with the City, binders of insurance evidencing
37 compliance with the requirements. As soon as practicable after delivery of the policy, the Contractor must deliver the insurance
38 certification specified above.

39 At any time upon the Owner's request, the Contractor must forward to the Owner a true and certified copy of any
40 insurance policy.

41 Certification of insurance must be issued to: CPCS, Department of Finance and Administrative Services, 700 Fifth
42 Avenue, Suite 4112, P.O. Box 94687, Seattle, WA 98124-4687.

43 If emailed, send as a PDF or XLS format attachment to Judy.Keefe@Seattle.Gov.

44 **1-07.18(6) INDEMNIFICATION**

45 The Contractor must defend, indemnify, and hold harmless the Owner and its officials, officers, employees, and agents
46 from every claim, risk, loss, damage, demand, suit, action, judgment, and attorney's fee, and any other kind of expense:

- 47 1. On account of injury to or death of any and all persons, or on account of property damage of any kind, whether
48 tangible or intangible, or loss of use resulting there from, arising out of or in any manner connected with the Work
49 performed or to be performed under this Contract; or
- 50 2. Caused or occasioned by the presence of the Contractor's materials, equipment, vehicles, or other personal property
51 on or in proximity to the property of the Owner, or an official, officer, employee, or agent of the Contractor, a
52 Subcontractor, or a Supplier on or in proximity to the property of the Owner, at any time before the Completion Date;
53 or
- 54 3. Caused or occasioned by the Contractor's violation of any applicable law, regulation, or permit, or by the Contractor's
55 breach of this Contract.

1 If the claim, suit, or action for injuries, death, or damage is caused by or results from the concurrent negligence of the
2 Contractor or its officers, agents, or employees and the Owner or its officials, officers, agents or employees, the indemnity
3 provisions are valid and enforceable only to the extent of the Contractor's negligence.

4 The Contractor must also defend, indemnify, and hold harmless any state, county, city, or district and the officials,
5 officers, and employees of the state, county, city, or district connected with the Work within the limits of which county, city or
6 district the Work is being performed, all in the same manner and to the same extent as provided above for the protection of the
7 Owner and the Owner's officials, officers, employees, and agents, provided that no retention of money due to the Contractor
8 will be paid by the Owner except as provided in RCW 60.28, pending disposition of suits or claims for damages brought
9 against the state, county, city, or district.

10 The Contractor assumes all risk of damage to its property, or injury to its officers, directors, agents, Suppliers,
11 Subcontractors, or invitees, in or about the project from any cause, and waives all claims against the Owner. The Contractor
12 further waives, with respect to the Owner only, its immunity under Title 51 RCW Industrial Insurance, or any other worker's
13 compensation law.

14 The Contractor and the Owner acknowledge that the provisions of this Indemnification Section have been negotiated by
15 them, that the Contractor considered these obligations of this Indemnification Section in preparing their Bid, and that the
16 Contract Price reflects this negotiation.

17 Neither the requirement that the Contractor maintain insurance, nor the type or amount of any insurance maintained by
18 the Contractor, are construed as waiving or limiting the Contractor's liability under this Indemnification Section.

19 **1-07.18(7) WORKER'S BENEFITS**

20 The Contractor must make all payments required for unemployment payment under Title 50 RCW and for industrial
21 insurance and medical aid required under Title 51 RCW. If any payment required by Title 50 or Title 51 is not made when due,
22 including payments due from Subcontractors, the Owner may retain such payments from any money due the Contractor and
23 pay the same into the appropriate fund.

24 For Work on or adjacent to water, the Contractor is responsible for ensuring workers are covered under the
25 Longshoremen's and Harbor Worker's Compensation Act administered by the U.S. Department of Labor, or the State
26 Industrial Insurance coverage administered by the Washington State Department of Labor and Industries, or both coverages.

27 The Contractor must include in the Bid, all costs for payment of unemployment payment and for providing either or both
28 of the insurance coverages. The Contractor is not entitled to any additional payment for failure to include such costs, or for
29 determinations made by US DOL or L&I regarding the insurance coverage.

30 The Public Works Contract Division of L&I will provide the Contractor with applicable industrial insurance and medical aid
31 classification and premium rates. The L&I Request for Release form also serves the purpose of obtaining a release with
32 respect to the payments of industrial insurance and medical aid premiums.

33 **1-07.19 GRATUITIES AND ETHICS**

34 The Contractor must not extend any loan, gratuity, or gift of money in any form whatsoever to any employee or officer of
35 the Owner; or to the consultant or employee of consultant under Contract with the Owner for services related to the Work. The
36 Contractor must not rent or purchase any equipment or Materials from any employee or officer of the Owner or the consultant
37 or employee of the consultant.

38 The Contractor must comply with all applicable Sections of the State Ethics law, RCW 42.52, which regulates gifts to
39 Owner's officers and employees. Under that statute, any Owner officer or employee who has or will participate with the
40 Contractor regarding any aspect of this Contract is prohibited from seeking or accepting any gift, gratuity, favor or anything of
41 economic value from the Contractor. Accordingly, neither the Contractor nor any agent or representative may offer anything of
42 economic value as a gift, gratuity, or favor directly or indirectly to any such officer or employee.

43 The Contractor must comply with the City of Seattle's Code of Ethics in SMC 4.16 and all other applicable City codes and
44 ordinances regulating gratuities and ethics.

45 **1-07.20 PATENTED DEVICES, MATERIALS, AND PROCESSES**

46 The Contractor assumes all costs arising from the use of patented devices, Materials, or processes used on or
47 incorporated in the Work, and agrees to indemnify, defend, and save harmless the Owner, and its duly authorized agents and
48 employees from all actions of any nature for, or on account of the use of any patented devices, Materials, or processes.

49 **1-07.21 ROCK DRILLING SAFETY REQUIREMENTS**

50 The Contractor is responsible for maintaining safe working conditions during rock drilling, by keeping dust concentration
51 below the threshold limit value or by providing those protective devices that may be required by L&I, or both.

52 **1-07.22 USE OF EXPLOSIVES**

53 Do not use explosives without written authority of the Engineer; and then only under such restrictions as may be required
54 by the proper authorities. When the use of explosives is necessary, the Contractor's insurance must contain a special clause
55 covering the blasting. Explosives must be handled, marked, stored, and used in strict compliance with Chapter 296 52 WAC
56 and all applicable local laws, rules, and regulations. The stricter provisions apply. For Work within The City of Seattle, the

1 Seattle Fire Code, Article 77, also applies and the individual in charge of blasting must be certified by the Seattle Fire
2 Department. In all cases, the individual in charge of blasting must have a current Washington State Blaster Users License.

3 The Contractor must obtain, comply with, and pay for such permits and costs as may be necessary in conjunction with
4 blasting operations. Copies of the permits must be furnished to the Engineer. For Work within the city limits of Seattle, a permit
5 must be obtained from the Seattle Fire Department.

6 The Contractor must use the utmost care not to endanger life or property, cause slides, or disturb the materials outside
7 the neat lines of the cross-section. Blasting near proposed Structures must be completed before construction on such
8 Structures is undertaken. Do not leave explosives unprotected along or adjacent to any existing public place.

9 The Contractor must provide advance written notice of the location, date, time, and approximate duration of blasting to
10 public and private utilities having facilities near the blast site and any other property owner in the vicinity who may be affected
11 by blasting operations. Notification must be sufficiently in advance that affected entities can take steps to protect their property
12 from damage.

13 **1-07.23 PUBLIC CONVENIENCE AND SAFETY**

14 **1-07.23(1) CONSTRUCTION UNDER TRAFFIC**

15 The Contractor must make the applicable notification specified in Section 1-07.28, and must:

- 16 1. Conduct all operations with the least possible obstruction and inconvenience to the public.
- 17 2. Have under construction no greater length or quantity of Work than can be continuously and vigorously prosecuted
18 properly with due regards to the rights of the public.
- 19 3. To the extent possible, complete each section before starting Work on the next.
- 20 4. Minimize the disruption of traffic by:
 - 21 a. Permitting traffic to pass through the Work with the least possible inconvenience or delay except in those areas
22 where safety and lack of space requires detouring the traffic elsewhere.
 - 23 b. Maintaining existing roads, streets, sidewalks, bikeways, and paths that lie adjacent to or inside the Project Site
24 limits by keeping them open and in good, clean, and safe condition at all times. Deficiencies caused by the
25 Contractor's operation must be repaired at the Contractor's expense. Deficiencies not caused by the Contractor's
26 operations will be repaired by Owner forces at the Owner's expense. The Contractor must also maintain roads,
27 streets, sidewalks, bikeways, and paths adjacent to the Project Site when they are affected by the Contractor's
28 operations.
 - 29 c. Removing or repairing any condition resulting from the Work or Contractor's operations that might impede traffic
30 or create a hazard including the removal of deposits and debris that accumulates on the roadway surface, see
31 Section 1-04.10.
 - 32 d. If the Contractor fails or refuses to clean the streets, trucks, or equipment as required by the Engineer, the
33 Engineer may direct the Work suspended at the Contractor's risk until compliance with the Contractor's obligation
34 is assured. The Engineer may also direct the streets in question cleaned by others and such costs incurred by the
35 Owner in achieving compliance with these Contract requirements, including cleaning of the streets, will be
36 deducted from any progress payment due to the Contractor. The Contractor has no claim for delay or additional
37 costs if the Engineer chooses to suspend the Contractor's Work until compliance is achieved.
 - 38 e. Maintaining existing, permanent signs and not relocating or removing traffic control and street name signs that
39 interfere with construction until absolutely necessary; and installing and maintaining temporary pavement
40 markings and striping on the roadway using temporary pressure sensitive tape when necessary. The Contractor is
41 responsible for scheduling when to renew striping and pavement marking, subject to the Engineer's approval.
 - 42 f. Providing access at all times to emergency traffic such as police, fire, and disaster units. The Contractor is liable
43 for any damage to property or persons, resulting from failure to comply.
 - 44 g. Coordinating construction operations with all disposal firms and transit bus service that may be operating within
45 the Project Site. If METROKC operates in the area of Work, the Contractor must maintain the Project Site in such
46 a manner that transit bus service, including access to bus zones, is safe and convenient. Whenever it is
47 necessary to change METROKC Transit Bus or Trolley Service such as closure or temporary relocation of a bus
48 stop or on-street bus staging area, removal of a bus shelter, closure of or detour of a bus route, construction in a
49 roadway where bus transit is granted access and transit must be made aware of, or requesting a temporary
50 weekend-only diesel bus for an electric trolley, the Contractor must make the notification as specified in Section 1-
51 07.28, item 4).
 - 52 h. Keeping existing traffic signal and lighting systems in operation as the Work proceeds. The Owner will continue
53 the routine maintenance on such systems.
- 54 5. Protect the rights of abutting property owners by:
 - 55 a. Planning and conducting construction operations so that the least inconvenience possible is caused to abutting
56 property owners.

- 1 b. Making the required notification when it is impractical to carry on the construction and maintain traffic
2 simultaneously, or maintain ready and convenient pedestrian and vehicular access to driveways, houses, and
3 buildings along the line of Work.
- 4 c. Posting signs and barricades advising street closure at the nearest intersections away from the closed portion of
5 the street and on all cross streets. Street closings must not exceed 2 blocks in length at any one time unless
6 approved otherwise by the Engineer.
- 7 d. Making the required notification when street closure is required in the preparation of the roadway for placement of
8 asphalt pavement, concrete pavement, Sewer excavation, or other construction that prohibits safe vehicular traffic
9 notifying abutting property owners and tenants of any restrictions that might affect access to their property.
- 10 e. Providing temporary approaches to crossing or intersecting roads and keeping those approaches in good
11 condition.
- 12 f. Providing another access before closing an existing one whenever the Contract calls for removing and replacing
13 an abutting owner's access. Do not close the existing access until the replacement access facility is available.
- 14 6. When traffic must pass through grading areas, the Contractor must:
 - 15 a. Make cuts and fills that provide a smooth, even roadbed.
 - 16 b. Place, in advance of other grading Work, enough fill at all Culverts and bridges to allow traffic to cross.
 - 17 c. Make roadway cuts and fills, if ordered by the Engineer, in partial width lifts, alternating lifts from side to side to
18 allow traffic to pass on the side opposite the Work.
 - 19 d. Install Culverts on half the width of the traveled way, keeping the other half open to traffic and unobstructed until
20 the first half is ready for use.
- 21 7. After rough grading or placing any subsequent layers:
 - 22 a. Prepare the final roadbed to a smooth, even surface free of humps and dips suitable for use by traffic.
 - 23 b. Settle dust with water, or other dust palliative, as directed.
- 24 8. If grading Work is on or adjacent to a roadway in use, the Contractor must complete the grade immediately after
25 rough grading and place surfacing Materials as the Work proceeds.
- 26 9. Conduct all operations to minimize any drop offs, defined as abrupt changes in roadway elevation, left exposed to
27 traffic during Non-Working hours. Unless otherwise directed in the traffic control plan, the Contractor must also
28 protect drop offs left exposed to traffic during Non-Working hours as follows:
 - 29 a. Drop offs up to 0.20 feet may remain exposed with appropriate warning signs alerting motorists of the condition.
 - 30 b. Drop offs more than 0.20 feet that are in the traveled way are not allowed unless motorists are notified about the
31 danger of a drop off immediately ahead of them with appropriate warning signs and protection is provided as
32 specified in the immediately following subparagraphs c.1) or c. 2).
 - 33 c. Drop offs with depths more than 0.20 foot, but no more than 0.50 foot, that are not within the traveled way are not
34 allowed unless motorists are notified about the danger of a drop off immediately ahead of them with appropriate
35 warning signs and further protected by having 1 of the following:
 - 36 1) Channeling devices such as Type I barricades, plastic safety drums, or other devices 36 inches or more in
37 height placed along the traffic side of the drop off and a new edge of pavement stripes placed a minimum of 3
38 feet from the drop off on the traffic side. The number in feet of maximum spacing between the devices is the
39 posted speed number in miles per hour. Signs, warning of pavement drop off, must be placed in advance of
40 and throughout the drop off treatment.
 - 41 2) Temporary concrete barrier or other approved barrier installed on the traffic side of the drop off with 1 foot
42 between the drop off and the drop off side of the barrier, and a new edge of pavement stripe a minimum of 2
43 feet from the face of the traffic side of the barrier. An approved terminal, flare, or impact attenuator will be
44 required at the starting of the barrier facing oncoming traffic. For night use, the barrier must have standard
45 delineation such as paint, reflective tape, lane markers, or warning lights.
 - 46 d. Drop offs more than 0.50 feet not within the traveled way must be marked with appropriate warning signs and
47 further protected as specified in the immediately preceding subparagraphs c. 1) or c. 2) if all following conditions
48 are met
 - 49 1) The drop off is less than 2 feet;
 - 50 2) The total length throughout the project is less than 1 mile;
 - 51 3) The drop off does not remain for more than 3 Working Days;
 - 52 4) The drop off is not present on any of the Holidays listed in Section 1-01.3; and
 - 53 5) The drop off is only on 1 side of the roadway.
 - 54 e. Drop offs more than 0.50 feet that are not within the traveled way and are not otherwise covered by the
55 immediately preceding subparagraph d above must be both protected with appropriate warning signs and with
56 protections as specified in item c. 2) this Section.

1 10. Open trenches within the traveled way must have a steel plate cover placed and anchored over them. Place a wedge
2 of suitable material, if required, for a smooth transition between the existing surface and the steel plate, see Section
3 2-02.3(8). Use warning signs to alert motorists of the presence of the steel plates.

4 11. Castings that are exposed and are not in the plane of adjacent surface due to construction involving the surrounding
5 surface, must have temporary transition tapers on all sides of the exposed casting consisting of temporary pavement
6 patch material or other suitable material to prevent nuisance to traffic.

7 12. Whatever other specific Work the Contract indicates is to be furnished or performed by the Owner or Engineer.

8 **1-07.23(2) PEDESTRIAN CONTROL AND PROTECTION**

9 When the Work area encroaches on a sidewalk, walkway, or crosswalk area, give special consideration to pedestrian
10 safety. Make maximum effort to separate pedestrians from the Work area.

11 Protective barricades, fencing, and bridges, together with warning and guidance devices and signs, must be used so that
12 the passageway for pedestrians is safe and well defined. Whenever pedestrian walkways are provided across excavations,
13 they must be provided with suitable handrails. Footbridges must be safe, strong, free of bounce and sway, have a slip resistant
14 coating, and be free of cracks, holes, and irregularities that could cause tripping. Ramps must be provided at the entrance and
15 exit of all raised footbridges to prevent tripping. Adequate illumination and reflectorization must be provided during hours of
16 darkness. All walkways must be maintained at least 4 feet clear width except in areas of unusually heavy pedestrian traffic
17 such as business districts, where the minimum clear width is 8 feet.

18 Where sidewalks are required to be closed by construction, an alternate walkway must be provided, and to the extent
19 reasonably feasible, the walkway must be ADA compliant including curb ramps and detectable warnings.

20 Where it is necessary to divert pedestrians into the roadway, barricading or channeling devices must be provided to
21 separate the pedestrian walkway from the adjacent vehicular traffic lane. Do not divert pedestrians into a portion of a street
22 used concurrently by moving vehicular traffic.

23 At locations where adjacent alternate walkways cannot be provided, appropriate signs must be posted at the limits of
24 construction site, and in advance of the closure at the nearest crosswalk or intersection, to divert pedestrians to an alternate
25 walkway.

26 Physical barricades, per the current version of the City of Seattle Traffic Control Manual and 2009 MUTCD, must be
27 installed to prevent people with visual impairments from inadvertently entering a Work area or closed construction area.
28 Pedestrian access must be maintained to all properties adjacent to the Work area.

29 **1-07.23(3) SPEED AND PARKING CONTROL**

30 See Section 1-10.3(3)N for alteration of the legal or posted speed limit or parking control.

31 **1-07.24 REAL PROPERTY RIGHTS**

32 Restrictions to access such as Right of Way margins, parcel boundaries, limits of easements and other Real Property
33 rights, and limits of construction permits obtained by the Owner, will be specified in the Contract, but may not always be shown
34 on the Drawings. The Contractor's construction activities are not allowed beyond these restrictions. An exception may be
35 allowed if such exception is the use of private property, and such use of private property is not in violation of a condition in the
36 Contract, arrangements for such use of private property are made before commencement of construction, and the Engineer is
37 informed of such arrangement before use of said property.

38 The Owner will obtain, before the Bid Opening Date, all Real Property rights, both permanent and temporary, necessary
39 for carrying out the Work.

40 Whenever any of the Work is accomplished on or through property except public street Right of Way, the Contractor
41 must comply with and fulfill all covenants and stipulations of any Real Property agreement obtained by the Engineer from the
42 owner of the private property. Copies of the Real Property rights documents will be included in the Project Manual or made
43 available to the Contractor as soon as practical after they have been obtained by the Engineer.

44 The Contractor must not proceed with any portion of the Work on private property where Real Property rights have not
45 been secured. If the Contractor is delayed due to acts of omission on the part of the Owner in obtaining Real Property rights,
46 the Contractor will be entitled to an extension of time. The Contractor agrees that such delay is not a breach of Contract.

47 Each property owner must be notified in advance of the Contractor's entry onto that owner's property under Section 1-
48 07.28. This includes entry onto private property where private improvements must be adjusted.

49 The Contractor is responsible for providing, without expense or liability to the Owner, any additional land and access
50 thereto that the Contractor may desire for temporary construction facilities, storage of Materials, or other Contractor needs.
51 Before using any private property, whether adjoining the Work or not, the Contractor must file a written statement with the
52 Engineer granting permission by the property owner for such property use. Upon vacating the private property, the Contractor
53 must file a written release with the Engineer from the property owner. Each property disturbed or otherwise interfered with by
54 the Contractor for reasons of construction pursued under this Contract requires a written permission and written release. The
55 written permission and written release must be signed by the private property owner, or proper authority acting for the owner of
56 the property affected, stating that permission has been granted to use the property and all necessary permits have been
57 obtained or, in the case of a release, that the restoration of the property including cleanup as required in Section 1-04.10 has
58 been satisfactorily accomplished. The written permission and written release must include the parcel number, address, and

1 date of signature. Written releases must be filed with the Engineer before the Physical Completion Date can be established, as
2 specified in Section 1-05.11(2).

3 **1-07.25 OPENING OF SECTIONS TO TRAFFIC**

4 The Owner may use and open any portion of the Work before the Physical Completion Date without constituting
5 acceptance of any of the Work. This action will not cause the Owner to incur any liability to the Contractor except as otherwise
6 provided in the Contract.

7 If the Engineer opens any portion of the Work before the Physical Completion Date because early opening is specified in
8 the Contract, or the Contractor has failed to prosecute the Work continuously and efficiently, then any Work remaining after
9 that portion of the project is open to traffic will be performed at Bid Item prices for Bid Items of Work involved. No additional
10 payment will be made for costs incurred by the Contractor because of:

- 11 1. Inconvenience, additional length of travel to conform to established traffic patterns, or planned access features.
- 12 2. Compliance with statutes governing traffic regulations and limitations of loads.
- 13 3. Additional flagging costs necessary to protect the Work and the traveling public.

14 The Contractor must take all costs due to traffic using portions of the Work into account when submitting the Bid, and the
15 unit Contract prices for the various items of Work involved must include these costs.

16 **1-07.26 NO WAIVER OF OWNER'S LEGAL RIGHTS; ASSIGNMENT OF CLAIMS FOR DAMAGES FOR ANTI** 17 **TRUST LAW VIOLATIONS**

18 The Owner is not precluded or estopped by any measurement, estimate, certificate, or payment made, whether before or
19 after the Completion Date, from showing the true amount and character of the Work performed and Materials furnished by the
20 Contractor, or from showing that any such measurement, estimate, payment, or certificate is untrue or incorrectly made, or that
21 the Work or Materials do not conform in fact to the Contract. The Owner is not precluded or estopped notwithstanding any
22 such measurement, estimate, or certificate, and payment from recovering from the Contractor and the Contractor's Sureties
23 such damages as the Owner may have sustained by reason of the Contractor's or Sureties' failure to comply with the terms of
24 the Contract and bond. Neither the establishment of the Completion Date by the Owner, nor any payment for the whole or any
25 part of the Work, nor any extension of time, nor any possession taken by the Owner is considered a waiver of any portion of
26 the Work, or of any power herein reserved to the Owner, or any right to damages herein or otherwise provided or bar recovery
27 by the Owner of any money wrongfully or erroneously paid to the Contractor. A waiver by the Owner of any breach of the
28 Contract is not held to be a waiver of any other or subsequent breach.

29 The Contractor and the Owner recognize that the impact of any overcharge to the Owner by the Contractor resulting from
30 an anti-trust law violation by any Materialperson or Subcontractor of the Owner adversely affects the Owner rather than the
31 Contractor. Therefore the Contractor assigns to the Owner any and all claims for such overcharges.

32 **1-07.27 RESERVED**

33 **1-07.28 NOTIFICATIONS RELATIVE TO CONTRACTOR'S ACTIVITIES**

34 The Contractor must plan and schedule Work activities to allow time for notifications, approvals, reviews, and other
35 conditions of the Contract.

36 The Engineer will initially notify public and private entities having facilities within the Project Site:

- 37 a. The approximate time the Work will start
- 38 b. The project scope of Work
- 39 c. Utilities in the street Right of Way that require relocation per the project design

40 Thereafter the Contractor must make the following notifications regarding Work performed within the Project Site and
41 other areas affected by the Contractors operations in performance of the Work, as applicable. Notification must provide
42 information germane to the type of Work to be performed. The information must include the time of commencement and
43 completion of the Work, Work hours, location of the Work, names of streets affected by the Work, schedule of operation,
44 routes of detours, and closures.

- 45 1. For Work Outside the Seattle City Limits:

46 Notifications must be provided per permit and other requirements of the agency having jurisdiction. The Contractor
47 must be familiar with those requirements before starting Work.

- 48 a. For Work on roads and highways outside the Seattle City limits but within King County, notifications must be
49 made as indicated below, as otherwise specified in the permit, or by the requirements of the agency having
50 jurisdiction over those roads and highways. Construction permits in the King County Right of Way may be
51 obtained by calling (206) 296-7456. In unincorporated areas of King County, the following must be notified at least
52 2 Working Days in advance:

- 53 1) King County Roads Division: (206) 296-8100
- 54 2) King County Fire Marshall's Office (206) 296-6675
- 55 3) King County Police: 1-800-344-4080 or (206) 296-3311

- 1 b. For all other areas within the Project Site and other areas affected by the Contractors operations in performance
2 of the Work notifications must be made as specified in the Contract, as otherwise specified in permit, or by the
3 requirements of the agency having jurisdiction.
- 4 2. For Work That Partially or Completely Restricts Any Seattle Arterial, Street, Sidewalk, or Alley:
5 After receiving approval of the traffic control plan, see Section 1-10.2(5), the Contractor must provide notice to SDOT
6 at (206) 684-7623 Monday to Friday by 2:00 p.m. at least 1 Working Day before the start of Work within the street
7 Right of Way. The Contractor must also provide SDOT notification upon completion of Work within the street Right of
8 Way no later than 9:00 a.m. the first Working Day following completion. This notification requirement includes partial
9 or full lane closures, parking restrictions, sidewalk closures, detours, complete or partial street closures, shoulder
10 work, and pedestrian rerouting, as well as the placing of building Materials or equipment on city streets, sidewalks, or
11 alleys.
- 12 a. Complete or partial closure of any street: In addition to notifying SDOT, provide 24 hours advance notification to
13 the following:
14 1) Within Seattle City Limits:
15 a) Seattle Fire Department (206) 386-1494
16 b) Seattle Police Department, Parking Enforcement, and Traffic Section of the Seattle Police Department
17 (206) 684-5101 FAX (written notification only)
- 18 b. Complete closure of any arterial within the Seattle City Limits: Provide 3 Working Days advance notice to SDOT
19 (206) 684-7623 Monday to Friday 8:00 a.m. to 5:00 p.m.
- 20 c. Complete closure of any local access street, alley, or sidewalk within the Seattle City Limits: Provide notice to
21 SDOT at (206) 684-7623 Monday to Friday 8:00 a.m. to 5:00 p.m. by 2:00 p.m. at least 1 Working Day in
22 advance.
- 23 d. To restrict parking on any street within the Seattle City Limits: Provide 2 Working Days advance notification to
24 SDOT (206) 684-7623 Monday to Friday 8:00 a.m. to 5:00 p.m. To arrange for inspection of No Parking easels
25 and other parking related signs by a parking enforcement officer or uniformed peace officer, contact (206) 386-
26 9012 after placing the easels and 24 hours in advance of the effective date of enforcement on the easels, see
27 Section 1-10.2(5)C, item 4.).
- 28 e. When signs are Owner furnished, signs will be provided by SDOT. To order signs, or to coordinate SDOT's
29 installation of signs, the Contractor must provide at least 15 Working Days and no more than 20 Working Days
30 advance notification to the Engineer and must verify signs and locations per the Contract for signs to be installed
31 by the Contractor, and/or provide notification of signs to be installed by SDOT. The Contractor must provide a list
32 of locations and specify the number and type of signs needed and include contract information for the
33 coordination of work to be performed by SDOT crews. The Engineer will notify the Contractor of when the signs
34 are ready for pickup. The Contractor must pick up the signs at the SDOT sign shop at 4200 Airport Way South on
35 Business Days between the hours of 8:00 a.m. to 3:00 p.m.
- 36 f. To coordinate the installation of the bus zone signs, numbered base plates and signs associated with parking pay
37 stations, contact SDOT Traffic at (206) 684-5092 at least 10 Business Days before completion of new sidewalk
38 work or scheduled mounting of signs on existing infrastructure.
- 39 g. To coordinate and/or to verify location of the installation of the traffic sign, street designation signs, and street
40 name, contact SDOT at (206) 684-5370 at least 10 Business Days before completion of new sidewalk work or
41 scheduled mounting of signs on existing infrastructure.
- 42 3. City of Seattle - Signage, Parking Pay Stations, Parking Meters:
43 a. Parking Meters, Parking Pay Stations, and sidewalk containing D-22 signage (Pay R, Pay L, Pay H, and Pay RL
44 signs and posts) and numbered base plates: 10 Working Days advance notice is required for the following:
45 1) To request covering of parking meters and placing no parking markers on numbered base plates where
46 parking pay stations exist, contact (206) 684-5086. Also see Section 1-10.3(3)N.
47 2) To request removal of parking meters, parking pay stations, and sidewalk containing D-22 signage and
48 numbered base plate, contact (206) 684-5370. Also see Section 2-02.3(3)F.
49 3) After completion and acceptance of newly constructed sidewalk, to request installation of parking pay station,
50 D-22 signage, and numbered base plates, contact (206) 684-5370.
51 4) The Contractor must reimburse SDOT for lost parking revenue unless this is an SDOT Project.
- 52 b. Traffic Signs and Street Designation Signs: see Section 8-21.3(1)A.
- 53 4. Disruptions to, or service modification requests for METROKC Transit, Streetcar service and facilities, or Sound
54 Transit Link Light Rail service and facilities:
55 a. Contact the Construction Information Center (CIC) at (206) 684-2732 or (206) 684-2785 for non-trolley requests
56 and (206) 684-2792 for trolley requests or email construction.coord@kingcounty.gov or see the website at
57 <http://www.kingcounty.gov/transportation/kcdot/MetroTransit/Construction.aspx> for the following:

- 1) For work resulting in temporary closure/relocation of a bus stop or for work within an area of a bus stop that will limit full access to it by coaches and pedestrians/passengers, 3 Business Days advance notification is required.
 - 2) For work resulting in Metro removing any transit facility structure including, but not limited to shelters, boards/kiosks, and bus stop signs, 15 Business Days advance notification is required.
 - 3) For work resulting in road closure on which buses operate that will require rerouting, 10 Business Days advance notification is requested while 5 Business Days advance notification is required.
 - 4) For work resulting in a full or partial road closure on which a streetcar operates that does not require overhead line deactivation or a shutdown to its track operation, a 5 Business Days advance notification is required.
 - 5) The request for assignment of diesel coaches for electric coaches on electric trolley routes on non-Business Days must be made no later than 10 Business Days before the weekend requested, which is COB Monday 2 weeks prior. Metro will not grant diesel coach substitutions on Business Days. If line deactivation is required see b) below.
- b. Contact METROKC at (206) 263-1800 for overhead power wire requests as follows:
- 1) Overhead power line modification or outage requests for an electric bus require 10 Business Days advance notification, which is COB Monday 2 weeks prior. Request forms must be submitted to Construction Information Center (email above). Trolley bus overhead deactivation is limited to weekends only (4:30 a.m. Saturday morning until 2:00 a.m. Monday morning).
 - 2) Overhead power line modification or outage requests for a streetcar require 10 Business Days advance notification, which is COB 10 Days prior. Request forms must be submitted to Construction Information Center. Streetcar deactivations are limited to non-operational hours during periods when Streetcar staff are not testing cars or training new operators.
 - 3) When working within 10 feet of any electric bus or streetcar overhead power, 10 Business Days advance notification is required. It is the responsibility of the Contractor to comply with Washington Administrative Code guidelines in regards to working within the vicinity of high voltage lines.
 - 4) Requests for overhead power line modification or outage may have an associated cost payable by the Contractor. In addition, outage requests for non-SDOT projects may be subject to a recently-legislated King County Trolley Ordinance Fee. The Contractor must consult with MetroKC to determine costs and include such costs within the Bid. Requests may require additional information. Approval is dependent on METROKC Transit Power Distribution's ability to perform requests; some overhead power line modification requests may require more than 10 Business Days advance notification.
- c. For Sound Transit Link Light Rail Right of Way and power outage requests, call (206) 903-7696. If work affects both rail and busses, the Construction Information Center listed above under a. also needs to be notified.
5. Seattle Monorail: When Work is within 20 feet of any portion of the monorail Structure above or below ground the Contractor must contact Seattle Monorail at (206) 396-5490 at least 10 Working Days in advance of construction.
 6. Property access restrictions: Provide abutting property owners and tenants of impending access restrictions. Advance notification must be 24 hours for residential property and 2 Business Days for commercial property.
 7. Emergency Work for City of Seattle Pavement or Sidewalk Problems: Provide immediate notification to: SDOT (206) 684-7623 Monday to Friday 8:00 a.m. to 5:00 p.m., all other times (206) 386-1218.
 8. Water Mains, Hydrants, Water Services, and Related Appurtenances:
 - a. Shutdowns and Obstructions: For all shutdowns involving facilities owned by Seattle Public Utilities, for any Work involving water service and/or water service connections, and for any hydrant access restrictions, the Contractor must coordinate scheduling and notification with the Seattle Public Utilities Water Operations Division via the Engineer. The same applies to Work that will obstruct normal access to any fire hydrant or water utility valve. The Contractor must not operate, or restrict access to, any water valve owned by the Seattle Public Utilities. Notifications must be as follows:
 - 1) Within SPU Water Service Franchise Area: Seattle Public Utilities Water Operations (206) 386-1800. Water Main shutdown notifications and advisories regarding fire hydrant status will be provided to fire agencies by SPU Water Operations.
 - a) All Work impacting Water Mains, water service or water service connection requires a minimum of 3 Working Days advance notice to the Engineer. The Engineer will plan and coordinate the shutdown with Water Operations.
 - b) All Work requiring a shutdown of a Water Main, interruption of water service or restricting access to hydrants or valves requires a minimum of 5 Working Days advance notice to the Engineer. The Engineer will plan and coordinate the shutdown with Water Operations.
 - c) All Work requiring Water Main shutdowns in commercial, industrial and critical service areas and in areas where over 5 percent of the population consists of a specific language group except English requires a minimum of 7 Working Days advance notice to the Engineer. The Engineer will plan and coordinate the shutdown with Water Operations.

- 1 d) All Work on pavement impacting castings and Structures connected to the water distribution or water
2 transmission system requires a minimum of 5 Working Days advance notice to the Engineer. The Engineer
3 will plan and coordinate with Water Operations.
- 4 2) Within King County: Seattle-King County Department of Public Health (206) 296-4722. At least 2 Working
5 Days advance notice is required.
- 6 3) Outside SPU Water Service Franchise Area and outside King County: The Contractor must notify the water
7 service franchise as specified in the Contract, as otherwise specified in permits, or the agency having
8 jurisdiction.
- 9 b. Application for New and Temporary Water Service within SPU Water Service Franchise Area: Contact SPU
10 Customer Service at (206) 684-3333.
- 11 c. Water Mains and Clearance with other Utilities within SPU Water Service Franchise Area:
- 12 1) When proposed underground utilities are within the clearance limits of water pipe except cast iron, see
13 Section 1-07.17(2)A2, any required Contractor notification will be addressed in the Contract.
- 14 2) When excavation is proposed near a cast iron water pipe, see Section 1-07.17(2)A3, Contractor required
15 notification will be addressed at the preconstruction conference specified in Section 1-08.1(2)A.
- 16 d. Backflow Prevention Assembly (BPA) Inspection within SPU Water Service Franchise Area: When a backflow
17 prevention assembly is required in any temporary or permanent connection with a Water Main, the Contractor
18 must request inspection by making the following notification at least 2 Working Days in advance of making the
19 connection to the Water Main, see Section 2-12, Section 8-03.3(1), Section 8-03.3(8), and Section 9-30.13:
- 20 1) Denny Way and north (206) 233-2635
21 2) South of Denny Way (206) 684-3456
- 22 e. Hydrant permit for temporary withdrawal of water within SPU Water Service Franchise Area, see Section 2-
23 12.3(2).
- 24 9. Electrical Safety and Service within SCL Service Area:
- 25 a. Electrical Safety Observer: To schedule an Electrical Safety Observer, notify Seattle City Light at least 7 Working
26 Days in advance of the need to enter a Seattle City Light vault, or to work on or within any other Seattle City Light
27 electrical Structure or facility, or to work on or near any Seattle City Light electrical transmission or distribution
28 system (206) 684-4911, see Section 1-05.2(2).
- 29 b. Electrical Service Connection and Inspection: To schedule an electrical service connection or inspection except
30 street lighting and signals, see Section 8-30.1(1) and except irrigation, see Section 8-03.3(1), contact (206) 684-
31 3000 at least 30 Days in advance.
- 32 c. Excavation at or near Underground Electrical Distribution and Transmission System: When proposed excavation
33 is within the vicinity of underground electrical distribution and transmission facilities as specified in Section 1-
34 07.17(2)C, the Contractor must notify Seattle City Light at least 10 Working Days in advance of the excavation as
35 follows:
- 36 1) At and North of Denny Way: (206) 615-0600
37 2) South of Denny Way: (206) 386-4200
- 38 d. Streetlight System Inspections: To schedule an inspection for streetlight systems, contact SCL at least 10 Days in
39 advance.
- 40 10. Sanitary Sewer Spills: In the event of a sanitary Sewer spill immediately notify:
- 41 a. Public Health – Seattle & King County (206) 296-4632 within King County
42 b. METROKC (206) 263-3801 within King County
43 c. Seattle Public Utilities (206) 386-1800 within SPU service area
44 d. The Sewer service as specified in the Contract, as otherwise specified in permits, or the agency having
45 jurisdiction
- 46 11. Chemical, Oil, Hazardous Substance, or other Contaminant Spill or Discharge or Release: When the Contractor first
47 becomes aware of an environmental spill, discharge or release of: chemicals, oil, hazardous substances,
48 Contaminated Material(s), Dangerous Waste(s), or TSCA Waste(s) the Contractor must immediately notify:
- 49 a. The Engineer always and Seattle Public Utilities
50 b. If within SPU service area including watersheds (206) 386-1800
51 c. If into Lake Union, Ship Canal, or Puget Sound:
- 52 1) U.S. Coast Guard (206) 217-6001 or the National Response Center, Washington, D.C. 1-800-424- 8802
53 (operated 24 hours a Day);
54 2) Washington Department of Fish and Wildlife (360) 902-2530; and
55 3) Seattle Harbor Patrol (206) 684-4071.
56 d. If into any side Sewer, sanitary Sewer or combined Sewer if within King County:

- 1) King County Industrial Waste (206) 263-3000 Monday to Friday 8:00 a.m. to 5:00 p.m.; or
 - 2) West Point Treatment Plant (206) 263-3801 at all other times.
 - e. If into Storm Drain, sanitary Sewer, combined Sewer, side Sewer, rivers, streams, lakes:
 - 1) Washington State Department of Ecology (425) 649-7000; and
 - 2) If within Seattle, the Seattle Surface Water Quality Hotline (206) 684-7587, elsewhere the Sewer service as specified in the Contract, as otherwise specified in permits, or the agency having jurisdiction.
 - f. For flammable or hazardous materials: Seattle Fire Department 911.
12. Overhead Electrical Power Lines and Trees: When tree trimming or tree removal is within 10 feet of overhead power lines less than 50kV or within 16-1/2 feet of overhead power lines 50kV or higher, if within SCL service area contact Seattle City Light at least 7 Working Days in advance at (206) 386-1663, else contact as specified in the Contract, as otherwise specified in permits, or the agency having jurisdiction, see Sections 1-07.16(2) and 1-07.17(2)C.
 13. Underground Utility Locator: The Contractor must call the Utilities Underground Location Center at 811 (or 1-800-424-5555) not less than 2 or more than 10 Working Days before the scheduled date for commencement of any excavation that might affect underground facilities. Alternate notification time periods limits may be substituted if mutually agreed to, in writing, by the Contractor and utility involved. If a utility is known to have, or suspected of having, underground facilities within the area of any proposed excavation, and that utility is not a subscriber to the Underground Utilities Location Center, notice by the Contractor must be provided individually to the utility, see Section 1-07.17(1).
 14. Entry onto Private Property: Each property owner must be provided 2 Business Days advance written notice before entry by the Contractor, see Section 1-07.24.
 15. U.S. Postal Service Collection Boxes, Mail Receptacles, and other Structures: U.S. Postal Service collection box and other Structures requiring temporary relocation to accommodate construction, the Contractor must contact (206) 241-7061 at least 5 Working Days in advance for coordination. Only the U.S. Post Office will move postal property, see Section 1-07.16(3).
 16. Signalized Intersections, Traffic Signals, and Loop Detection Systems: Where pedestrian and/or vehicular signals, or a loop detector system, or a signalized intersection are impacted, or will be impacted by construction, see Sections 1-07.17(1) and 8-31.1(1), within the City of Seattle the Contractor must provide at least 10 Working Days advance notice to (206) 386-1206 for coordinating temporary signal wire disconnect and temporary signal timing requirements, or else provide notification as specified in the Contract, as otherwise specified in permits, or the agency having jurisdiction.
 17. Survey Monumentation: When proposed construction or other activity requires removal or destruction of a monument, at least 2 Working Days prior to this work, the Contractor must provide the Engineer with a copy the Department of Natural Resources (DNR) permit authoring the removal or destruction of the monument per WAC 332-120. Removal or destruction is defined to mean the physical disturbance or covering of a monument such that the survey point is no longer visible or readily accessible. Before Physical Completion, the Contractor must provide the Engineer with a copy of the DNR final report form. For permitting information see <http://www.dnr.wa.gov/public-land-survey-office> or call DNR at (360) 902-1230. At the time the permits are provided to the Engineer, the Contractor must forward a copy of this initial DNR permit with authorizing signatures and final report form to the Land Survey Manager, Seattle Public Utilities, physical address: Seattle Municipal Tower, 700 Fifth Avenue, or mailing address: PO Box 34018, Seattle, WA 98124-4018
The Contractor may request SPU Survey Section to perform the monument permitting and Surveying. Contact the Land Surveying Manager at (206) 684-0564.
If SPU Surveying is to perform the work, the following applies:
 - a. Before removing monument castings, the Contractor must provide a minimum 4 Working Days advance notice to the SPU Land Survey Section to allow SPU survey crews to tie the survey point or monument out and to obtain the DNR monument permit.
 - b. Before placing monument casting, the Contractor must provide a minimum 4 Working Days advance notice to the SPU Land Survey Section to allow SPU survey crews to provide the monument casting placement location.
 - c. Within 4 Working Days after placing the monument casting, the Contractor must notify the SPU Land Survey Section to allow SPU survey crews to reset the monument and to obtain the DNR final report form.
 18. Gas Main, Transmission line, and Service Lateral: Before removals over underground gas facilities or before excavation or new facility construction, which are within the clearances of gas infrastructure as specified in Section 1-07.17(2)D, the Contractor must contact PSE at 1-888-Call-PSE (1-888-225-5773) at least 3 Working Days in advance of removal or excavation, or as otherwise specified in the Contract, in permits, or by the agency having jurisdiction.
 19. Salvage; Brick, Cobblestone, and Granite Curb within Seattle: When brick, cobblestone, or granite curb is to be salvaged, the Contractor must coordinate the loading operations with the SDOT Pavement Supervisor by giving at least 2 Working Day advance notice of the impending removal operations. Where removal takes place south of Denny Way, the Contractor must call (206) 386-1223. Where removal takes place north of Denny Way, the Contractor must call (206) 684-4660.

20. Replacement Casting and Covers: For Seattle City Light (SCL) replacement of casting and covers pick-up or delivery coordination and notification of adjustment the Contractor must call the SCL utility castings electrical reviewer at phone number (206) 684-4911 at least 10 Working Days in advance of the scheduled work.

For Seattle Public Utilities (SPU) Sewer and Drainage replacement of casting and covers pick-up or delivery coordination and notification of adjustment the Contractor must call the SPU Controls Structures Asset Manager at phone number (206) 615-1442 at least 10 Working Days in advance of the scheduled work.

For Seattle Public Utilities (SPU) Water replacement of casting and covers pick-up or delivery coordination and notification of adjustment the Contractor must call the SPU Field Crew Scheduling at phone number (206) 386-1835 at least 10 Working Days in advance of the scheduled work.

For PSE replacement of casting and covers pick-up or delivery coordination and notification of adjustment the Contractor must call PSE utility castings at phone number (888) 321-7779 at least 5 Working Days in advance of the scheduled work.

For all other replacement of casting and covers pick-up or delivery coordination and notification of adjustment the Contractor must call or as specified in the Contract, as otherwise specified in permits, or the agency having jurisdiction in advance of the scheduled work.

21. For Coordination Contacts Not Specifically Specified Above: The Contractor must notify the service or franchise as specified in the Contract, as otherwise specified in permits, or the agency having jurisdiction.

1-07.29 DISCOVERIES OF CONTAMINATED MATERIAL(S), DANGEROUS WASTE(S) AND TSCA WASTE(S)

1-07.29(1) GENERAL

Section 1-07.29 addresses Work related to responding to potential Contaminated Material(s), potential Dangerous Waste(s), and potential TSCA Waste(s) encountered or generated during construction or in connection with the Contract or Project Site but not otherwise identified in Contract-related documents.

1-07.29(2) PRESENT SITE CHARACTERIZATION

Contract-related documents may identify Contaminated Material(s), Dangerous Waste(s), or TSCA Waste(s) that the Owner has documented on the Project Site. The Owner may not have confirmed the presence or absence of contaminants in all areas of the Project Site. Therefore, the potential exists for encountering Contaminated Material(s), Dangerous Waste(s), or TSCA Waste(s) at the Project Site.

1-07.29(3) DISCOVERIES

During the performance of the Work, the Contractor must respond to each discovery of potential Contaminated Material(s), potential Dangerous Waste(s), or potential TSCA Waste(s) on the Project Site using due diligence.

Potential Contaminated Material(s), potential Dangerous Waste(s), and potential TSCA Waste(s) at a Project Site may include soils or debris containing petroleum, metals or other contaminants, and vector wastes (street, Storm Drain, and Sewer cleanings). Indicators of the presence of Contaminated Material(s), Dangerous Waste(s), or TSCA Waste(s) may include, but are not limited to, the presence of:

1. Visibly stained and/or discolored soil and other areas presumed to contain petroleum, oil, and lubricants;
2. Suspect areas based on historical use or the presence of an aboveground or underground feature such as drums or other similar containers, a tank or conveyance piping or dry wells under drains in floor slabs or in maintenance holes and conveyance piping with visible staining;
3. Other areas based on staining and odor, or field screening instrument readings;
4. Exposed or buried debris; or
5. Suspect building materials based on age, appearance, or historical use.

Upon discovery by Contractor or any other entity of potential Contaminated Material(s), potential Dangerous Waste(s), or potential TSCA Waste(s) not otherwise identified in Contract-related documents the Contractor must:

- a. Immediately suspend Work activities only in the vicinity of the area of concern.
- b. Immediately notify the Engineer of the discovery.
- c. Secure the area of concern as needed to protect the general public and other personnel from entering the area of concern.
- d. If authorized by the Engineer, secure all potential Contaminated Material(s), potential Dangerous Waste(s), and potential TSCA Waste(s) as that prevents their release to the environment, to the extent the Contractor can do so in compliance with all applicable law.

Work in the area of concern must not resume until the Engineer releases the Contractor to resume Work. This release does not relieve the Contractor from the requirements to maintain a safe workplace.

If potential or confirmed Contaminated Material(s), Dangerous Waste(s), or TSCA Waste(s) not otherwise identified in Contract-related documents are generated or encountered, the Contractor must immediately submit to the Engineer both oral and written notice of all available information regarding the materials and waste. The Contractor must not take further action with respect to the characterization, disposal, or recycling of the materials unless directed to do so by the Engineer in writing.

1 If the Engineer subsequently informs the Contractor in writing to proceed regarding the materials or waste, the Contractor
 2 must arrange for and implement the proper and legal handling, storage, transport, and/or disposal of the materials or waste in
 3 compliance with the Contract and any direction from the Engineer.

4 The Contractor must comply with applicable regulations and law at all times using trained and qualified personnel.

5 **1-07.29(4) TESTING**

6 Testing will be performed by the Owner or as specified in writing by the Engineer before testing.

7 The Contractor must provide reasonable assistance to the Engineer. Such assistance may include collecting samples.
 8 Any Work performed by the Contractor must be done consistent with applicable law which may include:

- 9 1. Code of Federal Regulations: 29 CFR 1910 Occupational Safety and Health Standards
- 10 2. Washington Administrative Code: WAC 296-155 Safety Standards for Construction Work and WAC 296-800 Safety
 11 and Health Core Rules

12 The Owner will provide the Contractor 1 copy of all constituent test reports conducted on materials discovered at the
 13 Project Site.

14 **1-07.29(5) PAYMENT**

15 No separate measurement and payment will be made for Work required under this Section before the notification to the
 16 Engineer of a discovery, and after the Engineer's order to resume Work. All costs in connection with suspended work activities
 17 and work directed by the Engineer must be as specified in Section 1-04.3. Work not directed by the Engineer will not be
 18 measured for payment except to the extent necessary to meet the obligations specified in Sections 1-07.29(3) and 1-07.29(4).

19 **SECTION 1-08 PROSECUTION AND PROGRESS**

20 **1-08.1 PRELIMINARY AND ON-GOING MATTERS**

21 **1-08.1(1) COPIES OF CONTRACT**

22 The Engineer will issue to the Contractor, without charge, the following:

- 23 1. Full size Drawings (22" x 34"), 1 Set
- 24 2. Reduced Drawings (11" x 17"), 1 Set
- 25 3. Project Manual, 1 Set

26 **1-08.1(2) CONTRACT CONFERENCES AND MEETINGS**

27 **1-08.1(2)A PRECONSTRUCTION CONFERENCE**

28 After the Contract has been Executed, but before the Contractor starts Work, a preconstruction conference will be held
 29 for the Contractor, the Engineer and such other interested parties as may be invited.

30 The purpose of the preconstruction conference will be:

- 31 1. To review the preliminary critical path schedule indicating major work activities including the order and duration of
 32 work activities, milestones and time frames required in the Contract, and the critical path.
- 33 2. To establish a working understanding among the various parties affected by the Work.
- 34 3. To establish and review procedures for items including but not limited to progress estimates and cut-off Dates,
 35 notifications, approvals, reviews, and submittal delivery methods.
- 36 4. To establish normal working hours for the Work.
- 37 5. To review safety standards, traffic control, and maintaining cleanliness.
- 38 6. To review the Construction Stormwater Pollution Prevention Submittal requirements and leads specified in Sections
 39 1-05.13, 1-07.5, 1-07.15, and Section 8-01 and related permits, as applicable.
- 40 7. To review Material sources as may be applicable.
- 41 8. To start the 360 Review process for projects as applicable, see Section 1-05.13(2).
- 42 9. To discuss such other related items as may be pertinent to the Work.

43 See Section 1-05.3(5) for submittals due at the preconstruction conference.

44 **1-08.1(2)B PREOPERATIONAL CONFERENCES**

45 The Contractor must also meet with the Engineer for preoperational conferences as required before starting any new
 46 phase of Work to more thoroughly establish effective working understandings when more detail is required than was provided
 47 at the preconstruction conference. In addition to representatives of the City, attendees will include each Subcontractor,
 48 Supplier, or other entity, or their representative concerned with current operations.

1-08.1(2)C WEEKLY PROGRESS MEETINGS

Weekly progress meetings will be held at a mutually agreed location, at regular weekly intervals or as otherwise mutually agreed. In addition to representatives of the City, attendees will include the Contractor, each Subcontractor, Supplier, or other entity, or their representative concerned with current progress or involved in planning, coordination, or performance of future activities. These meetings will be used to coordinate work and review progress and to review the project CPM schedule as specified in Section 1-08.3.

1-08.1(3) SUBCONTRACTING

Work done by the Contractor's own organization must account for at least 30 percent of the Awarded Contract Price. The Contract may specifically designate any Work that may be excluded from the calculation of the 30 percent of the Awarded Contract Price. If it does, then the Contractor must subtract the cost of any excluded Work from the Awarded Contract Price before computing this percentage.

Work must not be subcontracted, regardless of tier, without written consent of the Engineer. A request to subcontract must be made on the Subcontractor Approval Application Form provided by the Engineer. If the Owner requests, the Contractor must provide documentation that the Subcontractor meets the supplemental Bidder responsibility criteria. Each subcontract must contain a provision that requires the Subcontractor to comply with Chapter 39.12 RCW and furnish to the Contractor all certificates, statements, and submittals that the Contractor is required by the Contract to furnish to the Owner. The Contractor is responsible for verifying that the Subcontractor meets the Responsible Bidder requirements of Sections 1-02.1 and 1-02.2.

Along with the request to subcontract, the Contractor must submit the names of any contracting firms a Subcontractor proposes to use of any tier. Collectively, these second and lower tier Subcontractors must not do an amount of work that exceeds 25 percent of the total amount subcontracted to the first tier Subcontractor. When a Subcontractor is responsible for construction of a specific Structure or Structures, the following Work may be performed by second and lower tier Subcontractors without being subject to the 25 percent limitation:

1. Furnishing and driving of piling; and
2. Furnishing and installing concrete reinforcing and post tensioning steel.

Except for the 25 percent limit, second and lower tier Subcontractors must comply with the same requirements as first tier Subcontractors.

Consent to subcontract will not be provided unless the Engineer is satisfied with the proposed Subcontractor's prior performance, equipment, experience, and ability to perform the Work. Approval to subcontract does not:

- a. Relieve the Contractor of any responsibility to carry out the Contract;
- b. Relieve the Contractor of any obligation or liability under the Contract and the Contractor's bond;
- c. Create any Contract between the Owner and the Subcontractor; or
- d. Convey to the Subcontractor any right against the Owner.

The Owner will not consider as subcontracting:

- 1) The purchase of sand, gravel, crushed stone, crushed slag, batch concrete aggregates, ready mixed concrete, off-site fabricated structural steel, other off-site fabricated items, and any other materials supplied by established and recognized commercial facilities;
- 2) Delivery of any of the materials identified in item 1) immediately above to the Project Site in any vehicle owned or operated by the Materialperson of such material or by a recognized independent or commercial hauling company. Such purchase is considered as being purchased from Materialpersons.

The Washington State Department of Labor and Industries may determine that Chapter 39.12 RCW applies to the employees of any Materialperson identified in items 1) or 2) immediately above per Chapter 296-127 WAC. If this should occur, the provisions of Section 1-07.9, as modified or supplemented, applies.

When a portion of the Work that has been subcontracted by the Contractor is not being prosecuted as satisfactory to the Engineer, the Subcontractor must be removed and replaced immediately upon the Engineer's written order, and must not again be employed on the Work unless the Contractor makes protest and the Contractor's protest is upheld by the Owner.

If the Engineer determines that any Subcontractor is performing any services in an unsatisfactory manner or is not completing the Work as specified in the Contract or is otherwise undesirable or unacceptable, the Engineer will so advise the Contractor by written notice. The Contractor must then take immediate steps to terminate such Subcontractor. Further subcontracting by Subcontractors will be subject to the same Owner's rights and Subcontractors' obligations. The Contractor and each of its Subcontractors must ensure that such Owner's right is included in each subcontract and sub subcontract for any portion of the Work.

The Contractor's cost records pertaining to any subcontracting of this Contract must be open to inspection, subject to retainage periods, and as specified in Section 1-09.10.

The Contractor must report on Subcontractors as specified in Section 1-07.11(3)A.

1 **1-08.1(4) HOURS OF WORK**

2 The normal hours of Work must be between 6:00 a.m. and 7:00 p.m. on any Working Day and consists of 8 hours,
3 exclusive of a lunch period of not more than 1 hour. The normal work week must not exceed 40 hours of Work. The normal
4 hours of Work are established at the preconstruction conference or before the Contractor starts the Work and must not be
5 changed or extended without approval of the Engineer.

6 The Engineer, in their sole discretion, may grant permission to work beyond the normal daily hours, normal work week, or
7 Working Days subject to certain conditions.

8 Permission to work outside normal hours of Work may be withdrawn at any time. The Contractor has no claim for
9 damages or delay should such permission be withdrawn.

10 Any request to perform Work outside of normal hours of Work or on Non-Working Days must be submitted to the
11 Engineer before noon on the Working Day before the Day that the Contractor is requesting permission to work.

12 **1-08.1(5) REIMBURSEMENT FOR OVERTIME WORK OF EMPLOYEES OF OWNER**

13 If the Contractor requests permission to work on a Saturday, Sunday or Holiday, or in excess of the established normal
14 hours of Work described in Section 1-08.1(4) and the Engineer approves, then such work is considered overtime work. On all
15 such overtime work, the Contractor must reimburse the Owner for each of the Owner’s employees required to work overtime
16 hours to support Contractor requested overtime on any project related construction activity. The number of Owner employees,
17 and the duration of their participation in supporting the Contractor’s overtime Work is at the sole discretion of the Engineer.

18 The Contractor must reimburse the Owner according to a table of overtime charges contained in the Project Manual. If no
19 table of overtime charges is included in the Project Manual, the Contractor must reimburse the Owner \$100 per hour for each
20 Owner employee supporting the Contractor’s overtime Work.

21 The Contractor hereby authorizes the Engineer to deduct the reimbursement required in the paragraph immediately
22 above from any amount that might then be or thereafter become due or payable by the Owner to the Contractor under or by
23 virtue of the Contract until such reimbursement has been recouped by the Owner.

24 **1-08.2 ASSIGNMENT**

25 The performance of the Work or any part of it must not be assigned without written consent of the Owner. Consent will
26 not be provided to a proposed assignment that would relieve the Contractor or the Contractor’s Surety of their responsibilities
27 under the Contract.

28 The Contractor may assign moneys due or to become due to the Contractor under the Contract. This assignment will be
29 recognized by the Owner, if provided notarized written notice, to the extent permitted by law. Assignment of monies is subject
30 to all set offs, withholdings, and deductions provided by law and under the Contract.

31 **1-08.3 CRITICAL PATH SCHEDULE AND SCHEDULE CONSTRAINTS**

32 **1-08.3(1) CRITICAL PATH SCHEDULE**

33 **1-08.3(1)A GENERAL REQUIREMENTS**

34 The Contractor is responsible for scheduling the Work. The construction of this project will be planned and tracked by
35 use of a conventional Critical Path Method (CPM) schedule.

36 The Engineer’s review and acceptance of any critical path schedule does not transfer any of the Contractor’s
37 responsibilities to the Owner or to the Engineer. Acceptance implies only that the Engineer has determined that the Critical
38 Path Schedule submittal with any noted exceptions is within reasonable conformity to the requirements of the Contract.
39 Acceptance of any schedule does not relieve the Contractor of its responsibility to complete the Work within the required
40 Contract Time.

41 All schedules must comply with these general requirements.

42 The critical path is the series of sequentially-linked activities in a project schedule that will take the longest total amount
43 of time to complete. Therefore, at any point in time, the critical path will be the path with the least amount of total float. The
44 critical path does not have to follow the same logic path from start to finish and does not have to have zero total float. A critical
45 task is a discrete work activity within a critical path. Total Float is the number of Days that a scheduled activity can be delayed
46 without affecting a given intermediate milestone or Physical Completion Date. A milestone is a zero-duration task marking the
47 completion of a significant body of work or important date/event associated with the Contract.

48 The baseline CPM Schedule and each Critical Path Schedule update must conform to the following guidelines:

- 49 1. Schedules must be prepared, viewed, and printed using standard Gantt-chart format.
- 50 2. Show all activities necessary to complete the Work.
- 51 3. Each task must have a descriptor sufficiently detailed to understand the scope of work encompassed by that task.
52 Overly-broad descriptors such as grading, electrical, or plumbing may be rejected by the Engineer, especially when in
53 conjunction with long durations.
- 54 4. Activities must be assigned durations consistent with the activity’s scope of work, assuming that work will be done
55 continuously over the entire task duration. Float time is not represented as a part of the task duration. Except for the

- 1 Preliminary CPM Schedule, the maximum duration for any 1 activity is 10 Working Days unless otherwise accepted
2 by the Engineer.
- 3 5. Sequential work activities must be linked logically by precedent/successor activities.
- 4 6. Display the Critical Path as a red-colored sequence within the project schedule. Multiple parallel critical paths are not
5 allowed unless the Contractor can demonstrate that each of the parallel paths has minimal total float time.
- 6 7. Comply with all order of Work requirements included in the Contract.
- 7 8. Show durations in Working Days.
- 8 9. Show Contract milestones including the following:
- 9 a. Notice to Proceed Date
- 10 b. Substantial Completion Date
- 11 c. Physical Completion Date
- 12 d. Any milestones defined in the Special Provisions of this Contract
- 13 e. Other milestones at the option of the Contractor
- 14 10. Show required submittals for significant activities. Establish discrete work activities for provision and review of
15 submittals, ensuring durations conform to the time allowed by the Contract.
- 16 11. Identify special labor or equipment needs that may constrain or limit the Contractor's ability to perform project tasks
17 simultaneously. These may be shown as Resources within the CPM schedule, or described separately in narrative
18 format.
- 19 12. Show procurement, manufacture, and delivery activities for significant Material items of Work that affect the schedule.
- 20 13. Show significant Owner activities and/or delivery of Owner-supplied Materials that may impact the schedule.
- 21 14. Show significant elements of the Construction Stormwater and Pollution Prevention Plans. These elements may
22 include but are not limited to the installation and removal of erosion/sedimentation controls, and stormwater control.
- 23 15. Include project close-out items such as punch-list items, provision of O&M manuals and as-built Drawings.

24 Unless otherwise specified in the Contract, the Contractor must allow the Engineer a reasonable amount of time to
25 perform the Owner's activities. Reasonable will be defined as customary or normal for the type of work involved.

26 Float available in the CPM Schedule, at any time, must not be considered for the exclusive use of either the Contractor or
27 the Engineer. However, any float used by the Owner that is later needed by the Contractor and results in delay to the critical
28 path will be considered an excusable non-compensable delay.

29 If the CPM Schedule is not within reasonable conformity to these Specifications, it will be returned to the Contractor for
30 correction and re-submittal.

31 The Contractor, or its Subcontractors, must not deviate from the projected start and completion times for major phases of
32 the Work shown on the accepted CPM Schedule without providing at least 14 Days advance notice to the Engineer. Failure to
33 notify the Engineer of a deviation from projected start and completion times for a major phase of the Work shown on the
34 schedule may impact costs to the Owner, including the cost of additional community outreach to communicate changes in
35 schedule to the public. The Contractor is responsible for resulting costs due to this failure to notify. The Owner will deduct
36 these costs from any payment due or to become due to the Contractor.

37 **1-08.3(1)B SCHEDULE TYPES**

38 **1-08.3(1)B1 PRELIMINARY CPM SCHEDULE**

39 The Contractor must prepare and submit a preliminary critical path schedule at the preconstruction conference. The
40 preliminary schedule must show the first 30 Days of Work in reasonable conformity to these Specifications. The remaining
41 schedule must show the critical path schedule using broad Work activities, and major milestones and durations for the purpose
42 of review and discussion at the preconstruction conference.

43 **1-08.3(1)B2 BASELINE CPM SCHEDULE**

44 The Contractor must submit for Engineer's review and acceptance a baseline CPM Schedule no later than 7 Days after
45 receipt of the Notice to Proceed. The baseline schedule will not be accepted unless it satisfies Section 1-08.3(1)A General
46 Requirements.

47 Within 7 Days of the Engineer receiving the submittal, the Engineer and the Contractor must meet for joint review,
48 correction, and adjustment of the initial baseline CPM schedule. Within 7 Days, the baseline schedule must be resubmitted to
49 the Engineer showing the agreed on adjustments. Adjusted baseline CPM schedules submitted by the Contractor will be
50 reviewed by the Engineer and returned to the Contractor within 7 Days of the Engineer's receiving the submittal. If necessary,
51 the joint review and adjusted schedule submittal process must be repeated. However, the schedule must be finalized within 30
52 Days after Notice to Proceed.

1 1-08.3(1)B3 CPM SCHEDULE UPDATE

2 The Contractor must submit monthly Critical Path Schedule updates and whenever changes occur that have potential to
3 delay substantial or physical completion by 5 or more working Days. When required, include with the updates a written
4 narrative describing the project schedule status, the critical path, and any revisions to the schedule.

- 5 1. At the discretion of the Engineer, progress meetings may be held monthly for the purpose of updating the critical path
6 schedule. Progress will be reviewed to verify actual start and finish Dates, remaining duration and percent complete
7 of uncompleted activities, and any proposed revisions to the schedule. It is the Contractor's responsibility to provide
8 the Engineer with the status of activities at this progress meeting and prepare schedule updates based on this
9 information once it has been verified and agreed upon. If the Work conforms to the last accepted critical path
10 schedule, the Engineer may waive the monthly update or the final as-built CPM schedule.
- 11 2. The updated critical path schedule must contain the agreed on revisions or be resubmitted.

12 The Contractor must submit a supplemental Critical Path Schedule update within 7 Days of a request by the Engineer
13 and of Substantial Completion. The CPM Schedule updates must conform to the following additional requirements:

- 14 a. Schedule updates must be presented in a Tracking Gantt format, showing 2 sets of Gantt-style progress bars
15 consisting of 1) the latest approved Baseline CPM versus 2) a combination of the actual start/finish progress of
16 completed tasks and projected start/finish Dates of uncompleted tasks.
- 17 b. Include columns showing actual or projected start and finish Dates of all activities. Identify changes to activity
18 precedents, successors, and/or constraints that have altered the critical path.
- 19 c. Highlight any new activities or additional activities resulting from the restructuring/splitting of existing baseline
20 activities.
- 21 d. Identify the current critical path, which could vary from the baseline critical path due to actual Work progress,
22 additional work, or changed conditions.

23 Unresolved issues or disputes with asserted time effects may be reflected in a schedule update by comparing the
24 baseline critical path to the revised critical path shown on an updated schedule. If Work cannot be completed within the
25 Contract Time, the updated schedule must reflect the earliest Completion Date practicable, and a narrative must be provided
26 by the Contractor addressing the reason behind the delay. Acceptance of late completion schedules will be at the discretion of
27 the Engineer and does not relieve the Contractor from Liquidated Damages.

28 1-08.3(1)B4 LOOK-AHEAD SCHEDULE

29 At each weekly progress meetings, the Contractor must submit a look-ahead schedule showing the Contractor's, and all
30 Subcontractors' proposed Work activities and any Owner activities or supplied Materials for the next 3 weeks. Include the
31 description, duration and sequence of Work, and highlight any deviations between planned and regular hours of Work. The 3
32 week look-ahead may be reduced to a 2 week look-ahead with the approval of the Engineer. Unless otherwise specified in the
33 Contract, the Contractor must notify the Engineer at least 2 Working Days in advance of changing Work as shown on the look-
34 ahead schedule; an updated look-ahead schedule must be submitted with the notification.

35 1-08.3(1)C SUBMITTALS

36 The Contractor must submit 1 copy of the CPM schedule in Gantt chart format, with columns displayed to show
37 predecessors and successors of each activity, and any narrative, and 1 full electronic copy in selected CPM software format.
38 Unless approved otherwise by the Engineer, the CPM Schedule must be printed on 24" x 36" paper or larger. The CPM
39 Schedule and any narrative must also be submitted in PDF format.

40 The Gantt chart format is a standard method of presenting schedule information. The following standard requirements
41 apply:

- 42 1. The schedule must include a horizontal time scale consistent with the project calendar.
- 43 2. Each activity/task/milestone must be listed in order of start date in a tabular grid to the left of the time scale. The
44 tabular grid must include the task number, description, start date, completion date, predecessors, successors, and
45 float. Baseline schedules must show the baseline-planned start and finish Dates. Updated schedules must show the
46 actual/projected start and finish Dates.
- 47 3. Each activity must be provided with a corresponding task bar in the horizontal time scale, with a plotted length
48 conforming to its duration and Dates.
- 49 4. Linked activities must be indicated by logic arrows in the timescale portion of the Gantt chart, as needed to clearly
50 show the sequence and interdependence of all activities required for complete performance of all items of Work
51 under the Contract.
- 52 5. Activities on the critical path must be highlighted using red task bars.

53 The electronic copy of the Critical Path Schedule must be compatible with Microsoft project or other Engineer approved
54 software. The Contractor must submit a functional and complete CPM schedule electronically via email, on compact disk, or
55 other medium accepted by the Engineer.

1 1-08.3(1)D EARLY COMPLETION

2 The Engineer allocates resources to a Contract based on the Contract Time. The Engineer will review and accept a
3 Critical Path Schedule indicating an early Physical Completion Date but cannot guarantee Owner resources will be available to
4 comply with the accelerated schedule. No additional payment or time will be allowed if the Contractor is not able to comply
5 with its accelerated schedule due to the unavailability of Owner resources or for other reasons beyond the Engineer's control.

6 1-08.3(1)E PAYMENT

7 Payment for the cost necessary to complete the Work described in this Section is considered incidental to and included
8 in all Bid Items of Work. No separate payment will be made for the Work required in this Section.

9 1-08.3(2) SCHEDULE CONSTRAINTS

10 The Contractor's CPM schedule must reflect constraints imposed by applicable laws and regulations, and those specified
11 in the Contract. Constraints include but are not limited to the following:

- 12 1. Submittal requirements and review durations, see Section 1-05.3
- 13 2. Traffic Control restrictions, see Section 1-10.2(5)
- 14 3. Environmental restrictions, see Sections 1-07.5, 1-07.15 and permits
- 15 4. Safety restrictions, see regulations and permits
- 16 5. Holiday Construction Moratorium, see Section 1-10.2(5)C

17 1-08.4 NOTICE TO PROCEED AND PROSECUTION OF THE WORK

18 Upon Execution of the Contract, the Contractor may proceed on submittals and procurement of Materials critical to
19 project completion within Contract Time. The Contractor bears all risks for any Work begun before the Contract Execution
20 Date. The Contractor must not start any other Work until the Notice to Proceed has been provided by the Engineer. The
21 Engineer may provide a limited Notice to Proceed and authorize only a portion of the Work to commence. Notice to Proceed
22 will be provided after the Contract has been Executed and the Payment and Performance Bond and evidence of insurance
23 have been approved and filed by the Owner.

24 The Contractor bears all risks for any Work begun before the Notice to Proceed except for submittals and procurement
25 after Execution of the Contract. Contract Time starts on the Notice to Proceed Date.

26 The Contractor must diligently pursue the Work to the Physical Completion Date within the time specified in the Contract.
27 The Contractor must not voluntarily shut down or slow Work operations without requesting and obtaining prior approval of the
28 Engineer. Such approval does not relieve the Contractor from the contractual obligation to complete the Work within the
29 Contract Time.

30 1-08.5 TIME FOR COMPLETION

31 The Work must be physically complete within the time specified in the Contract or as changed by the Engineer.

32 Unless the Contract specifies otherwise, the Contract Time will be stated in Working Days, starts on the Notice to
33 Proceed Date, and ends on the Physical Completion Date.

34 Each successive Working Day, starting with the Notice to Proceed Date and ending with the Physical Completion Date,
35 must be charged to the Contract Time as it occurs except a Day or part of a Day that is designated a Non-Working Day or an
36 Engineer determined Unworkable Day.

37 The Engineer will furnish Contractor with a weekly report showing:

- 38 1. The number of Working Days charged against the Contract Time for the preceding week
- 39 2. The Contract Time in Working Days
- 40 3. The number of Working Days remaining in the Contract Time
- 41 4. The revised Physical Completion Date as applicable
- 42 5. The number of Non-Working Days
- 43 6. Any whole Days during the immediately preceding week that the Engineer declared to be an Unworkable Day.

44 If the Contractor elects to work 10 hours a Day and 4 Days a week and the fifth Day of the week in which a 4-10 shift is
45 worked would ordinarily be charged as a Working Day then the fifth Day of that week will be charged as a Working Day
46 whether or not the Contractor works on that Day.

47 The Contractor will be allowed 10 Days after the date of each report in which to file a written notice of protest of an
48 alleged discrepancy in the Contract Time as reported. Otherwise, the report will be deemed to have been accepted by the
49 Contractor as correct.

50 Unworkable Days may be granted for unsuitable weather and such other conditions beyond the control of the Contractor
51 that prevent satisfactory and timely performance of the Work, see Section 1-08.6.

1-08.6 SUSPENSION OF WORK

The Contractor must immediately suspend the Work or resume suspended Work only when ordered or authorized in writing to do so by the Engineer. The Engineer may suspend all or part of the Work and for such periods of time as the Engineer may deem proper if:

- 1. Unsuitable weather and such other conditions beyond the control of the Contractor occur that prevent satisfactory and timely performance of the Work; or
- 2. The Contractor does not comply with the Contract or the Engineer's orders.

When ordered by the Engineer to suspend or resume Work, the Contractor must do so immediately.

If the Work is suspended for reason 1. above, the period of Work stoppage will be counted as Unworkable Days. The Engineer will set the number of Unworkable Days or parts of Days by deciding how long the suspension delayed the entire project.

In order to be granted an Unworkable Day, the Contractor must demonstrate vigorous work on the affected work and this work must be on the critical path as shown on the Contractor's latest CPM schedule. The Contractor may be granted 1 Unworkable Day when weather or other conditions beyond the control of the Contractor prevent work for a period greater than 1/2 of a Working Day.

If the Work is suspended for reason 2. above, the period of Work stoppage will be counted as Working Days. The lost Work time, however, does not relieve the Contractor from any Contract responsibility.

If the Contractor believes that the performance of the Work is suspended, delayed, or interrupted for an unreasonable period of time and such suspension, delay, or interruption is the responsibility of the Owner, the Contractor must immediately submit a written notice of dispute to the Engineer as specified in Section 1-04.4. No adjustment will be allowed for any costs incurred more than 10 Calendar Days before the date the Engineer receives the Contractor's written notice of protest.

The Engineer will determine if an equitable adjustment in cost or time is due as specified in this Section. The equitable adjustment for increase in costs, if due, is subject to the limitations specified in Section 1-09.4, provided that no profit of any kind will be allowed on any increase in cost necessarily caused by the suspension, delay, or interruption.

Request for extensions of time will be evaluated as specified in Section 1-08.8.

The Engineer's determination as to whether an adjustment should be made will be final as specified in Section 1-05.1.

No claim by the Contractor under this clause is allowed unless the Contractor has followed the procedures specified in Section 1-04.4.

1-08.7 MAINTENANCE DURING SUSPENSION

In preparing for or during suspensions of the Work as specified in Section 1-08.6, the Contractor must do whatever is necessary to prevent damage to or deterioration of the Work. The Contractor's safety and maintenance responsibilities remain unchanged except for those assumed by the Engineer under the conditions set forth in this Section.

At no additional expense to the Owner, the Contractor must maintain a safe, smooth, and unobstructed roadway, sidewalks, paths, temporary roads, or detours for public use through the construction area during suspension of the Work as specified in Section 1-07.23.

If the Engineer determines that the Contractor failed to pursue the Work vigorously, diligently, and without unauthorized interruption before the suspension, or failed to comply with the Contract or the Engineer's orders, the Contractor must maintain the temporary roadway, detour, sidewalks, or paths in use during suspension. In this case, the Contractor bears the maintenance costs. If the Contractor fails to maintain the temporary roadway, detour, sidewalks, or paths, the Owner will do the maintenance work and deduct all resulting costs from payments due to the Contractor specified in Section 1-05.8.

If the Engineer determines that the Contractor has pursued the Work vigorously, diligently, and without unauthorized interruption before the suspension, the Owner will do the routine maintenance work and bear its cost. The maintenance performed by the Owner will include only routine maintenance of:

- 1. The traveled way and shoulders, sidewalks, paths, and detour surface.
- 2. Roadway drainage along and under the traveled roadway or detour.
- 3. All barricades, signs, and lights needed for directing traffic through the temporary roadway or detour in the construction area.

The Contractor must protect, maintain, and bear the costs of completing all other portions of the Work in areas not used for traffic.

After a suspension, during which the Owner has done the routine maintenance, the Contractor must accept the traveled roadway or detour as is, when the Work resumes. The Contractor must make no claim against the Owner for the condition of the roadway or detour.

After any suspension, the Contractor retains responsibility for repairing or restoring the roadway, its slopes, and its drainage system to the requirements of the Contract.

1-08.8 TIME EXTENSIONS AND DELAYS ENTITLEMENT AND COMPENSATION**1-08.8(1) GENERAL**

The Engineer determines the Contract Time sufficient to complete the Work. For this reason the Engineer will not grant a time extension for any reason except those specified in Section 1-08.8(3)A.

The Contract will be extended for a period equivalent to the actual time the Work is suspended or delayed for an excusable reason. Entitlement, length of time extension, and applicable payment will be determined by the Engineer.

If the Work is suspended or delayed and the Contractor believes the reason for the suspension or delay is excusable or compensable, the Contractor must submit to the Engineer a written notice requesting an adjustment in the Contract Time, in the costs, or both. To be considered, the request must be submitted to the Engineer no later than 10 Days after the claimed suspension or delay occurs. The request must state the reasons why the adjustment should be granted. Upon receipt, the Engineer will evaluate the Contractor's request and determine if the:

1. The portion of the Work that was delayed:
 - a. Is on the critical path of the critical path schedule in effect at the time as specified in this Section below; or
 - b. Has increased in cost, time, or both as a result of such suspension or delay.
2. Delay was caused by one or more conditions beyond the control of, and were not the fault of, the Contractor or any of the Contractor's Materialperson or Subcontractor at any approved tier;
3. The suspension was not on an Unworkable Day;
4. Performance was not suspended or delayed by any other cause; and
5. Adjustment is provided for or specifically excluded, under any other term or condition of this Contract.

If the Engineer agrees that an adjustment is warranted considering all evaluation criteria stated in items 1. through 5. immediately above, the Engineer will make an adjustment in Contract Time, cost, or both (excluding profit) and change the Contract accordingly. No adjustment will be allowed for any cost that was incurred by the Contractor more than 10 Days before the date the Engineer received the Contractor's written notice requesting an adjustment. The reasons for and times of extensions are determined by the Engineer and such determination is final under Section 1-05.1. Any disagreement with the Engineer's determination must be pursued as specified in Section 1-04.4.

The Contractor's accepted critical path schedule in effect at the start of the claimed delay will be used to evaluate the extent of the delay and the claimed delay's impact on the Contract Time. The Contractor is responsible for showing on this critical path schedule that the change or event:

- a. Had a specific impact on the critical path, and except in cases of concurrent delay, was the sole cause of such impact; and
- b. Could not have been avoided by resequencing of the Work or other reasonable alternative.

Failure of the Contractor to efficiently use all available time after the Notice to Proceed Date will be considered in evaluating requests for extensions of time.

The granting of a time extension or granting payment of additional payment or granting of both will be made by Change Order, except that time extensions and/or payment of additional payment for suspensions of the Work on Days determined by the Engineer to have been Unworkable Days will be as specified in Section 1-08.8.

1-08.8(2) NON-EXCUSABLE DELAYS

Non excusable delays are those delays caused by factors within the Contractor's control that could have been foreseen or avoided had the Contractor exercised due care, prudence, foresight, or diligence and pursued the Work vigorously and without unauthorized interruption. Non-excusable delays do not entitle the Contractor to an extension of time and are not compensable.

Non excusable delays include, but are not limited to:

1. Delays caused by or resulting from the Contractor's own Subcontractors or Materialpersons.
2. The Contractor's lack of sufficient working capital.
3. The default of the Contractor.
4. The Contractor's act or failure to act.
5. The Contractor's failure to procure Materials or to provide labor or to perform the Work according to the Contract.
6. Changes, protests, increased quantities, or changed conditions that do not delay the completion of the Contract or prove to be an invalid or inappropriate time extension request.
7. Delays caused by Contractor submittal as specified in Section 1-05.3.
8. Rejection of faulty or inappropriate equipment as specified in Section 1-05.9.

The Contract may be terminated for a non-excusable delay.

1 **1-08.8(3) EXCUSABLE DELAYS**

2 **1-08.8(3)A GENERAL**

3 Excusable delays are those delays caused by one or more factors beyond the control and without fault or negligence of
4 the Contractor.

5 Excusable delays may be compensable and will entitle the Contractor to an extension of time if the activities that are
6 subject to the delay are on the critical path of the accepted critical path schedule in effect at that time, and the Contractor has
7 submitted a request for an extension of time within the prescribed time limits.

8 Excusable delays are limited to:

- 9 1. Acts of nature;
- 10 2. Acts of the public enemy;
- 11 3. Acts of a government in its sovereign capacity;
- 12 4. Acts or omissions or defaults of the Owner, or any of its officers and employees, including the Engineer, or of another
13 Contractor employed by the Owner;
- 14 5. Unforeseeable conditions not the fault of the Contractor;
- 15 6. Fires or floods due to nature or other casualty for which the Contractor is not responsible;
- 16 7. Epidemics;
- 17 8. Quarantine restrictions;
- 18 9. Unusual transportation delays such as freight embargoes;
- 19 10. Strikes or combined actions of labor;
- 20 11. Unusually severe weather as defined in this Section, provided that:
 - 21 a. The Engineer has not already allowed it as an Unworkable Day as specified in Section 1-08.5;
 - 22 b. The Contractor timely filed a written notice of protest (per Section 1-08.5) asserting that time the Engineer
23 charged as a Working Day should have been allowed as an Unworkable Day or portion thereof; and
 - 24 c. The Engineer responded to the Contractor's written notice of protest of item k. 2) above with a written notice
25 approving that time as an Unworkable Day or portion thereof.
- 26 12. Any other conditions for which the Contract permits time extensions including but not limited to:
 - 27 a. Section 1-04.3 if a change increases the time to do any of the Work including unchanged Work;
 - 28 b. Section 1-04.4 if the increased time is part of a dispute that is found to be valid;
 - 29 c. If a dispute or claim also involves a delay in completing the Contract and the dispute or claim proves to be valid;
 - 30 d. Section 1-04.5 if increases in the quantities of any Bid Item of Work exceed 25 percent and these increases
31 caused a delay in completing the Contract;
 - 32 e. Section 1-04.6 if a changed condition is determined to exist that caused a delay in completing the Contract;
 - 33 f. Section 1-05.3 if the Engineer does not approve properly prepared and acceptable Shop Drawings within the
34 specified time frame for review;
 - 35 g. Section 1-07.13 if the performance of the Work is delayed as a result of damage by others not party to the
36 Contract;
 - 37 h. Section 1-07.17 if the removal or the relocation of any utility by forces except the Contractor caused a delay;
 - 38 i. Section 1-07.24 if a delay results from the Owner not purchasing the Right of Way necessary for construction and
39 the Project Manual does not make specific provisions regarding unpurchased Right of Way;
 - 40 j. Section 1-08.6 if the performance of the Work is suspended, delayed, or interrupted for an unreasonable time that
41 proves to be the responsibility of the Engineer or Owner; or
- 42 13. Exceptional causes not specifically identified in items 1. through 12., provided the request letter proves the Contractor
43 had no control over the cause of the delay and could have done nothing to avoid or shorten it.

44 Unusually severe weather will be as determined by the Engineer. Minimum requirements for unusually severe weather
45 are monthly average temperature, precipitation, or precipitation events outside of 2 standard deviations of the historical
46 weather data of the past 9 years. Weather meeting the minimum requirements for unusually severe weather will be subject to
47 evaluation based on its effect on active work. If the Contractor elects not to perform the Work during periods of normal
48 inclement weather that does not qualify as unusually severe weather, and the Engineer does not grant an Unworkable Day(s),
49 the Contractor is not entitled to an extension of time.

50 **1-08.8(3)B COMPENSABLE DELAYS**

51 Payment will be provided for an increase in cost of performance of the Work (excluding profit) if the performance of all or
52 any part of the Work is suspended or delayed for an unreasonable period of time by an act of the Engineer or the Owner in the
53 administration of the Work and such act is not expressly or implicitly authorized by the Contract; or by failure of the Engineer or

1 Owner to act within a time period specified in the Contract (or if no time is specified, within a reasonable time). However, no
2 adjustment will be made under this Section for a suspension or delay if:

- 3 1. The performance would have been suspended or delayed by any other cause including the fault or negligence of the
4 Contractor; or
- 5 2. Payment is provided for or excluded under any other provision of the Contract (i.e. Concurrent Delays).

6 Compensable time extensions may be granted for reasons arising from the changes or changed conditions (differing site
7 conditions) Contract provisions. However, a time extension granted under the changes or changed conditions (differing site
8 conditions) Contract provisions are not considered a delay or suspension of the Work as defined in this Section. If the
9 Contractor believes an excusable delay is compensable, the Contractor must immediately submit a written request for
10 adjustment as specified in Section 1-08.8(1). The Engineer will determine if an equitable adjustment in cost or time is due. The
11 equitable adjustment for increase in costs, if due, is subject to the limitations specified in Section 1-09.4, provided that no profit
12 of any kind will be allowed on any increase in cost necessarily caused by the suspension, delay, or interruption.

13 The Engineer's determination as to whether an adjustment should be made will be final unless the decision is disputed
14 per the dispute resolution procedures specified in Section 1-04.4.

15 **1-08.8(3)C NON-COMPENSABLE DELAYS**

16 Non compensable delays are delays to the completion of the Work arising from conditions beyond the control and without
17 fault or negligence of the Contractor, the Engineer, or the Owner. Non compensable delays include, but are not limited to:

- 18 1. Acts of nature
- 19 2. Acts of the public enemy
- 20 3. Fires
- 21 4. Floods due to nature
- 22 5. Epidemics and quarantine restrictions
- 23 6. Unusual transportation delays (freight embargoes)
- 24 7. Strikes or combined actions of labor
- 25 8. Unusually severe weather
- 26 9. Delays of Subcontractor or Materialperson at any tier

27 **1-08.8(4) CONCURRENT DELAYS**

28 Concurrent delays are those delays where progress on critical path activities is impeded over the same period of time
29 due to causes attributable to both the Contractor, and Engineer or Owner. In the event of a concurrent delay, neither party is
30 entitled to payment from the other over the period of time that concurrency of delay exists.

31 **1-08.8(5) COST FOR SPU CREWS DUE TO CONTRACTOR DELAYS**

32 Except for excusable delays specified in Section 1-08.8(3), the Contractor must reimburse SPU for work the Contractor
33 has scheduled to be completed by SPU crews for water transfers and connections, if the Contractor is not prepared to allow
34 SPU to perform the work as scheduled. The Contractor must reimburse SPU for the costs to mobilize crews for the scheduled
35 work and for the crew time lost on a time and materials basis.

36 **1-08.9 LIQUIDATED DAMAGES**

37 Time is of the essence to the Contract. By entering into this Contract, the Contractor has agreed to complete the project
38 within the specified Contract Time. Liquidated Damages have been agreed upon to provide payment for damages resulting
39 from failure to achieve Physical Completion within the Contract Time. Such obligation is not construed as a penalty.

40 In the event that the Contractor has not achieved Physical Completion, and has not received an approved Contract Time
41 extension, the Contractor agrees to pay the Liquidated Damages specified in Section 4 of the Agreement Form, until Physical
42 Completion is achieved.

43 Likewise, in the event that the Contractor fails to achieve Substantial Completion within the Contract Time, the Contractor
44 agrees to pay the Liquidated Damages specified in Section 4 of the Agreement Form until Substantial Completion is achieved.

45 The Contractor:

- 46 1. Must pay Liquidated Damages for delay or for overruns in the Contract Time;
- 47 2. Authorizes the Engineer to deduct these damages from any money due or to become due to the Contractor; and
- 48 3. Is liable for any other damages as provided in this Contract.

49 No deduction or payment of such damages for delay will release the Contractor, in any degree, from further obligations
50 and liabilities to complete the entire Contract.

51 **1-08.10 TERMINATION OF CONTRACT**

52 **1-08.10(1) TERMINATION FOR DEFAULT**

53 The Owner may terminate the Contract upon the occurrence of any one or more of the following events:

- 1 1. If the Contractor fails to supply sufficient skilled workers or suitable Materials or equipment.
- 2 2. If the Contractor refuses or fails to prosecute the Work with such diligence as will ensure its physical completion
- 3 within the Contract Time and any extension of time that may have been granted to the Contractor by Change Order
- 4 or otherwise.
- 5 3. If the Contractor is adjudged bankrupt or insolvent, or makes a general assignment for the benefit of creditors, or if
- 6 the Contractor or a third party files a petition to take advantage of any debtor's act or to reorganize under the
- 7 bankruptcy or similar laws concerning the Contractor, or if a trustee or receiver is appointed for the Contractor or for
- 8 any of the Contractor's property on account of the Contractor's insolvency, and the Contractor or its successor in
- 9 interest does not provide the Engineer adequate assurance of future performance as specified in the Contract within
- 10 15 Days of receipt by the Contractor or its successor in interest of a request for assurance from the Engineer.
- 11 4. If the Contractor disregards any law, ordinance, rule, code, regulation, directive, or similar requirement of any public
- 12 entity having jurisdiction.
- 13 5. If the Contractor disregards the authority of the Engineer.
- 14 6. If the Contractor performs any portion of the Work in a way that deviates from the Contract requirements, and
- 15 neglects or refuses to correct any rejected performance.
- 16 7. If the Contractor otherwise violates in any material way any material provision or requirement of the Contract.
- 17 8. If the Contractor failed to disclose or submitted false or misleading information in the Supplemental Bidder
- 18 Responsibility Criteria Form or attached documentation.

19 Once the Owner determines that sufficient cause exists to terminate the Contract, written notice will be provided to the
 20 Contractor and its Surety declaring that the Contractor is in default on the Contract and that the Contractor is to cure the
 21 default within 15 Days after the written notice is delivered. In case of an emergency such as potential damage to life or
 22 property, the response time to cure the default after the written notice may be shortened. If the cure does not take place to the
 23 satisfaction of the Engineer, the Engineer, by serving written notice to the Contractor and Surety, may either:

- 24 a. Transfer the performance of the Work from the Contractor to the Surety; or
- 25 b. Terminate the Contract and, at the Engineer's option, prosecute it to completion by Contract or by other means. Any
- 26 extra costs or damages to the Owner will be deducted from any money due or coming due to the Contractor or Surety
- 27 under the Contract.

28 If the Owner elects to pursue 1 cure, it will not bar the Owner from pursuing other cures on the same or subsequent
 29 defaults.

30 Upon receipt of a written notice that the Work is being transferred to the Surety, the Surety will enter on the Project Site
 31 and take possession of all Materials, tools, and appliances for the purpose of completing the Work under the Contract and
 32 employ by Contract or otherwise any person or persons satisfactory to the Engineer to complete the Work and provide the
 33 Materials without termination of the Contract. Such employment does not relieve the Surety of its obligations under the
 34 Contract and the Payment and Performance Bond. If there is a transfer to the Surety, payments on progress estimates
 35 covering the Work after the transfer is made to the extent permitted under law to the Surety or its agent without any right of the
 36 Contractor to make any claim against the Owner for such sums.

37 If the Contractor fails to cure any default within the time specified in the Owner's written notice and if the Owner
 38 terminates the Contract or provides such sufficiency of labor or Materials as is required to complete the Work, then the
 39 Contractor is not entitled to receive any further payment on the Work until the Work has been fully performed. The Contractor
 40 bears all extra expenses incurred by the Owner in completing the Work, including all increased costs for completing the Work,
 41 and all damages sustained, or that may be sustained, by the Owner by reason of such refusal, neglect, failure, or
 42 discontinuance of the Work by the Contractor. If Liquidated Damages are provided for in the Contract, the Contractor is liable
 43 for whatever amount of such damages accrues through the Substantial Completion Date. After all Work encompassed by the
 44 Contract has been completed, the Engineer will calculate the total expenses and damages for the completed Work. If the total
 45 expenses and damages are less than any unpaid balance due the Contractor, the excess will be paid by the Owner to the
 46 Contractor. If the total expenses and damages exceed the unpaid balance, the Contractor and the Surety are jointly and
 47 severally liable to the Owner and must pay the difference to the Owner on demand. The Contractor and its sureties are liable
 48 for all damages and costs, including but not limited to: (1) compensation for Architect and engineering services and expenses;
 49 (2) any other costs or damages incurred by the Owner in completing and/or correcting the Work; and (3) any other special,
 50 incidental or consequential damages incurred by the Owner which results from the termination.

51 In exercising the Engineer's right to prosecute the Work to physical completion, the Engineer has the right to exercise
 52 sole discretion as to the manner, method, and reasonableness of the costs of completing the Work. In the event that the
 53 Owner takes Bids for remedial work or physical completion of the project, the Contractor is not eligible for the Award of such
 54 contract.

55 In the event the Contract is terminated, the termination of the Contract does not affect any rights of the Owner against the
 56 Contractor, including any warranties or assurances. The rights and remedies of the Owner under the termination clause are in
 57 addition to any other rights and remedies provided by law or under this Contract. Any retention or payment of monies to the
 58 Contractor by the Owner will not release the Contractor from liability.

59 If a written notice of termination for default has been issued and it is later determined for any reason that the Contractor
 60 was not in default, the rights and obligations of the parties is the same as if the written notice of termination had been issued

1 under Termination for Public Convenience in Section 1-08.10(2). This result applies where the Contract is terminated for
2 default because of failure to prosecute the Work, and where a Contractor's delay was found to be excusable as specified in
3 Section 1-08.8. Any termination for default may be grounds for debarment as specified in Section 1-08.10(8).

4 **1-08.10(2) TERMINATION FOR PUBLIC CONVENIENCE**

5 The Owner may terminate the Contract in whole, or from time to time in part, whenever:

- 6 1. The Contractor is prevented from proceeding with the Work as a direct result of an Executive Order of the President
7 with respect to the prosecution of war or for national defense; or an Executive Order of the President or Governor of
8 the State with respect to the preservation of energy resources.
- 9 2. The Contractor is prevented from proceeding with the Work by reason of a preliminary, special, or permanent
10 restraining order of a court of competent jurisdiction where the issuance of such restraining order is primarily caused
11 by an act or omission of a person or agency except the Contractor.
- 12 3. The Owner determines that such termination is in the best interest of public or the Owner.
- 13 4. The Owner determines that such termination is mutually beneficial to the Owner and the Contractor.

14 **1-08.10(3) PAYMENT FOR TERMINATION FOR PUBLIC CONVENIENCE**

15 Whenever the Contract is terminated as specified in Section 1-08.10(2), payment will be made for actual Work performed
16 at Bid Item prices for completed Bid Items of the Work. An equitable adjustment for partially completed Bid Items of Work and
17 disposal of Materials will be made as specified in Section 1-09.5.

18 **1-08.10(4) TERMINATION CLAIM BY CONTRACTOR**

19 After receipt of a written notice of termination of Contract for public convenience, the Contractor must submit to the
20 Engineer a termination claim in sufficient detail to enable the Engineer to ascertain the basis and amount of the claim. The
21 claim must provide the minimum detailed information specified in Section 1-04.4(3). The claim must be submitted promptly but
22 in no event later than 60 Days after the effective date of termination. The Contractor must pursue resolution of the claim
23 through the established administrative channels of the Owner. The Contractor must make its business and office records
24 available to the extent necessary for the Engineer to verify the Contractor's claim and to determine the amount of entitlement
25 as specified in Section 1-09.10. The decision of the Engineer is final, see Section 1-05.1.

26 **1-08.10(5) TERMINATION FOR DELAYS DUE TO LITIGATION**

27 Pursuant to RCW 60.28.080, if the delay caused by litigation exceeds 6 months, the Contractor may then elect to
28 terminate the Contract and receive payment in proportion to the quantity of the Work completed plus the cost of the delay.
29 Amounts retained and accumulated under RCW 60.28.011 will be held for a period of 60 Days following the election of the
30 Contractor to terminate.

31 **1-08.10(6) RESPONSIBILITY OF THE CONTRACTOR AND SURETY**

32 Termination of the Contract or an Order of Debarment does not relieve the Contractor of any responsibilities under the
33 Contract for Work performed.

34 Termination of the Contract or an Order of Debarment does not relieve the Surety or Sureties of obligations under the
35 Payment and Performance Bond, and Retainage Bond if applicable, for Work performed.

36 **1-08.10(7) TERMINATION BEFORE COMPLETION**

37 Pursuant to RCW 60.28.011(7), if after a substantial portion of the Work has been completed, an unreasonable delay will
38 occur in the completion of the remaining portion of the Contract for any reason not the result of a breach thereof, the Owner
39 may, if the Contractor agrees, delete from the Contract the remaining Work and accept as final the Improvement at the stage
40 of completion then attained and make payment in proportion to the quantity of the Work accomplished. In such case, whatever
41 amount of the Contractor's payment has been retained and accumulated under RCW 60.28.011(7) will be held for the statutory
42 period of 60 Days following the establishment of the Completion Date. In the event that the Work has been terminated before
43 Completion, the Owner may thereafter enter into a new Contract with the same Contractor without an Advertisement for Bids
44 or Bid for the performance of the remaining Work or Improvement for an amount equal to or less than the cost of the remaining
45 Work under the original Contract.

46 **1-08.10(8) DEBARMENT**

47 The Owner may debar a Contractor under SMC 20.70.

48 **SECTION 1-09 MEASUREMENT AND PAYMENT**

49 **1-09.1 MEASUREMENT OF QUANTITIES**

50 In measuring all acceptably completed Bid Items of Work, the Engineer will:

- 51 1) Use United States standard measure.
- 52 2) Make all measurements as described in this Section, unless individual Specifications require otherwise.

- 3) Follow methods generally recognized as conforming to good engineering practice.
- 4) Conform to the usual practice of the Owner by carrying measurements and computations to the proper significant figure or fraction of units for each Bid Item.
- 5) Measure horizontally or vertically (unless otherwise specified).

The terms listed below are defined as follows in all measurements under this Section:

- a) Lump sum (when used as a Bid Item of payment): Complete payment for the Work described for that item in the Contract.
- b) Gauge: In the measurement of plates as the U.S. Standard Gauge; in the measurement of galvanized sheets used to manufacture corrugated metal pipe, metal plate pipe Contracts and arches, and metal cribbing, as specified in AASHTO M 36, M 167, M 196, M 197, or M 219; and in the measurement of wire as specified in AASHTO M 32.
- c) Ton: The short ton is equal to 2,000 pounds of avoirdupois weight. All Materials that are measured or proportioned by weight will be weighed according to the requirements of Section 1-09.2. If Material is shipped by rail, the car weight may be accepted provided only the actual weight of Material is paid for. However, car weights are not acceptable for Material to be passed through mixing facilities.
- d) Calculated: When the unit of measurement is calculated, payment or deduction will be calculated per the applicable specification. Calculated (abbreviated CALC) will be used as the Bid Item unit of measurement in the Bid form. The extended Bid Item amount in the Bid Form will be either zero or an estimated amount for bidding purposes only.

For each basis of measurement listed below, the Engineer will use the method of measurement described. For Bid Items or Materials measured on the basis of:

- 1. Square Yard or Square Foot: The measurement must be a calculation from the neat dimensions shown on the Drawings or as changed by the Engineer. If there is an exception within the measured area where the item of Work is not performed (such as a drainage Structure within a measured sidewalk) and if the exception area is greater than 9 square feet, then the area of the exception will be subtracted from the payment area calculated from the neat dimensions.
- 2. Linear Foot: Items such as pipe, guardrail, and under drains are measured parallel to the Structure's base or foundation, unless the Drawings require otherwise.
- 3. Weight: Weighed as required in Section 1-09.2.
- 4. Volume:
 - a. Excavation and Embankment: Measured by the average end area method or by the finite element analysis method using digital terrain modeling techniques. All or some computations may be based on ground elevations and other data derived photogrammetrically. The Engineer may correct for curvature.
 - b. In Hauling Vehicle: Measured at the point of delivery. Hauling vehicles may be of any size or type the Engineer approves provided that the body is of such shape that the actual contents may be readily and accurately determined. If the Engineer requires, the Contractor must level loads at the delivery point to facilitate measurement.
 - c. Mineral Aggregates: Measured by the cubic yard compacted in place to the neat line dimensions indicated on the Drawings or Standard Plans.

1-09.1(1) UNIT WEIGHT - VOLUME CONVERSION FACTORS FOR MEASUREMENTS

Bid Items for which the Contract requires measurement by volume may, at the Contractor's request and with the Engineer's approval, or at the discretion of the Engineer, be converted to weight from volume measurements using a determination of density (unit weight) factor. Bid Items for which the Contract requires measurement by weight may, at the Contractor's request and with the Engineer's approval, or at the discretion of the Engineer, be converted to volume from weight measurements using a determination of density (unit weight) factor.

The relationship between degree of compaction of aggregates or soils in a hauling unit, stockpile, or compacted in-place are unknown. The conversion for measurement will be based on bulk density (unit weight) factor at location and condition of measurement; typically compacted in-place. The following tests may be applicable:

- 1. ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods
- 2. ASTM C29 / C29M Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate
- 3. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
- 4. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
- 5. Other methods as approved by the Engineer

When proposed by the Contractor, conversion factor testing must be performed at the Contractor's expense by an Engineer approved independent materials Laboratory retained by the Contractor; the Engineer may verify testing and if testing results are in conflict, the Engineer's conversion factor will govern. When directed all testing for conversion factor will be by the Engineer.

For each item listed below, the Engineer will use the method of measurement described:

- 1 a. Structures: Measured on the neat lines shown on the Drawings or as changed by the Engineer. When a complete
2 Structure or Structural unit is specified as the unit of measurement, the unit must include all fittings and accessories.
- 3 b. Timber: Measured by the thousand board feet (MBM) actually used in the Structure. Measurements will be based on
4 the nominal width, thickness, and the extreme length of each piece.
- 5 c. Standard Manufactured Items: Materials such as fence, wire, plates, rolled shapes, or pipe conduit, when specified,
6 must be measured by the manufacturer's identification of gage, unit weight, and section dimension. The Engineer will
7 accept manufacturing tolerances set by each industry unless cited Specifications require more stringent tolerances.
- 8 d. Portland Cement: Measured by the pound, ton, or sack. A sack weighs 94 pounds.
- 9 e. Asphalt: Measured by the gallon or ton. If measured by gallon, measurement will be made at 60 °F (or will be
10 corrected to the volume at 60 °F in keeping with ASTM D 1250). If shipped by rail, truck, or transport, measurement
11 will be by net certified scale weights or certified volumes (corrected for Material lost en route or not actually
12 incorporated into the Work). The Engineer will use the volume weight conversion table below to compute asphalt
13 measurements:

14
15 **Conversion Factors**
16 **Average Weights and Volumes of Asphalt**

| Grade | Gallons per Ton | Pounds per Gallon |
|---------------------------|-----------------|-------------------|
| Liquid Asphalt | @ 60 °F | @ 60 °F |
| 70 | 253 | 7.90 |
| 250 | 249 | 8.03 |
| 800 | 245 | 8.16 |
| 3000 | 241 | 8.30 |
| Paving Asphalt | | |
| All PG Grades | 235 | 8.51 |
| Emulsified Asphalt | | |
| All Grades | 240 | 8.33 |

17
18 No measurement will be made for:

- 19 1) Work performed or Materials placed outside lines shown on the Drawings or set by the Engineer;
20 2) Materials wasted, used, or disposed of as contrary to the Contract;
21 3) Rejected materials (including those rejected after placement if the rejection resulted from the Contractor's failure to
22 comply with the Contract);
23 4) Hauling and disposing of rejected materials;
24 5) Material remaining on hand after the Work is completed, except as provided in Section 1-09.8; or
25 6) Any other Work or Material contrary to any Contract provision.

26 **1-09.2 WEIGHING EQUIPMENT**

27 **1-09.2(1) GENERAL REQUIREMENTS FOR WEIGHING EQUIPMENT**

28 Materials proportioned, or measured and paid for by weight must be weighed on accurate, approved scales by
29 competent, qualified personnel at locations satisfactory to the Engineer.

30 Scales for the weighing of natural, manufactured, or processed construction materials obtained from natural deposits,
31 stockpiles, or bunkers which are required to be proportioned or measured and paid for by weight, must be furnished, erected
32 and maintained by the Contractor, or must be certified, permanently installed commercial scales.

33 Each truck to be weighed must have a unique identification number. This number must be legible and in plain view of the
34 scale operator. Trucks used to haul Material being paid for by weight must be weighed empty at least once daily or at such
35 times as the Engineer directs. Duplicate weight tickets must be prepared and accompany each truckload of Material delivered
36 to the project. The duplicate weight tickets must be submitted to the Engineer on the Day of delivery. The tickets must be
37 legible and contain the following information:

- 38 a. Preprinted ticket serial number
39 b. Identification number of truck/truck trailer
40 c. Date and hour of weighing
41 d. Type of Material
42 e. Weight of load including gross, tare, and net weights. If the scale has a tare beam so the net weight can be read
43 directly, only the net weight need be recorded on the ticket.

- 1 f. Weighperson's identification
- 2 g. Item number
- 3 h. Contract number
- 4 i. Unit of measure
- 5 j. Legal gross weight in remarks section
- 6 k. Location of delivery (station or by street name)

7 The net weight of Material measured by the ton that is being placed in each truck must be printed on the ticket by an
 8 automatic weighing device from a certified scale.

9 Scales must:

- 10 1. Be accurate to within 1/2 of 1 percent throughout the range of use
- 11 2. Not include spring balances
- 12 3. Include beams, dials, or other reliable readout equipment
- 13 4. Be arranged so that operators and inspectors can safely and easily see the dials, beams, rods, and operating scale
 14 mechanisms
- 15 5. Be built to prevent scale parts from binding, vibrating, or being displaced and to protect all working parts from falling
 16 material, wind, and weather
- 17 6. Be carefully maintained, with
 - 18 a. Bunkers and platforms kept clear of accumulated materials that could cause errors.
 - 19 b. Knife edges given extra care and protection.

20 At each batch and platform scale location, the Contractor must keep 10 standard 50 pound weights for scale calibration
 21 and testing. If the Engineer has approved other calibration and testing equipment, the Contractor may substitute the approved
 22 other equipment for these weights.

23 **1-09.2(2) SPECIFIC REQUIREMENTS FOR BATCHING SCALES**

24 All Materials proportioned by weight must be weighed on an accurate, approved scale by qualified operators. Scale
 25 locations require the Engineer's approval.

26 Each scale must be designed to support a weighing hopper. The arrangement must make it convenient for the operator
 27 to remove Material from the hopper while watching readout devices. Any hopper mounted on a platform scale must have its
 28 center of gravity directly over the platform centerline.

29 Marked intervals on the readout device must be spaced evenly throughout and must be based on the scale's nominal
 30 rated capacity. These intervals must be at least 1 pound, but less than 1/10 of 1 percent of nominal rated capacity.

31 An agent of the scale manufacturer must test and service any batch scale before its use at each new site and then at 6
 32 month intervals. The Contractor must provide the Engineer a copy of the final results after each test. Whenever the Engineer
 33 requests, the Contractor's operator must test the scale while the inspector observes.

34 Portland or asphalt cement must be weighed on a scale not used for other materials.

35 **1-09.2(3) SPECIFIC REQUIREMENTS FOR PLATFORM SCALES**

36 Platform scales must be certified scales that automatically print the net, tare, and gross weights on the ticket and must
 37 have the size and capacity to weigh an entire hauling vehicle or combination of connected vehicles at one time. No part of the
 38 connected vehicle or combination can be off the platform when weighing.

39 A platform scale operator must be assigned by the Contractor to weigh all materials on the Contractor's platform scales
 40 and make the records thereof. The Contractor may also elect to use commercial scales. The Contractor must furnish approved
 41 load tickets at the scale and legible duplicate copies to the Engineer at the delivery point and guarantee permission for Owner
 42 personnel to periodically observe the weighing and to check and compile the daily record of scale weights. Tare weights of
 43 each conveyance must be taken 2 or more times daily.

44 The scales must be calibrated daily. The scales check methods and documentation procedures for scale checks and
 45 recording tare weights must be approved by the Engineer. Checks must be made throughout each Day to see that the scales
 46 are balanced and return to zero when no load is on them.

47 Any Contractor supplied scale must include a scale house with a floor space of at least 6' x 10'. The scale house must:

- 48 1. Be wind and weather tight.
- 49 2. Have windows for light and ventilation.
- 50 3. Include a door.
- 51 4. Be lockable.

52 The scale house must include a table, a chair, electrical power, and a space heater. The Contractor must provide a rest
 53 room near the scale house.

1 Platform scales must be installed and maintained with the platform level and rigid bulkheads at each end to eliminate
2 binding and shifting. The platform scale beam or dial must have graduated intervals of no more than 40 pounds. When testing
3 the scales, the weights must be read and recorded to the nearest 20 pounds and during weighing operations, weights must be
4 read and recorded to the nearest hundred weight (cwt.).

5 Before use at a new site and every 6 months thereafter, the scales must be approved per local ordinances or rules of the
6 State Department of Agriculture's Weights and Measures Section, or be serviced and tested by a scale company
7 representative with at least 10,000 pounds, with a copy of the final test results provided to the Engineer.

8 **1-09.2(4) SPECIFIC REQUIREMENTS FOR BELT CONVEYOR SCALES**

9 Conveyor belt weighing may be accepted for untreated Materials provided that this method or device meets the general
10 requirements of weighing equipment.

11 Belt conveyor scales must comply with the requirements for belt conveyor scales as specified in the National Bureau of
12 Standards, Handbook No. 44, except as modified by these Specifications.

13 A daily static load test must be made after an approximate 1/2 hour of continuous running of the belt conveyor and
14 whenever the air temperature varies significantly. A chain test will be required whenever a need for adjustment has been
15 determined by the daily static load test.

16 The test chain calibration computation, calibration procedures and results, and related documents must be available for
17 review by the Engineer. The test chain must be clearly marked with its calibration. The test chain must be carried in a suitable
18 container and must be immediately available for testing of the belt conveyor scales.

19 Comparisons of accuracy may be made by checking the average of 5 or more sequential hauling unit payloads on
20 platform scales meeting the requirements of these Specifications. A comparative accuracy of ± 0.5 percent of the payload of
21 the average hauling unit will be acceptable. Since the recording odometer, of conveyor belt scales in general use, is graduated
22 in 0.1 ton (200 lb.) increments and, since the recording is a cumulative process, minor differences in reading or variations
23 smaller than 0.1 ton carry over from one vehicle unit to another. For greater accuracy, confirmation of the conveyor weights
24 will be based on the tonnage values obtained from readings taken from the sealed odometer at the starting and end of each
25 check period. The number of check loads may be increased by the Engineer should the test results fluctuate.

26 The Contractor must furnish appropriate serially numbered tickets as approved by the Engineer for self-printing of the
27 time and date of loading and the approximate load out weight. Each ticket must be imprinted from a recording device at the
28 loading point by the truck driver and delivered to the Engineer at the Project Site. The delivered ticket must be marked with
29 hauling conveyance equipment number.

30 The recording tape, odometer, totalizer, calibration adjustment, and clock time imprinter must be secured and locked. All
31 keys must be in the possession of the Engineer.

32 **1-09.2(5) UNDERWEIGHING / OVERWEIGHING SCALES**

33 In the event inspection, or random checks, reveals that scales have been underweighing, the scales must be adjusted
34 and no additional payment to the Contractor will be allowed for Materials previously weighed and recorded. Scales
35 overweighing (indicating more than true weight) are not permitted to operate and all Materials received after the last previous
36 corrected weighing accuracy test will be reduced by the percentage of error in excess of 1/2 of 1 percent. No payment will be
37 made for Materials received by weight which have not been weighed per the foregoing Specification or other methods
38 specifically approved in writing for the individual project. In the event these random checks result in net weights that are
39 different by more than 1 percent of the smaller net weight, the Contractor must, at the Engineer's option, use a certified scale
40 of the Engineer's choice.

41 **1-09.2(6) PAYMENT**

42 All costs in connection with furnishing, installing, certifying and maintaining scales for furnishing check weights and scale
43 house and for all other items specified in this Section for the weighing of construction Materials for proportioning or payment
44 are included in the Bid Item prices for the various Bid Items of Work which comprise the Contract.

45 **1-09.3 SCOPE OF PAYMENT**

46 **1-09.3(1) GENERAL**

47 The Contractor must receive and accept payment provided in the Contract as full payment for the following:

- 48 1. Furnishing all Materials and for performing all Work under the Contract in a complete and acceptable manner
49 including changes in the Work, Materials, or Drawings as provided for by approved Change Orders.
- 50 2. All risks, loss, damage, or expense of whatever character arising out of the nature or prosecution of the Work.
- 51 3. All expense incurred as a result of the suspension or discontinuance of the Work as specified in the Contract.

52 The payment of any estimate or retained percentage does not relieve the Contractor of the obligation to make good any
53 defective Work or unauthorized Work or defective Materials.

54 Unless the Contract provides otherwise, the Bid Item prices for the various Bid Items of the Work listed in the Bid Form
55 will be full payment for all labor, Materials, Supplies, equipment, tools, and all things of whatever nature required for the
56 complete incorporation of the Bid Item into the Work.

1 The term lump sum, when used as a Bid Item or Bid Items of payment, means full payment for the Work described for
2 that Bid Item in the Contract.

3 Unless modified otherwise in the Contract, the Bid Items listed or referenced in the payment clause of each Section of
4 the Specifications will be the only Bid Items for which payment will be made for the Work described in or specified in that
5 particular Section. Should the Contractor perform Work that is listed as a Bid Item in a payment clause but not in the Bid Form,
6 payment for that Work will be made as specified in Section 1-04.1(2).

7 If the payment clause in the Specifications relating to any Bid Item price in the Bid Form requires that said Bid Item price
8 cover and be considered payment for certain Work or Material essential to the item, then the Work or Material will not be
9 measured or paid for under any other Bid Item which may appear elsewhere in the Bid Form or Specifications.

10 Certain Bid Items appearing in the Standard Specifications may be modified in the Contract to include words such as:

- 11 a. "For Structure," or "For Concrete Barrier," or "For Bridge" with the intent of clarifying specific use; and/or
- 12 b. "Site (site designation)," with the intent of clarifying where a specific item of Work is to be performed.

13 Modifications of the Bid Items in this manner do not change the intent of the Specifications relating to these items.

14 Payment for Bid Items listed or referenced in the payment clause of any particular Section of the Specifications includes
15 all Work required, specified, or described in that particular Section. Payment items will generally be listed generically in the
16 Specifications (e.g. "Maintenance hole (type)") and specifically in the Bid Form (e.g. "Maintenance hole, Type 204A"). When
17 items are to be furnished under one payment item and installed under another payment item, such items must be furnished
18 FOB to the Project Site or, if specified in the Contract, delivered to a designated Owner site. The Contractor is responsible for
19 Materials furnished or furnished and installed under these conditions, with regard to storage, until such items are incorporated
20 into the Work or, if such items are not to be incorporated into the Work, delivered to the applicable City storage site if specified.

21 Payment for Material furnished but not yet incorporated into the Work may be made on progress estimates to the extent
22 allowed.

23 **1-09.3(2) LUMP SUM BREAKDOWN**

24 This breakdown will be used to determine partial lump sum Bid Item payments on progress payments. Without an
25 accepted lump sum breakdown, partial lump sum payments will be at the discretion of the Engineer. Submittals must be as
26 specified in Section 1-05.3

27 Within 3 Working Days of the Notice to Proceed or at the preconstruction conference, the Contractor must submit a lump
28 sum breakdown for each lump sum Bid Item except mobilization, Bid Items less than \$5,000, and short term Bid Items for
29 scopes of work that can be completed in less than 2 weeks. The Contractor's lump sum breakdown must be by elements of
30 work. For elements of work with a cost greater than \$5,000, the breakdown must also include costs by labor, equipment, and
31 Material. Short term Bid Items and elements of Work in a lump sum breakdown that are partially complete will be paid at a
32 prorated percentage as determined by the Engineer.

33 **1-09.4 EQUITABLE ADJUSTMENT FOR CHANGES**

34 **1-09.4(1) CHANGES IN CONTRACT WORK**

35 The equitable adjustment provided for elsewhere in the Contract will be determined by agreement between the
36 Contractor and the Owner using:

- 37 1. Unit prices; or
- 38 2. Other agreed on prices including lump sum.

39 When payment is by lump sum the Contractor must provide substantiation of the lump sum price as specified in Section
40 1-09.3(2). The payment includes all costs for the Work, overhead, and profit.

41 The Contractor must include retail sales tax in the agreed price, as specified in Section 1-07.2.

42 The following limitations apply in determining the amount of the equitable adjustment:

- 43 a. The equipment rates must not exceed the rates set forth in the AGC/WSDOT Equipment Rental Agreement in effect
44 at the time the Work is performed as specified in Section 1-09.6.
- 45 b. To the extent any delay or failure of performance was concurrently caused by the Owner and the Contractor as
46 specified in Section 1-08.8(4), the Contractor is entitled to a time extension for the period of delay, provided it make
47 such a request as specified in Section 1-08.8; however, the Contractor is not entitled to any adjustment in Contract
48 Price.
- 49 c. No claim for anticipated profits on deleted, terminated, or uncompleted Work will be allowed.
- 50 d. No claim for consequential damages of any kind will be allowed.

51 If the parties cannot come to an agreement then the Owner will determine the total price for the Work including overhead
52 and profit.

53 **1-09.4(2) CHANGES IN LAW OR TAXES**

54 Adjustments in the amount to be paid by the Owner under the terms and conditions of the Contract will not be made as a
55 result of any change in laws, ordinances or regulations except as specifically provided by the following:

- 1 1. Changes in Laws: The Owner will not adjust payment to compensate the Contractor for changes in legal
- 2 requirements unless those changes are specifically within the scope of RCW 39.04.120. For changes under RCW
- 3 39.04.120 the Owner will compensate the Contractor as specified in Section 1-09.4(1).
- 4 2. Changes in Taxes: The Owner will adjust payment to compensate for tax changes under the following conditions:
- 5 a. The changes involve federal or state taxes on Materials used in or consumed for the Work.
- 6 b. The changes increase Contractor paid taxes by more than \$500.
- 7 c. For items in the original Contract, the tax change must occur after the Bid Opening Date.
- 8 d. For negotiated Contracts, the tax change must take place after the Execution date of the Contract.
- 9 e. The Contractor if requested by the Engineer certifies in writing that the Awarded Contract Price does not include
- 10 an extra amount to cover a possible change in taxes.
- 11 f. The Contractor permits the Owner to audit the Contractor's records to the extent necessary to substantiate any
- 12 claim for payment under this Section.

13 Within the above conditions the Owner will adjust payment by the actual dollar amounts of increase or decrease caused
14 by the tax changes.

15 **1-09.5 DELETED OR TERMINATED WORK**

16 The Engineer may delete work by Change Order as specified in Section 1-04.3. The Owner may terminate the Contract
17 in whole or part as specified in Section 1-08.10. When the Contract is terminated in part, the partial termination will be treated
18 as a deletion Change Order for payment purposes under this Section.

19 Payment for completed items will be at Bid Item prices.

20 When any item is deleted in whole or in part by Change Order or when the Contract is terminated in whole or in part,
21 payment for deleted or terminated work will be made as follows:

- 22 1. Payment will be made for the actual number of units of work completed at the Bid Item unit prices unless the
- 23 Engineer determines the Bid Item unit prices are inappropriate for the work actually performed. When that
- 24 determination is made by the Engineer, payment for work performed will be as mutually agreed. If the parties cannot
- 25 agree the Engineer will determine the amount of the equitable adjustment as specified in Section 1-09.4.
- 26 2. Payment for partially completed lump sum Bid Items will be as mutually agreed. If the parties cannot agree, the
- 27 Engineer will determine the amount of the equitable adjustment as specified in Section 1-09.4.
- 28 3. To the extent not paid for by the Bid Item prices for the completed units of work, the Owner will pay as part of the
- 29 equitable adjustment those direct costs necessarily and actually incurred by the Contractor in anticipation of
- 30 performing the Work that has been deleted or terminated.
- 31 4. The total payment for any 1 Bid Item in the case of a deletion or partial termination cannot exceed the Bid Item price
- 32 as modified by approved Change Orders less the estimated cost (including overhead and profit) to complete the Bid
- 33 Item of work and less any amount paid to the Contractor for the Bid Item.
- 34 5. The total payment where the Contract is terminated in its entirety cannot exceed the revised Contract Price less those
- 35 amounts paid to the Contractor before the effective date of the termination.
- 36 6. No claim for damages of any kind or for loss of anticipated profits on deleted or terminated work will be allowed
- 37 because of the termination or Change Order.

38 Contract Time will be adjusted as the parties agree. If the parties cannot agree, the Engineer will determine the equitable
39 adjustment for Contract Time.

40 Acceptable Materials ordered by the Contractor before the date the Work was terminated as specified in Section 1-
41 08.10(2) by the Owner or deleted as specified in Section 1-04.3 by the Engineer, will either be purchased from the Contractor
42 by the Owner at the actual cost and become the property of the Owner, or the Owner will reimburse the Contractor for the
43 actual costs connected with returning these Materials.

44 **1-09.6 FORCE ACCOUNT**

45 **1-09.6(1) GENERAL**

46 The terms of the Contract or of a Change Order may call for Work or Material to be paid for by force account. The Owner
47 will reimburse the Contractor for all costs associated with the force account Work, including costs of labor, small tools,
48 Supplies, equipment, specialized services, Materials, disposal costs, and applicable taxes, The mark-up values provided in
49 this Section are intended to compensate for all applicable overhead, and profit. The amount to be paid is determined as
50 specified in this Section.

51 Nothing in this provision precludes the Contractor from seeking an extension of time or time-related adjustments to
52 unchanged Work arising as a result of the force account Work. The amount and costs of any Work to be paid by force account
53 will be computed by the Engineer, and the result is final as specified in Section 1-05.1.

54 The parties may agree at any time to convert items included in the Bid as force account or added by Change Order as
55 force account into agreed on unit prices or lump sums applicable to the remaining Work.

1 Mark-up in Sections 1-09.6(2) to 1-09.6(5) will only be applied once, regardless of whether such items are provided by
2 the Contractor or by any tier of Subcontractor. However, the mark-up in Sections 1-09.6(2) to 1-09.6(5) will not be applied for
3 services acting in the manner of a Subcontractor. Services acting in the manner of a Subcontractor as specified in Section 1-
4 09.6(7) are considered a Subcontractor. Mark-up on work performed by a Subcontractor specified in Section 1-09.6(7) will only
5 be applied once, regardless of tier of Subcontractor, and not at all for work performed by the prime Contractor.

6 **1-09.6(2) LABOR**

7 Labor reimbursement calculations are based on a Contractor's Project Labor List (Labor List) prepared and submitted to
8 the Engineer by the Contractor for the Contractor and for any Subcontractor before that firm commences force account Work.
9 All Labor List submittals must be made as specified in Section 1-05.3. The Engineer will have 10 Working Days to review and
10 either approve or reject a Labor List. If a Labor List is rejected, the Engineer will identify the reasons for rejection and the
11 Contractor or Subcontractor will have 2 Working Days to submit a new Labor List for review and approval. Once a Labor List is
12 approved by the Engineer, it will be used to calculate force account labor payment until a new Labor List is submitted and
13 approved. The Engineer may compare the Labor List to payrolls and other documents and may, at any time, request the
14 Contractor to submit a new Labor List. The Contractor may also submit a new Labor List at any time subject to the same
15 procedure for review and approval as the initial Labor List. Prior payments will not be adjusted as a result of a new Labor List.

16 To be approved, the Labor List must be accurate and comply with the requirements of this Section. The Labor List must
17 include regular time rates and overtime rates for all employees and work classifications expected to participate in force
18 account Work. These rates must meet or exceed the basic prevailing wage and fringe benefits, the current rates for Federal
19 Insurance Compensation Act (FICA), Federal Unemployment Tax Act (FUTA) and State Unemployment Tax Act (SUTA), the
20 firm's present rates for medical insurance and Industrial Insurance premiums, and the planned payments for travel and per
21 diem payment. The rates cannot include any type of overhead cost or profit.

22 If there is no approved Labor List at the time for Work or Material to be paid for by force account the Engineer may elect
23 to unilaterally develop a Labor List, using data that the Engineer determines to be the best available. Prior calculations
24 prepared using the Engineer's Labor List will not be changed as a result of differences with the Contractor's Labor List.

25 In addition to payment for direct labor costs defined above, the Owner will pay the Contractor 27 percent of the sum of
26 the costs calculated for labor reimbursement to cover project overhead, general company overhead, profit, bonding, insurance
27 specified in Section 1-07.18, Business & Occupation tax, and any other costs incurred. This overhead amount will include any
28 costs of standard safety training and health tests.

29 **1-09.6(3) MATERIALS**

30 The Owner will reimburse invoice cost for Contractor-supplied Materials. For the purpose of the provision, direct material
31 costs include those items incorporated into the Work, Supplies used during the Work and items consumed as part of the Work.
32 This cost includes freight and handling charges and applicable taxes. Before Work is started, the Engineer may require the
33 Contractor to obtain multiple quotations for the Materials to be used and the Engineer may select the vendor with prices and
34 terms most advantageous to the Owner.

35 The Owner may provide Materials. In this case, the Contractor will not receive payment for any costs, overhead, or profit
36 arising from the value of the Materials themselves. Additional costs to handle and place the Owner (or Agency) furnished
37 Material will be compensated as specified in Section 1-09.6.

38 Tipping fees, material disposal services, and other material disposal costs are not considered Materials, and are
39 considered subcontracted services as specified in Section 1-09.6(5).

40 The Contractor will provide a list of the types and quantities of Contractor-supplied Materials, subject to verification by the
41 Engineer. This list will be furnished promptly after the Material is incorporated, on a daily basis unless agreed otherwise. The
42 Contractor must attach valid copies of vendor invoices to the list. Tickets of lading must be submitted to the Engineer the Day
43 Materials are received.

44 The Engineer will have 10 Working Days to review the prices and quantities on the Contractor-supplied Materials list. If
45 the Engineer agrees to the proposed prices, the Engineer will approve the completed list. If the Engineer does not agree, the
46 list will be returned to the Contractor for revision. The Contractor must submit the revised list to the Engineer within 3 Working
47 Days. If the Engineer does not agree with revised prices or if the list has not been received by the Engineer within 3 Working
48 Days after the list has been returned to the Contractor for revision, the Engineer will determine the cost for all or part of those
49 Materials, using the best data available.

50 If invoices are not available for Materials from the Contractor's stocks, the Contractor must certify actual costs at a
51 reasonable level by Affidavit including an explanation of how the actual costs certified were determined and supported by any
52 relevant information supporting the certification. The Engineer will have 5 Working Days to review. If the Engineer agrees to
53 the certified prices, the Engineer will approve the completed list. If the Engineer does not agree, the list will be returned to the
54 Contractor for re-certification. If the Engineer does not agree with revised prices or if the list has not been received by the
55 Engineer within 3 Working Days after the list has been returned to the Contractor for re-certification, the Engineer will
56 determine the cost for all or part of those Materials, using the best data available.

57 Once the list is approved, the prices will be used in the calculation of force account reimbursement for Materials.

58 In addition to payment for direct Materials cost, the Owner will pay the Contractor 17 percent of the sum of direct Material
59 costs to cover project overhead, general company overhead, profit, bonding, insurance specified in Section 1-07.18, Business
60 & Occupation tax, and any other costs incurred.

1-09.6(4) EQUIPMENT

The Owner will reimburse the Contractor for the cost of equipment used in the force account Work. The equipment provided by the Contractor must be of modern design and in good working condition. For the purpose of this provision, provided means that the equipment is owned (either through outright ownership or through a long-term lease) and operated by the Contractor or Subcontractor, or that the equipment is rented and operated by the Contractor or Subcontractor.

Equipment that is not being directly used for the force account work will not be compensated on a stand-by or any other basis. Equipment that is being used on-site for Contract work and for force account Work will only be compensated under force account for the actual operational use, not on a stand by basis. Equipment required by the Engineer to be on-site for force account Work and no other Contract Work will be compensated either for actual operational use or on a stand by basis. Equipment that is rented with operator cannot be included here, but is considered a service or service acting as a Subcontractor and addressed according to Section 1-09.6(5) Services.

The amount of payment for any Contractor-owned equipment that is used is determined according to the version of the AGC/WSDOT Equipment Rental Agreement in effect at the time the force account Work is authorized. The rates listed in the Rental Rate Blue Book (as modified by the current AGC/WSDOT Equipment Rental Agreement) will be full payment for all fuel, oil, lubrication, ordinary repairs, maintenance, and all other costs incidental to furnishing and operating the equipment except labor for operation.

Contractor-owned equipment reimbursement calculations are based on a Contractor-owned equipment list (equipment list) prepared and submitted by the Contractor and by any Subcontractor before that firm commences force account Work. All equipment list submittals must be made as specified in Section 1-05.3. Once an equipment list is approved by the Engineer, it will be used to calculate force account Contractor-owned equipment payment until a new equipment list is submitted and approved. The equipment list must contain only equipment expected to be used in force account Work. The Engineer will compare the equipment list to the Rental Rate Blue Book, at any time, and may require the Contractor to submit a new equipment list. The Contractor may submit a new equipment list at any time. Prior payment will not be adjusted as a result of a new equipment list.

To be approved, the equipment list must be accurate and comply with the requirements of this Section. The equipment list must be supplemented with a rental equipment list showing daily, weekly, and monthly rental rates as applicable. Rental agreements must be attached for all equipment that may be used on force account.

In the event that an acceptable initial equipment list or a revised equipment list is not received within 3 Working Days of a request by the Engineer, the Engineer will unilaterally develop an equipment list, using the best data available. The Engineer's equipment list will be used until a Contractor's equipment list is received and approved. Prior payments, prepared using the Engineer's equipment list, will not be changed as a result of differences with the Contractor's equipment list.

Payment for rented equipment will be made on the basis of a valid invoice, covering the time period of the Work. Before this Work is started, the Engineer may require the Contractor to obtain multiple quotations for the rental of equipment to be used and select the vendor with prices and terms most advantageous to the Owner. In the event that prior quotations are not obtained and the vendor is not a firm independent from the Contractor or Subcontractor, then after-the-fact quotations may be obtained by the Engineer from the open market in the vicinity and the lowest such quotation may be used in place of submitted invoice.

In addition to the payments for Contractor-owned and rented equipment, 1 or more lump sum payments may be made for small tools. The amount to be paid is determined as outlined in the AGC/WSDOT Equipment Rental Agreement.

The Owner will add 17 percent to equipment costs to cover project overhead, general company overhead, profit, bonding, insurance as required by Section 1-07.18, Business & Occupation tax, and any other costs incurred. This markup will be over and above those equipment costs and will not be adjusted for any equipment overhead amounts included in the Blue Book rates.

Copies of the AGC/WSDOT Equipment Rental Agreement are maintained on the WSDOT's website:

<http://www.wsdot.wa.gov/>.

1-09.6(5) SERVICES

A service is one that is typically billed through invoice in standard industry practice and consists of work that is being directly supervised or overseen by the Contractor. Tipping fees, material disposal services, and other material disposal costs incurred as a result of a force account item are considered subcontracted services. Payment under force account for services will be made on the basis of an invoice from the service provider unless otherwise directed as provided for within this Section.

Before force account Work is started, the Engineer may require the Contractor to obtain multiple quotations for the service to be used and select the provider with prices and terms most advantageous to the Owner. A service will be approved by the Engineer before the start of the service provider's work. If services are not preapproved, or in the event that prior quotations are not obtained and the service invoice is submitted, then after-the-fact quotations may be obtained by the Engineer from the open market in the vicinity and the lowest such quotation may be used in place of the submitted invoice, or the Engineer may require the services to itemize labor, equipment, and Materials and be paid based on these itemized rates, whichever results in the lower cost to the Owner.

Except as noted below and up to and including \$10,000 of invoiced cost, the Owner will pay the Contractor an additional 17 percent of the sum of the costs included on invoices for services to cover initial and ongoing project overhead, general

1 company overhead, profit, bonding, insurance required by Section 1-07.18, Business & Occupation tax, and any other costs
 2 incurred.

3 Mark ups for services which are acting in the manner of a Subcontractor are specified in Section 1-09.6(7). When a
 4 Supplier of services is compensated through invoice cost over \$10,000, the firm is acting in the manner of a Subcontractor as
 5 specified in Section 1-09.6(7), and the markup for the invoiced costs over \$10,000 must be as specified in Section 1-09.6(7).

6 **1-09.6(6) FORCE ACCOUNT MOBILIZATION**

7 Force account mobilization is defined as the preparatory Work performed by the Contractor including procurement,
 8 loading and transportation of tools and equipment, and personal travel time (when such travel time is a contractual obligation
 9 of the Contractor or a customary payment for the Contractor to all employees). Mobilization also includes the costs incurred
 10 during demobilization. Pro-rata adjustments may be made when the mobilization applies to both force account and other
 11 Contract Work. The Owner will pay for mobilization for off-site preparatory Work for force account items provided that notice
 12 has been provided sufficiently in advance, as determined by the Engineer, to allow the Engineer to witness the off-site
 13 preparatory Work, if desired.

14 Any costs experienced during mobilization activities for labor, equipment, Materials, Supplies, or services will be listed in
 15 those Sections of the force account summary and paid accordingly.

16 **1-09.6(7) CONTRACTOR MARKUP ON SUBCONTRACTORS AND SERVICES ACTING IN THE MANNER OF A**
 17 **SUBCONTRACTOR**

18 When Work is performed on a force account basis by one or more approved Subcontractors (including lower-tier
 19 Subcontractors or Suppliers), or through invoice by service firm acting in the manner of a Subcontractor, the Contractor will be
 20 allowed a markup, from 1 of the tables below.

21 The markup in this Section will only be applied once, regardless of tier level of Subcontractor.

22 The markup rates for the Contractor are calculated based on the accumulative cost, as specified in Sections 1-09.6(2) to
 23 1-09.6(4), and Section 1-09.6(5) if applicable, for the Work done by each Service or each Subcontractor on each force account
 24 item established.

25 The Engineer may request detailed breakdown of invoices as needed to verify costs and markups have been applied as
 26 specified in the Contract.

27 A service provider or any other firm may be considered to be acting as a Subcontractor when the Engineer observes one
 28 or more of the following characteristics:

- 29 1. The person in charge of the firm's activities takes an active role in managing the overall project, including extensive
 30 coordination, interpretation of Drawings, interaction with the Owner or Engineer, or management of a complex and
 31 inter-related operation.
- 32 2. Rented equipment is provided, fueled, operated, and maintained by the firm. Operators of rented equipment are
 33 supervised directly by the firm's representative. There is little interaction between the Contractor and the employees
 34 of the firm.
- 35 3. The firm appears to be holding the risk of performance and quality of the work.
- 36 4. The firm appears to be responsible for liability arising from the work.
- 37 5. The firm is performing a significant amount of work for the project, or force account item if applicable; the firm has
 38 performed over \$10,000 of invoiced work on the project, or force account item.

40 **Markups on Work Performed by Subcontractors**

| Accumulative Costs | Applicable Mark-up |
|--|--------------------|
| On amounts of \$25,000 or less | 12 percent |
| On amounts greater than \$25,000 up to \$100,000 | 10 percent |
| On amounts greater than \$100,000 | 7 percent |

41 **Markups on Work Performed by Services Acting in the Manner of a Subcontractor**

| Accumulative Costs | Applicable Mark-up |
|--|--|
| Up to \$10,000 | No additional mark up if a mark-up was provided on the first \$10,000 of invoices under Section 1-09.6(5) or If no mark-up was provided under 1-09.6(5), then 12 percent |
| On amounts greater than \$10,000 up to \$25,000 | 12 percent |
| On amounts greater than \$25,000 up to \$100,000 | 10 percent |

| Accumulative Costs | Applicable Mark-up |
|-----------------------------------|--------------------|
| On amounts greater than \$100,000 | 7 percent |

1

2 **1-09.7 PAYMENT FOR MOBILIZATION**

3 Mobilization includes preconstruction expenses and the costs of preparatory Work that occur at the start of a project. For
4 the first payment, the mobilization Bid Item will be either paid in full or 10 percent of the Awarded Contract Price whichever is
5 lower.

6 **1-09.8 PAYMENT FOR MATERIAL ON HAND**

7 Progress estimates, to a maximum of 90 percent of the invoiced cost of Materials excluding taxes, or the Bid Item price,
8 whichever is less, may be made for Materials not yet incorporated into the Work if the Materials:

- 9 1. Meet the requirements of the Contract based on inspections or testing by the Engineer;
- 10 2. Are delivered to Project Site or are stockpiled at a storage facility not on the Project Site;
- 11 3. Are properly stored and protected; and
- 12 4. Are insured against loss or damage.

13 In addition to the requirements above, Material delivered to the Project Site or to a storage facility not on the Project Site
14 as permitted in item 2 above, will be considered for progress estimate only if the following additional conditions are met:

- 15 a. The storage of Materials is required for more than 30 Days;
- 16 b. The Material is segregated from materials for any other project;
- 17 c. The Material is tagged, labeled, or otherwise identified as belonging to the project; and
- 18 d. All costs associated with transportation of Material to the Project Site or other provisions acceptable to the Engineer
19 made with regard to eventual delivery to the Project Site, are at the sole expense of the Contractor and must be
20 considered included in the Bid Item price.

21 The Materials on hand payment amount will be determined by quotes or invoices from suppliers that have sufficient detail
22 to determine the actual cost. The Contractor must furnish the Engineer an invoice for the Material marked "paid" within 60
23 Days of the progress payment by the Owner for that Material on hand. If the paid invoice is not furnished within the prescribed
24 time, and the Material has not been incorporated in the Work, a payment that has been made for that Material will be deducted
25 from the next progress estimate and the Material is not eligible for future payment as Material on hand.

26 The Engineer will not consider requests for payment for individual items or group of items of Material on hand amounting
27 to an invoice total of less than \$2000. Payment for sales taxes due on the purchase of such Material or equipment will not be
28 made unless said taxes were paid by the Contractor to the Materialperson or fabricator for transmittal to the State by the
29 Materialperson or fabricator and such tax is included on the invoice issued by the Materialperson.

30 Payment for Materials will not constitute acceptance. Unacceptable Material will be rejected even though payment may
31 have been made for such Material in a progress estimate.

32 Deductions at the same rates and equal in amount to the payment for Material on hand will be made to future progress
33 estimates as Material is incorporated into the Work and paid at the Bid Item unit price, or for a Bid Item lump sum price, the
34 progress estimates percentage of the Bid Item lump sum price. Deductions, at the same rates and equal in amount to the
35 payment for Material on hand, will also be made for Material on hand which is rejected after a payment was made.

36 **1-09.9 PAYMENTS**37 **1-09.9(1) PROGRESS ESTIMATES**

38 Payments for completed Work and Material on hand will be based on progress estimates prepared by the Engineer and
39 signed by the Contractor. A progress estimate cutoff date will be established at the preconstruction meeting.

40 Within 3 Days after the progress estimate cutoff date but not more often than once a month, the Contractor must submit
41 an Application for Payment to the Engineer for review. The Application for Payment, filled out and signed by the Contractor,
42 must cover the Work completed, accepted, and not in dispute for the payment period before the progress estimate cutoff date.
43 Application for Payments that include force account Work must be accompanied by documentation supporting the claim for
44 payment.

45 Payment requested for Materials and equipment on hand must be as specified in Section 1-09.8. The initial progress
46 estimate will be made not later than 30 Days after the Contractor commences the Work, and successive progress estimates
47 will be made every month thereafter until the Completion Date. Progress estimates made during progress of the Work are
48 tentative, and made only for the purpose of determining progress payment. The progress estimates are subject to change at
49 any time before the calculation of the final payment.

50 The value of the progress estimate will be the sum of the following:

- 51 1. Unit Price Bid Items in the Bid Form: The approximate quantity of Bid Item units of Work completed multiplied by the
52 Bid Item unit price.

- 1 2. Lump Sum Bid Items in the Bid Form: The estimated percentage of each lump sum Bid Item completed multiplied by
2 the Bid Item lump sum price.
- 3 3. Materials on Hand: To a maximum of 90 percent of invoiced cost of Material delivered to the Project Site or other
4 storage area specified in Section 1-09.8.
- 5 4. Change Orders: Entitlement for approved extra cost or completed extra work as determined by the Engineer.
6 Progress payments will be made per the progress estimate less:
- 7 a. 5 percent per RCW 60.28.
- 8 b. The amount of progress payments previously made.
- 9 c. Funds withheld by the Owner for disbursement as specified in the Contract.
- 10 Progress payments for Work performed is not evidence of acceptable performance or an admission by the Engineer that
11 any Work has been satisfactorily completed.
- 12 Payments will be made by warrants, issued by the Owner's fiscal officer, against the appropriate fund source for the
13 project.
- 14 Payments received by the Contractor on account of Work performed by a Subcontractor are subject to RCW 39.04.250.

15 **1-09.9(1)A FINAL PROGRESS PAYMENT**

16 The Final Contract Price will be calculated based on a final progress estimate made by the Engineer. The final progress
17 payment will not be paid until the Contractor has submitted on the Owner-provided form a complete list of all Subcontractors of
18 all tiers and Suppliers who worked on the project and information including but not limited to Subcontractor name, UBI
19 Number, Intent and Affidavit Numbers, and total amount paid.

20 Acceptance by the Contractor of the final payment is a release to the Owner from the Contractor:

- 21 1. Of all claims and all liabilities of the Owner, except claims in stated amounts which have been asserted under the
22 Dispute and Claim Resolution process as specified in Section 1-04.4;
- 23 2. For all things done or furnished in connection with the Work;
- 24 3. For every act and neglect by the Owner; and
- 25 4. For all other claims and liability relating to or arising out of the Work.

26 A payment (monthly, final, retainage, or otherwise) does not:

- 27 a. Release the Contractor or the Contractor's Surety from any obligation required under the terms of the Contract or the
28 Payment and Performance Bond; or
- 29 b. Preclude the Owner from recovering damages, setting penalties, or obtaining such other remedies as may be
30 permitted by law.

31 **1-09.9(2) RETAINAGE OPTIONS**

32 Pursuant to Chapter 60.28 RCW there will be reserved and retained from monies earned by the Contractor on progress
33 estimates during the progress of the Work, a sum equal to 5 percent of the monies earned by the Contractor. Such retainage
34 will be used as a trust fund for the protection and payment of:

- 35 1. Claims by the State with respect to taxes imposed under Titles 50, 51, and 82 RCW that may be due from such
36 Contractor;
- 37 2. The claims of any person or persons, mechanic, Subcontractor or Materialperson who performs any labor under such
38 Contract or the doing of said Work, and all persons who supplies such person or persons or Subcontractors with
39 provisions or Supplies for carrying on such Work; and
- 40 3. After satisfaction of the foregoing claims, the Owner may withhold from the remaining retained amounts or bond for
41 claims it may have against the Contractor and thereafter must pay or in the case of a bond, release, the balance, if
42 any, to the Contractor under RCW 60.28.021.

43 At the option of the Contractor, monies reserved under provisions of Chapter 60.28 RCW will be:

- 44 a. Retained in a non-interest bearing fund by the Owner.
- 45 b. Deposited by the Owner in an interest bearing account in a bank, mutual savings bank, or savings and loan
46 association. Interest on moneys reserved by the Owner under a public improvement Contract will be paid to the
47 Contractor.
- 48 c. Placed in escrow with a bank or trust company by the Owner. When the monies reserved are to be placed in escrow
49 the Owner will issue a check representing the sum of the monies reserved payable to the bank or trust company and
50 the Contractor jointly. Such check must be converted into bonds and securities chosen by the Contractor and
51 approved by the Owner and the bonds and securities held in escrow. Interest on the bonds and securities may be
52 paid to the Contractor as the interest accrues.
- 53 d. Provided for by the Contractor's submission of a retainage bond (bond instead of retained funds). The Owner may
54 accept the retainage bond if it is complete, on a form provided by the Owner, provided by a Surety meeting the

1 requirements of Section 1-03.3(2), for the amount equal to 5 percent of the Award Contract Price, less Washington
2 State sales tax, and meets the provisions of RCW 60.28.

3 The Contractor must select the option desired on the Agreement Form at the time the Contractor executes the Contract
4 with the Owner. If the Contractor chooses option 2) or 3) on the Agreement Form, the Contractor assumes full responsibility to
5 pay all costs that may accrue from escrow services, brokerage charges or both, and further assumes all risks in connection
6 with the investment of the retained percentages in securities.

7 Retainage will not be reduced for any reason below the minimum limit provided by law.

8 **1-09.9(3) OWNER'S RIGHT TO WITHHOLD AND DISBURSE CERTAIN AMOUNTS**

9 The Contractor agrees that in addition to moneys retained per RCW Ch. 60.28, RCW 39.04.250, RCW Ch. 39.12, and
10 RCW Ch. 39.76, the withholding of progress payments due to cover the Owner's costs for or to remedy the following
11 situations:

- 12 1. Damage to another contractor when there is evidence thereof and a claim has been filed.
- 13 2. Where the Contractor has not paid fees or charges to public authorities or municipalities that the Contractor is
14 obligated to pay.
- 15 3. Using Material, tested and inspected by the Engineer, for purposes not connected with the Work, see Section 1-05.6.
- 16 4. Landscape damage assessments as specified in Section 1-07.16.
- 17 5. For overtime work performed by City personnel as specified in Section 1-08.1(5).
- 18 6. Anticipated or actual failure of the Contractor to complete the Work on time:
 - 19 a. As specified in Section 1-08.8; or
 - 20 b. Lack of construction progress based on the Engineer's review of the Contractor's approved progress schedule
21 that indicates the Work will not be completed within the Contract Time. When calculating an anticipated time
22 overrun, the Engineer will make allowances for weather delays, approved unavoidable delays, and suspensions
23 of the Work. The amount withheld under this subparagraph will be based on the Liquidated Damages amount per
24 Day set forth in Contract multiplied by the number of Days the Contractor's approved progress schedule, in the
25 opinion of the Engineer, indicates the Contract may exceed the Contract Time.
- 26 7. Failure of the Contractor to perform any of the Contractor's other obligations under the Contract, including but not
27 limited to:
 - 28 a. Failure of the Contractor to promptly pay as specified in Section 1-09.11.
 - 29 b. Failure of the Contractor to provide the Engineer with a field office when specified in the Contract.
 - 30 c. Failure of the Contractor to protect items such as survey stakes or markers, or to provide adequate survey work
31 as specified in Section 1-05.5.
 - 32 d. Failure of the Contractor to correct defective or unauthorized Work as specified in Section 1-05.8.
 - 33 e. Failure of the Contractor to furnish a Manufacturer's Certificate of Compliance instead of Material testing and
34 inspection as specified in Section 1-06.3.
 - 35 f. Failure to submit weekly payrolls, Intent to Pay Prevailing Wage forms, or correct underpayment to employees of
36 the Contractor or Subcontractor of any tier as specified in Section 1-07.9.
 - 37 g. Failure of the Contractor to pay worker's benefits (Title 50 and Title 51 RCW) as specified by Section 1-07.18(7).
 - 38 h. Failure of the Contractor to submit and obtain approval of, and revise as required, a progress schedule as
39 specified in Section 1-08.3.
 - 40 i. Failure to comply with non-discrimination requirements as specified in Section 1-07.11.
 - 41 j. Failure of the Contractor to comply with the outcome of the resolution of payment disputes. In this instance, the
42 withholding of funds will be consistent with the terms of the dispute resolution process, including any cost of the
43 dispute resolution process as applicable, see Section 1-04.4.
 - 44 k. Failure of the Contractor to timely comply with submittal requirements, including providing the Engineer with
45 updates to the submittal control document, see Section 1-05.3.
 - 46 l. Failure of the Contractor to comply with requirements of the Social Equity provisions, including but not limited to
47 WMBE Inclusion, Priority Hire, Labor Standards, or related submittals and deliverables.

48 The Contractor authorizes the Owner to act as agent for the Contractor in disbursing such funds as have been withheld
49 under this Section to a party or parties who are entitled to payment. Disbursement of such funds, if the Owner elects to do so,
50 will be made only after giving the Contractor 15 Calendar Days prior written notice of the Owner's intent to do so, the reason
51 the funds are being withheld or deducted, and stating what action, if any, the Contractor must take to remedy the situation or
52 resolve the dispute. The Owner will withhold or disburse the funds after the expiration of the 15 Calendar Day period so long
53 as:

- 54 1) No legal action has commenced to resolve the validity of the claims; and
- 55 2) The Contractor has not disputed such disbursement as specified in Section 1-04.4.

1 A proper accounting of all funds disbursed on behalf of the Contractor as specified in this Section will be made. A
2 payment made under this Section is considered as payment made under the terms and conditions of the Contract. The Owner
3 is not liable to the Contractor for such payment made in good faith.

4 If legal action is instituted to determine the validity of the claims before expiration of the 15 Day period mentioned above,
5 the Owner will hold the funds until determination of the action or written settlement agreement of the parties.

6 **1-09.9(4) CONTRACT COMPLETION AND RETAINAGE RELEASE**

7 **1-09.9(4)A REQUEST FOR CONTRACT COMPLETION DATE**

8 The Engineer will submit an acceptance package with supporting documents to CPCS after the Physical Completion
9 Date is established and after all obligations, including disputes and settlements, of the Contract except retainage release have
10 been completed. In order for CPCS to declare the project complete, CPCS requires the following:

- 11 1. Documents that all Work is completed:
 - 12 a. The State Notice of Completion (NOC) of Public Works Contract form (LNI form F215-038-000) filled out
 - 13 electronically by the administering department with as much information as possible (CPCS will submit the form);
 - 14 b. NTP, Substantial, and Physical Completion Notices with Dates;
 - 15 c. All Change Orders;
 - 16 d. All calculations of Liquidated Damages;
 - 17 e. All claims under Section 1-04.4 resolved and the Final Contract Price set;
 - 18 f. All permit conditions completed;
 - 19 g. The 360 Review is completed for all applicable projects; and
 - 20 h. Evidence that all other requirements of the Work are met.
- 21 2. The Contractor must furnish all documentation and reports electronically online, or via paper where allowed, as
22 required by the Contract and required by law, necessary to allow the Owner to certify the Contract as complete.
23 These include but are not limited to:
 - 24 a. List from the Contractor on the Owner-provided form of all Subcontractors of all tiers and Suppliers who worked
25 on the project and information including but not limited to Subcontractor name, UBI Number, Intent and Affidavit
26 Numbers, and total amount paid;
 - 27 b. The Contractor's approved Affidavit of Wages Paid on file with L&I;
 - 28 c. Final Subcontractor Payment Report submitted online as specified in Section 1-07.11(3)A;
 - 29 d. Audits as specified in Section 1-04.4(6);
 - 30 e. Material certifications as specified in Section 1-06.3 if not provided by Physical Completion;
 - 31 f. Certified payrolls and prevailing wage statements as specified in Section 1-07.9;
 - 32 g. All Apprenticeship Utilization Reports as specified in Section 1-07.11(6), if applicable;
 - 33 h. If it is a federally-funded Contract, all federal final approvals have been received, and all final federal reports
34 including training, EEO, and prevailing wage certified payrolls have been submitted; and any other federally-
35 required reports; and
 - 36 i. Any other reports or documentation required.

37 **1-09.9(4)B COMPLETION DATE**

38 CPCS will review the acceptance package and supporting documents to ensure all obligations of the Contract are
39 complete except release of retainage.

- 40 CPCS will then:
 - 41 1. Set the Completion Date and issue the Certificate of Completion.
 - 42 2. Send the Notice of Completion of Public Work Contract to the state agencies as required by RCW 60.28.051.
 - 43 3. Publish the Notice of the Completion Date and the deadline for filing liens and claims in the City's Official Publication.
 - 44 4. Notify the Surety and the Contractor.

45 The Contractor agrees that establishment of the Completion Date does not relieve the Contractor of the responsibility to
46 indemnify, defend, and protect the Owner against any claim of loss resulting from the failure of the Contractor, a Subcontractor
47 of any tier, or any other person who provides labor, Supplies, or provisions for carrying out the Work or for any payments
48 required for unemployment payment under Title 50 RCW or for Industrial Insurance and medical insurance required under Title
49 51 RCW. The establishment of the Completion Date will not constitute acceptance of unauthorized Work or defective Work or
50 Material.

51 Failure of the Contractor to perform any or all Contractor's obligations under the Contract does not bar the Owner from
52 unilaterally certifying the Contract as complete.

1-09.9(4)C RELEASE OF RETAINAGE

Release of the retainage or retainage bond will be made following the Completion Date under Chapters 39.12 RCW, 39.76 RCW, and 60.28 RCW provided all following conditions are met:

1. On Contracts totaling more than \$35,000.00 (excluding tax), a release has been obtained from the Washington State Department of Revenue, the Employment Security Department, and the Department of Labor and Industries (RCW 60.28.051).
2. No claims, as provided by law, have been filed against the retainage (RCW 60.28.021).
3. The Owner has no claim against the Contractor for unpaid fees, taxes, or other amounts.

For retainage bonds, notification will be provided to the Surety and Contractor of the release of the retainage bond.

Retainage will be released no later than 10 Working Days after all legal requirements have been met and retainage has been approved for release.

1-09.10 AUDITS**1-09.10(1) GENERAL**

The Contractor's wage, payroll, and cost records on this Contract must be open to inspection or audit by representatives of the Owner during the life of the Contract and for a period of not less than 3 years after the Completion Date. The Contractor must retain these records for that period. If requested, the Contractor must promptly furnish copies of these records to the Owner. The Contractor must also guarantee that the wage, payroll, and cost records of all Subcontractors, regardless of tier, be retained and open to similar inspection or audit for the same period of time.

The audit may be performed by employees of the Owner or by an auditor under Contract with the Owner. The Contractor and Subcontractors of any tier must provide adequate facilities, acceptable to the Owner, for the audit during normal business hours and must make a good faith effort to cooperate with the auditors.

If an audit is to be commenced more than 60 Calendar Days after the Completion Date, the Contractor will be provided 20 Calendar Days Written Notice of the time when the audit is to start. If any litigation, claim, or audit arising out of, in connection with, or related to this Contract is initiated, the wage, payroll, and cost records will be retained until such litigation, claim, or audit involving the records is completed.

1-09.10(2) CLAIMS

All claims, and documentation for mediation, filed against the Owner are subject to audit at any time following the filing of the claim or request for mediation as applicable. Failure of the Contractor or a Subcontractor of any tier or their agents, if applicable, to maintain and retain sufficient records to allow the auditors to verify all or a portion of the claim and documentation for mediation when applicable, or to allow the auditor access to books and records, constitutes a waiver of a claim and will bar any recovery thereunder.

1-09.10(3) REQUIRED DOCUMENTS FOR AUDITS

The Contractor must make available all documents requested by the auditors including, but not limited to, the following documents:

1. Daily time sheets and supervisor's daily reports.
2. Union agreements.
3. Insurance, welfare, and benefits record.
4. Payroll registers.
5. Earnings records.
6. Payroll tax forms.
7. Material invoices and requisitions.
8. Material cost distribution worksheet.
9. Equipment records (e.g. list of company equipment and rates).
10. Vendors, rental agencies, Subcontractors, and agents invoices.
11. Subcontractor agreements and, as specified in Section 1-08.1(3), payment certifications including those of second and lower tier Subcontractors when applicable.
12. Cancelled checks (payroll and Vendors).
13. Job cost report.
14. Job payroll ledger.
15. General ledger.
16. Cash disbursements journal.

- 1 17. Financial statements for all years that reflect the operations on this Contract. In addition, City auditors may require
- 2 additional financial statements for 3 years preceding Execution of the Contract, and for 3 years following the
- 3 Completion Date.
- 4 18. Depreciation records on all company equipment whether these records are maintained by the company involved, its
- 5 accountant, or others.
- 6 19. If a source other than depreciation records is used to develop costs for the Contractor's internal purposes in
- 7 establishing the actual cost of owning and operating equipment, all such other source documents.
- 8 20. All documents that relate to each and every claim together with all documents that support the amount of damages as
- 9 to each claim.
- 10 21. Worksheets or software used to prepare the claim establishing the cost components for items of the claim including
- 11 but not limited to labor, benefits and insurance; materials, equipment, Subcontractors; all documents which establish
- 12 the time periods, individuals involved, the hours for the individuals, and the rates for the individuals; and home office
- 13 overhead.
- 14 22. Worksheets, software, and all other documents used by the Contractor to prepare its Bid.

15 **1-09.11 PROMPT PAYMENT TO SUBCONTRACTORS AND PERSONS SUPPLYING LABOR, MATERIALS AND**

16 **SUPPLIES**

17 **1-09.11(1) GENERAL**

18 This Section requires every Contractor of any tier to pay every Subcontractor who is also a small business, within 30

19 Calendar Days of satisfactorily completed Work and delivered Materials. A Subcontractor who is also a small business is

20 defined as those the Contractor has engaged by agreement to provide labor or Materials for the project, including a person or

21 persons, mechanic, Subcontractor, Supplier or Materialperson, when the Subcontractor is registered as a WMBE firm with the

22 City of Seattle, is a business certified by the King County Small Business Concerns Program, or is certified by the State of

23 Washington as a DBE or by the State of Washington as a WMBE firm.

24 Payment is considered made when mailed or personally delivered to the Contractor; an invoice is considered received

25 when date-stamped or marked as delivered. If not date-stamped or marked as delivered, the invoice date is the date recorded

26 by the Contractor.

27 Nothing in this Section negates the right or importance of Subcontractors filing a claim against the bond or retainage and

28 otherwise protecting their legal rights.

29 **1-09.11(2) PROGRESS PAYMENTS AND PROMPT PAYMENT TO SUBCONTRACTORS**

30 The Contractor must promptly pay, within 30 Calendar Days, for invoiced Work satisfactorily completed or Materials

31 delivered by a certified small business Subcontractor (defined as above as a Subcontractor who is a WMBE firm who is

32 registered with the City of Seattle, a certified Small Business Concern by King County, or a DBE or a WMBE firm certified by

33 the State of Washington) and no later than 10 Working Days of receipt of a progress payment from the Owner for all other

34 work by Subcontractors which are not certified small businesses.

35 The Contractor of any tier must pay such Subcontractor, less applicable retainage, for all work that the Contractor has

36 found to comply with the quality and performance agreed on with the Subcontractor. This includes payment for actual

37 mobilization costs incurred. This also includes work that has been directed to the Subcontractor when the price has been

38 agreed to by the Owner, Contractor, and Subcontractor, whether the Owner has provided payment or executed a Change

39 Order to the Contractor. Amounts withheld are limited to the value of the portion of work that has not been satisfactorily

40 completed, with a documented dispute as specified in 1-09.11(3). Such withheld amount cannot exceed 150 percent of the

41 disputed amount.

42 **1-09.11(3) UNSATISFACTORY PERFORMANCE BY SUBCONTRACTOR**

43 If any work or product is unsatisfactory and subject to withholding of payment, the Contractor must provide written

44 notification to the Subcontractor and Owner of corrective actions required by the Subcontractor including a date to be

45 completed. Such written notice must be provided as soon as practicable after work has been performed.

46 After the Subcontractor satisfactorily completes the corrections, the Contractor must pay the Subcontractor within 8

47 Working Days the remaining amounts withheld, less retainage. Should a Contractor find work unsatisfactory without

48 reasonable cause, fail to provide written notification within a reasonable time, or otherwise fail to comply with the scheduled

49 Days herein, the Contractor may be found to be in breach of the Contract by the Owner, subject to all remedies.

50 **1-09.11(4) PAYMENT OF RETAINAGE TO SUBCONTRACTORS**

51 **1-09.11(4)A REQUIREMENTS**

52 The Contractor must determine if the subcontract has been satisfactorily completed and must notify the Subcontractor, in

53 writing, of the Contractor's determination.

54 If the Contractor determines that the subcontract has been satisfactorily completed, the Subcontractor's retainage or

55 retainage bond must be released by the Contractor within 10 Working Days from the date of the written notice.

1 If the Contractor determines that the Subcontractor has not achieved satisfactory completion of the subcontract, the
2 Contractor must provide the Subcontractor with written notice, stating specifically why the subcontract work is not satisfactorily
3 completed and what has to be done to achieve completion. The Contractor must release the Subcontractor's retainage or
4 retainage bond within 10 Working Days after the Subcontractor has satisfactorily completed the work identified in the notice.

5 In determining whether satisfactory completion has been achieved, the Contractor may require the Subcontractor to
6 provide documentation such as certifications and releases, showing that all laborers, lower-tiered Subcontractors, Suppliers of
7 material and equipment, and others involved in the Subcontractor's work have been paid in full. The Contractor may also
8 require any documentation from the Subcontractor that is required by the subcontract or by the Contract between the
9 Contractor and Owner or by law such as Affidavits of wages paid, material acceptance certifications and releases from
10 applicable governmental agencies to the extent that they relate to the Subcontractor's work.

11 If the Contractor fails to comply with the requirements of the Specification and the Subcontractor's retainage or retainage
12 bond is wrongfully withheld, the Subcontractor may seek recovery against the Contractor under applicable prompt pay statutes
13 in addition to any other remedies provided for by the subcontract or by law.

14 **1-09.11(4)B CONDITIONS**

15 This clause does not create a contractual relationship between the Owner and any Subcontractor as stated in Section 1-
16 08.1(3). Also, it is not intended to bestow upon any Subcontractor, the status of a third-party beneficiary to the Contract
17 between the Owner and the Contractor.

18 This Section of the Contract does not apply to retainage withheld by the Owner from monies earned by the Contractor.
19 The Owner will continue to process the release of that retainage based on the Completion Date of the project as defined in
20 Section 1-08.5 Time for Completion and per the requirements and procedures set forth in RCW Chapter 60.28.

21 **1-09.11(5) INCORPORATION OF PROVISIONS**

22 The Contractor must include either specifically in each of its subcontracts a provision setting forth the payment and
23 interest penalty clause of this Section 1-09.11, or in each of its subcontracts a provision incorporating by reference all terms of
24 its Contract with the Owner. In addition, the Contractor must require its Subcontractors to include such a payment and interest
25 penalty clause in each of their subcontracts and to require each of their Subcontractors to include such clauses in their
26 subcontracts with each lower tier Subcontractor, either specifically or by reference.

27 **1-09.11(6) OTHER SUBCONTRACT PAYMENT PROVISIONS**

28 Any subcontract agreement, at any tier, with provisions for Subcontractor payment sooner than those specified in this
29 Section, or interest payments greater than those specified in this Section, takes precedence over the Specifications of this
30 Section.

31 **1-09.11(7) SUBCONTRACTOR CLAIMS AGAINST BONDS**

32 Notification of the Owner is only part of the lien and claim process; All Subcontractors and Suppliers are responsible to
33 take all actions required under law to perfect their claims and liens including taking additional legal steps beyond notification of
34 the Owner.

35 To obtain a copy of a bond or notify the Owner of a lien or claim against the Contractor's Payment and Performance
36 Bond or the Retainage Bond, send the request or notification to Aleanna Kondelis at Aleanna.Kondelis@Seattle.gov or to the
37 CPCS mailing address, see Section 1-02.9(1).

38 **SECTION 1-10 TEMPORARY TRAFFIC CONTROL**

39 **1-10.1 GENERAL**

40 The Contractor must plan, manage, supervise, and perform all temporary traffic control activities needed to support the
41 Work of the Contract.

42 Installation and maintenance of temporary traffic control for pedestrian and vehicular traffic within the street Right of Way
43 must be performed as specified in Section 1-10.2(5)B.

44 The Contractor must:

- 45 1. Provide flaggers, signs, and other traffic control devices not otherwise specified as being furnished by the Owner.
- 46 2. Not work on or adjacent to any traveled way until all necessary signs and traffic control devices are in place.
- 47 3. Unless the section of street is to be completely closed to vehicular traffic, schedule and plan the Work to:
 - 48 a. Meet any lane closure restrictions that are specified in Section 1-10.2(5)D, and current approved traffic control
49 plan for the Work being performed.
 - 50 b. Permit the maximum number of normally available traffic lanes to be opened in the direction of the heaviest flow
51 of traffic during the peak hours.
 - 52 c. Maintain 2-way traffic at all times except on one-way streets. Additional width for facilitating traffic flow may be
53 obtained by requesting on-street parking be prohibited adjacent to the Work area.

- 1 d. Maintain traffic on a paved surface whenever possible. In the event that a graveled or dirt surface must be used
- 2 as a detour, maintain a smooth surface and control dust. Deviations from a paved surface require specific
- 3 approval from the Engineer.
- 4 e. Maintain safe conditions adjacent to the Job Site:
- 5 1) Clean up spillage from trucks and debris on the pedestrian or driving surface as specified in Sections 1-07.5
- 6 and 1-07.23.
- 7 2) Provide safe and protected pedestrian ways as specified in Section 1-07.23.
- 8 3) Not park or place construction equipment in a manner that creates unnecessary sight distance obstructions or
- 9 other safety issues for vehicular or pedestrian traffic.
- 10 4) Maintain, in proper condition, Job Site traffic control devices on an around the clock basis whether or not work
- 11 is actively being pursued. In addition, the Contractor must assure that tools and equipment are properly stored
- 12 and excavation bridging is secure and adequately covers excavation.
- 13 4. Erect and maintain all construction signs, warning signs, detour signs, and other traffic control devices necessary to
- 14 warn and protect the public at all times from injury or damage resulting from the Contractor's operations.
- 15 5. Be liable for injuries and damages to persons and property suffered by reason of the Contractor's operations or any
- 16 negligence in connection therewith.
- 17 6. Construct, maintain in a safe condition, keep open to traffic, and remove when no longer needed detours and
- 18 temporary approaches that will accommodate traffic diverted from the roadway, walkway, or bridge during
- 19 construction. The Contractor is responsible for all on-site or off-site detours required or necessitated by the Work,
- 20 including side street crossings, temporary bridges, utilization of 1 or more lanes of the construction area for
- 21 maintenance of through traffic, and related traffic control.
- 22 7. Comply with the requirements of the Street Use Permit as specified in Section 1-07.6.

1-10.1(1) DESCRIPTION

The Contractor must provide signs and other traffic control devices not otherwise specified as being furnished by the Owner. The Contractor must erect and maintain all construction signs, warning signs, detour signs, and other traffic control devices necessary to warn and protect the public at all times from injury or damage as a result of the Contractor's operations which may occur on highways, roads, streets, sidewalks, or paths. Do not start work on any traveled way until all necessary signs and traffic control devices are in place.

Upon failure of the Contractor to immediately provide flaggers; erect, maintain, and remove signs; or provide, erect, maintain, and remove other traffic control devices when ordered to do so by the Engineer, the Owner may, without further notice to the Contractor or the Surety, perform any of the above and deduct all costs from the Contractor's payments.

The Contractor must provide adequate labor, traffic control devices, and sufficient signs to perform traffic control procedures needed for the protection of the Work and the public at all times, regardless of whether or not the labor, devices, or procedures have been ordered by the Engineer, furnished by the Owner, or paid for by the Owner.

Wherever possible when performing Contract Work, the Contractor's equipment must comply with normal and legal traffic movements. The Contractor's ingress and egress of the Work area must be accomplished with as little disruption to traffic as possible. Traffic control devices must be removed by picking up the devices in the opposite direction of traffic. When located behind barrier or at other locations shown on approved traffic control plans, equipment may operate in a direction opposite to adjacent traffic.

1-10.1(2) MATERIALS

Materials must comply with the requirements of the following Sections:

| Material | Section |
|---|----------------|
| Stop/Slow Paddles | 9-38.1 |
| Construction Signs | 9-38.2 |
| Wood Sign Posts | 9-38.3 |
| Sequential Arrow Signs | 9-38.4 |
| Portable Changeable Message Signs | 9-38.5 |
| Barricades | 9-38.6 |
| Traffic Safety Drums | 9-38.7 |
| Barrier Drums | 9-38.8 |
| Traffic Cones | 9-38.9 |
| Tubular Markers | 9-38.10 |
| Warning Lights and Flashers | 9-38.11 |
| Truck-Mounted Attenuator | 9-38.12 |
| Tall Channelizing Devices | 9-38.13 |
| Portable Temporary Traffic Control Signal | 9-38.14 |
| Type III or Type IV Reflective Sheeting | 9-38.15 |

1

2 **1-10.2 TRAFFIC CONTROL MANAGEMENT**3 **1-10.2(1) GENERAL**

4 It is the Contractor's responsibility to plan, conduct, and safely perform the Work. The Contractor must manage
5 temporary traffic control with its own staff. The Owner may inspect Work in the street Right of Way with regard to type and
6 placement of pedestrian and vehicular traffic control devices. Traffic control devices not meeting the requirements of the
7 MUTCD, Seattle Traffic Control Manual (STCM), and the Contract are considered non-standard. Do not use non-standard
8 traffic control devices unless specifically approved for use, in writing, by the Engineer.

9 The Contractor must patrol the traffic control area at least once a Day and as often as necessary, to reset all disturbed
10 signs and traffic control devices. Signs and other traffic control devices must be removed or covered during periods when they
11 are not necessary.

12 Before starting work, the Contractor must assign an individual or individuals to perform the duties of Traffic Control
13 Manager (TCM) and Traffic Control Supervisor (TCS). Traffic control management responsibilities must be formally assigned
14 to 1 or more company supervisors who are actively involved in the planning and management of field Contract activities. The
15 Contractor must provide the Engineer with a copy of the formal assignment. The traffic control management duties of the TCM
16 may not be subcontracted.

17 The Contractor must assign an individual or individuals to perform the duties of the primary TCS. The designation must
18 also identify an alternate TCS who can assume the duties of the primary TCS in the event of that person's inability to perform.
19 The TCS is responsible for safe implementation of approved traffic control plans.

20 The primary and alternate TCS must be certified as worksite traffic control supervisors by 1 of the organizations listed
21 below or others as approved by the Engineer:

22 The Northwest Laborers-Employers Training Trust
23 27055 Ohio Ave.
24 Kingston, WA 98346
25 (360) 297-3035

26

27 Evergreen Safety Council
28 401 Pontius Ave. N.
29 Seattle, WA 98109
30 1-800-521-0778 or
31 (206) 382-4090

32

33 The American Traffic Safety Services Association
34 15 Riverside Parkway, Suite 100
35 Fredericksburg, Virginia 22406-1022
36 Training Dept. Toll Free (877) 642-4637

1 Phone: (540) 368-1701

2

3 Possession of a current flagging card by the TCS is mandatory. A traffic control management assignment and a TCS
4 designation are required on any Contract that will use traffic control. The Contractor must provide documentation of TCS
5 certifications.

6 The Contractor must maintain 24-hour telephone numbers at which the Contractor's assigned traffic control management
7 personnel and the TCS can be contacted and be available upon the Engineer's request except on normal working hours.
8 These persons must have the resources, ability, and authority to expeditiously correct any deficiency in the traffic control
9 system.

10 **1-10.2(2) TRAFFIC CONTROL MANAGER (TCM)**

11 The responsibilities of the Contractor's traffic control management personnel include:

- 12 1. Overseeing and approving the actions of the TCS to ensure that proper safety and traffic control measures are
13 implemented and consistent with the specific requirements created by the Contractor's work zones and the Contract.
14 Some form of oversight must be in place and effective even when the traffic control management personnel are not
15 present at the Job Site.
- 16 2. Providing the Contractor's assigned TCS with approved traffic control plans that are compatible with the Work
17 operations and traffic control for which they will be implemented.
- 18 3. Discussing proposed traffic control measures and coordinating implementation of the Contractor-adopted traffic
19 control plan with the Engineer.
- 20 4. Coordinating all traffic control operations, including those of Subcontractors and Suppliers, with each other and with
21 any adjacent construction or maintenance operations.
- 22 5. Coordinating the project's activities, such as ramp closures, road closures, and lane closures, with appropriate police,
23 fire control agencies, city or county engineering, medical emergency agencies, school districts, disposal companies,
24 and transit companies (for METROKC transit, Streetcars, and Sound Transit Link Light Rail, see Section 1-07.28).
- 25 6. Overseeing all requirements of the Contract that contribute to the convenience, safety, and orderly movement of
26 vehicular and pedestrian traffic.
- 27 7. Reviewing the TCS's diaries daily and being aware of field traffic control operations.
- 28 8. Being present on-site a sufficient amount of time to adequately satisfy the above-listed responsibilities.

29 Failure to carry out any of the above-listed responsibilities is a failure to comply with the Contract and may result in a
30 suspension of Work as specified in Section 1-08.6.

31 **1-10.2(3) TRAFFIC CONTROL SUPERVISOR (TCS)**

32 A TCS must be present on the Project Site whenever flagging or spotting or other traffic control labor is being used or
33 less frequently, as authorized by the Engineer.

34 The TCS must personally perform all duties of the TCS. During non-work periods, the TCS must be present at the Job
35 Site within a 45-minute time period after notification by the Engineer.

36 The TCS's duties include:

- 37 1. Having a current approved traffic control plan, the SCTM, and the latest adopted edition of the MUTCD, including the
38 Washington State Modifications to the MUTCD, the book Quality Guidelines for Work Zone Traffic Control Devices,
39 and applicable standards and specifications.
- 40 2. Inspecting traffic control devices and nighttime lighting for proper location, installation, message, cleanliness, and
41 effect on the traveling public. Traffic control devices must be inspected at least once per hour during working hours
42 except that Class A signs and nighttime lighting need to be checked once per week. Traffic control devices left in
43 place for 24-hours or more must also be inspected once during the nonworking hours when they are initially set up
44 (during daylight or darkness, whichever is opposite of the working hours). The TCS must correct, or arrange to have
45 corrected, any deficiencies noted during these inspections.
- 46 3. Preparing a daily traffic control diary on each Day that traffic control is performed and submitting them to the Engineer
47 before the end of the next Working Day. Diary entries must include:
 - 48 a. Time of Day when signs and traffic control devices are installed and removed.
 - 49 b. Location and condition of signs and traffic control devices.
 - 50 c. Revisions to the traffic control plan.
 - 51 d. Lighting used at night.
 - 52 e. Observations of traffic conditions.
- 53 4. Making minor revisions to the traffic control plan to accommodate Project Site conditions provided that the original
54 intent of the traffic control plan is maintained and the revision has the concurrence of both the Contractor and the
55 Engineer.

- 1 5. Attending traffic control coordinating meetings or coordination activities as necessary for full understanding and
2 effective performance.
- 3 6. Ensuring that all needed traffic control devices and equipment are available and in good working condition before the
4 need to install or use them.

5 The TCS may perform the Work described by the Bid Item for "Maintenance and Protection of Traffic Control" as long as
6 the duties of the TCS are accomplished. Possession of a current flagging card by the TCS is mandatory.

7 The TCS must wear a reflective vest and a hard hat.

8 **1-10.2(4) CONTRACTOR'S REFUSAL OR FAILURE TO ACT**

9 Upon failure or refusal of the Contractor to comply with the Engineer's written notice to:

- 10 1. Provide adequate flaggers;
- 11 2. Provide, erect, maintain, and remove, as applicable, barricades, signs, lights, on-site or off-site detours or detour
12 bridges; or
- 13 3. Provide any Work specified in Section 1-07.23:

14 The Engineer has the option to do one or any combination of the following:

- 15 a. Suspend the Work without further notice to the Contractor or the Contractor's Surety until the Contractor complies
16 with the Engineer's direction as specified in Section 1-08.6;
- 17 b. Immediately provide an off-duty uniformed peace officer;
- 18 c. Immediately provide flagging by Owner forces or by others; and/or
- 19 d. Provide, erect, maintain, and remove barricades, signs, and lights by Owner forces or by others.

20 All costs related to items a., b., c., and d. will be deducted from any progress payments due or coming due the Contractor
21 as specified in Section 1-09.9(3).

22 The above options do not bar the Owner from exercising other remedies because of the Contractor's failure or refusal to
23 comply with a contractual obligation.

24 **1-10.2(5) TRAFFIC CONTROL PLANS**

25 **1-10.2(5)A CONTENT AND SUBMITTAL REQUIREMENTS**

26 Based on the Contractor's intended method of performing the Work, the Contractor must develop, adopt, and submit to
27 the Engineer a specific traffic control plan for protecting and controlling pedestrian, bicycle and vehicle traffic during
28 construction operations. A separate traffic control plan is required for each work location within the street Right of Way. When
29 the Project Site cannot be fully opened to traffic after a workshift is completed, a separate traffic control plan is required for the
30 after workshift conditions.

31 Typical plans may be submitted for areas with identical traffic requirements. Typical plans must be clearly labeled to
32 indicate all locations the plan is to be implemented. Traffic control plans must take into consideration any street and lane
33 closure or other restrictions that may be specified in the Contract.

34 For non-SDOT projects, traffic control plans must be submitted to SDOT as part of the Street Use Permit application
35 process. The submittal must be made to SDOT and the Engineer at least 10 Working Days before planned implementation to
36 allow for SDOT evaluation. A copy of the approved TCP must be submitted to the Engineer for information and in case of any
37 additional neighborhood restrictions on traffic. The Contractor must not start Work in the street Right of Way until an approved
38 traffic control plan for the specific location has been returned by the Engineer. Submittals must be as specified in Section 1-
39 05.3.

40 Traffic control plans must indicate:

- 41 1. Vehicular, bicycle, and pedestrian traffic routing.
- 42 2. Proposed location of flaggers, barricades, lighting, signing, and other traffic control devices in relation to existing and
43 temporary roadway edges and lane markings.
- 44 3. Proposed number of working hours.
- 45 4. Arrangements for access to buildings within and immediately adjacent to the Project Site.
- 46 5. Arrangements for emergency exiting from buildings within and immediately adjacent to the Project Site.
- 47 6. Anticipated driveway blockage resulting from construction operations.
- 48 7. Restrictions to on-street parking within immediate vicinity of the Project Site, including arrangements for hooding
49 parking meters, and parking pay stations and associated appurtenances, as necessary.
- 50 8. Arrangements for temporary passenger and commercial loading and unloading zones, and temporary transit stop
51 zones.
- 52 9. Identification and description of temporary lateral relocations of trolley overhead wire system if necessary to maintain
53 trolley service.
- 54 10. Routing of construction trucks.

1 11. Coordination in sequencing traffic control with scheduling of Work and work locations.

2 12. Sequencing and layout of temporary pavement marking and removal as it relates with the scheduling of Work and
3 work locations.

4 When the signing of a particular area will be provided as detailed on 1 or more of the figures included in the STCM
5 without modification, the Contractor may reference the applicable figure number, shown on the manual, at the appropriate
6 location on the Drawings. When this procedure is used, variable distances such as minimum length of taper must be specified
7 by the Contractor. The spacing proposed for barricades and cones must also be specified.

8 If the Contractor's proposed pedestrian or traffic control measures differ from the traffic control requirements in the
9 STCM, the Contractor's alternate traffic control plan must detail the specific location of each necessary construction sign,
10 flagging, and other traffic control device required. The Contractor's alternate method for traffic and pedestrian control must be
11 developed per the same established standards for plan development demonstrated by the figures in the STCM. Acceptance of
12 alternative traffic control measures is entirely at the discretion of the Engineer. The Contractor has no claim for an equitable
13 adjustment:

14 a. For using alternative measures.

15 b. If the proposed alternate measures are rejected or modified.

16 c. If requests to use non-standard traffic control devices are rejected or modified.

17 The Contractor must plan and schedule Contractor work activities to conform to and allow time for notifications, reviews,
18 approvals, acceptances, and other conditions of the Contract. Most notifications are specified in Section 1-07.28.

19 **1-10.2(5)B CONFORMANCE TO ESTABLISHED STANDARDS**

20 Flagging, signs, and all other traffic control devices and procedures furnished or provided must conform to the standards
21 established in the current version (in effect on the Day the Work was advertised for Bid) of the MUTCD as modified and
22 adopted by WSDOT, as supplemented by the current edition of The City of Seattle STCM, and such additional requirements
23 as may be included in the Contract. RCW 47.36 requires traffic control devices along city streets to conform to the WSDOT
24 adopted standards to the extent possible.

25 The WSDOT adopted version of the MUTCD may be accessed at:

26 <http://www.wsdot.wa.gov/Publications/Manuals/M24-01.htm>

27 The City of Seattle STCM may be accessed at:

28 <http://www.seattle.gov/transportation/trafficcontrolmanual.htm>

29 Judgment of the quality of devices furnished will be based on Quality Guidelines for Temporary Traffic Control Devices,
30 published by the American Traffic Safety Services Association. Copies of the MUTCD and Quality Guidelines for Temporary
31 Traffic Control Devices may be purchased from the American Traffic Safety Services Association, 15 Riverside Parkway, Suite
32 100, Fredericksburg, Virginia 22406-1022. The Washington State Modifications to the MUTCD may be obtained from the
33 Department of Transportation, Olympia, Washington 98504.

34 In addition to the standards of the MUTCD, and the requirements described above, the Contractor must use crashworthy
35 devices. The National Cooperative Highway Research Project (NCHRP) Report 350 has established requirements for crash
36 testing. Work zone devices are divided into 4 categories. Each of those categories and, where applicable, is described below:

37 Category 1 includes those items that are small and lightweight, channelizing, and delineating devices that have been in
38 common use for many years and are known to be crashworthy by crash testing of similar devices or years of demonstrable
39 safe performance. These include cones, tubular markers, flexible delineator posts, and plastic drums. All Category 1 devices
40 used on the project must comply with the requirements of NCHRP 350 as certified by the manufacturer of the device.

41 Category 2 includes devices that are not expected to produce significant vehicular velocity change, but may otherwise be
42 hazardous. Examples of this class are barricades, portable sign supports and signs, intrusion alarms and vertical panels. All
43 Category 2 devices must comply with the requirements of NCHRP 350. For the purpose of definition, a sign support and sign
44 is considered a single unit. A new sign may be purchased for an existing sign support and the entire unit will be defined as
45 existing equipment.

46 Category 3 is for hardware expected to cause significant velocity changes or other potentially harmful reactions to
47 impacting vehicles. Barriers, fixed sign supports, crash cushions, and other work zone devices not meeting the definitions of
48 Category 1 or 2 are examples from this category. Many Category 3 devices are defined in the design of the project. Where this
49 is the case, NCHRP 350 requirements have been incorporated into the design and the Contractor complies with the
50 requirements by constructing devices according to the Contract and Specifications. Where the device is a product chosen by
51 the Contractor, the device chosen must be compliant with the requirements of NCHRP 350.

52 Category 4 includes portable or trailer-mounted devices such as arrow displays, temporary traffic signals, area lighting
53 supports, and portable changeable message signs. Crash testing is not required for these devices.

54 The condition of signs and traffic control devices must be acceptable or marginal as defined in the book Quality
55 Guidelines for Temporary Traffic Control Devices. The Contractor's TCM and TCS must verify the temporary traffic control
56 devices and materials comply with these Specifications. If the Engineer determines a sign or traffic control device is
57 unacceptable, it must be removed and replaced within 12 hours of notification. The Engineer's decision on the condition of a
58 sign or traffic control device is final.

1-10.2(5)C GENERAL TRAFFIC CONTROL RESTRICTIONS

In addition to any street and lane closure restrictions specified in the Contract, traffic control plans must be developed to comply with the following restrictions:

1. Arterial Paving: Arterial approaches to the streets being paved must remain open to vehicular traffic for their full roadway widths except when paving across arterial crossings. During such periods, the cross streets may be closed for a minimum amount of time as approved by the Engineer. Before the closure of any arterial cross street the Contractor must submit to the Engineer a traffic control plan for the location detailing the traffic controls to be used to reroute traffic. Do not reroute traffic without approval of the traffic control plan by the Engineer. The Contractor has no claim because of the traffic control plan being rejected or modified by the Engineer.
2. Time of Work: Except as may be otherwise itemized in the street and lane closure restrictions specified in the Project Manual, do not schedule Work in the traveled way on arterials during peak traffic hours without written authorization from the Engineer. Unless otherwise specified, peak traffic hours are from 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. with the following exceptions:
 - a. For the Central Business District (City of Seattle) peak hours are from 6:00 a.m. to 9:00 a.m. and 3:00 p.m. to 6:00 p.m.
 - b. For Aurora Avenue (City of Seattle) peak hours are from 6:00 a.m. to 9:00 a.m. and 3:00 p.m. to 7:00 p.m.

The Contractor must discontinue Work if a conflict exists with special events such as parades, sporting events, miscellaneous rallies, and large public meetings or with seasonal conditions, such as the Holiday Construction Moratorium. Information concerning such events can usually be obtained from (206) 684-5098.
3. Holiday Construction Moratorium (City of Seattle Only): No construction activities will be allowed on any portion of a project that lies within the Central Business District or the Pioneer Square area during the Christmas season, Thanksgiving Day through New Year's Day inclusive.

The Central Business District is that area within the boundaries of Interstate 5 on the east, Seneca Street on the south, First Avenue on the west, Virginia Street and Denny Way (east of Fairview Avenue) on the north.

The Pioneer Square Area is that area within the boundaries of Alaskan Way on the west, Second Avenue and Second Avenue South on the east, Columbia Street on the north and King Street on the south.
4. Parking: Where parking restricts traffic flow or is a hazard to through traffic or to the construction work, parking may be restricted either entirely or during the time when it creates a hazard. Parking restrictions may be requested by the Contractor and upon approval of the Engineer be established within construction and maintenance areas.

In areas where (City of Seattle) parking meters are present, the Contractor must apply to SDOT for installation of meter covers restricting such parking. In areas with parking pay stations and sidewalk containing D-22 signage (Pay R, Pay L, Pay H, and Pay RL signs and posts), and numbered base plates, the Contractor must apply to SDOT for no parking markers restricting such parking.

The Contractor must reimburse SDOT for lost parking revenue unless this is an SDOT Project.

Where no meters, parking pay stations, and D-22 signage and numbered base plates are present, the Contractor must contact SDOT so that the Contractor may install No Parking (T038 or T039) easel signs. Signs must be inspected by a parking enforcement officer or uniformed peace officer 24 hours before enforcement. See Section 1-07.28, item 3) for notification requirements. Load zone, consulate parking zone, and carpool parking zone restrictions must be per the STCM.

No Parking signs must conform in message, dimension, and color as specified in Part V of the STCM. Spacing of signs must be per Project Site conditions.

No Parking (T038 or T039) easel signs must be installed at an approximate interval of 50 feet to 75 feet, with a minimum of 4 units, per each full block. For partial block parking prohibition, R-101's or T-38's or T039's must be installed at approximately 50-foot intervals with R-160 signs at the terminus as shown in Figure V-1 of the STCM.

The employees of the Contractor must not park their private vehicles on the street, at the Project Site, or in commercial areas where general parking has been prohibited for construction or safety purposes.

1-10.2(5)D RESERVED**1-10.3 TRAFFIC CONTROL LABOR, PROCEDURES AND DEVICES****1-10.3(1) TRAFFIC CONTROL LABOR**

The Contractor must furnish all personnel for flagging, spotting, for the execution of all procedures related to temporary traffic control and for the setup, maintenance, and removal of all temporary traffic control devices and construction signs necessary to control traffic during construction operations.

Workers engaged as flaggers or spotters must wear reflective vests and hard hats. During hours of darkness, white coveralls or white or yellow rain gear must also be worn. The vests and other apparel must be as specified in Section 1-07.8.

1-10.3(1)A FLAGGERS AND SPOTTERS

1 Flaggers and Spotters must be posted where shown on approved traffic control plans or where directed by the Engineer.
2 All flaggers and spotters must possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho.
3 The flagging card must be immediately available and shown to the Owner upon request.

4 Show flagging stations on traffic control plans at locations where construction operations require stopping or diverting
5 traffic. Flagging stations must be staffed only when flagging is required. This staffing may be continuous or intermittent,
6 depending on the nature of the construction activity. Whenever a flagger is not required to stop or divert traffic, the flagger
7 must move away from the flagging station to a safer location. During hours of darkness, flagging stations must be illuminated
8 as that insures that flaggers can easily be seen but that does not cause glare to the traveling public. Flaggers must be
9 equipped with portable two-way radios, with a range suitable for the project. The radios must be capable of having direct
10 contact with project management (e.g. individuals such as foremen and superintendents).

11 The Contractor must furnish Stop/Slow paddles as specified in Section 9-38.1 for all flagging operations.

12 Show spotting stations on traffic control plans at locations where a spotter can detect errant drivers or other hazards and
13 provide an effective warning to other workers. Spotting stations are not allowed at locations where the spotter will be in
14 unnecessary danger. The Contractor must furnish noise-makers or other effective warning devices for spotting operations. The
15 duties of a spotter do not include flagging.
16

1-10.3(1)B OTHER TRAFFIC CONTROL LABOR

17 In addition to flagging or spotting duties, the Contractor must provide personnel for all other traffic control procedures
18 required by the construction operations and for the labor to install, maintain and remove any traffic control devices shown on
19 traffic control plans.
20

21 Before performing any traffic control Work on the Project Site, these personnel must be trained in work zone safety.

1-10.3(1)C TRAFFIC CONTROL PEACE OFFICERS

22 Only use an off-duty uniformed peace officer as a flagger to:

- 23 1. Countermand a traffic signal indication at a signalized intersection.
- 24 2. Direct vehicle and pedestrian traffic when a traffic signal indication is turned off or inoperative.
- 25 3. Perform flagging duties when and where specified in the accepted traffic control plan or elsewhere in the Contract. If
26 flagging duties indicated exclude the required uses in item 1 and 2 above, then the Engineer may direct the
27 Contractor to stop use of the Uniformed Peace Officer before the next Working Day.
28

29 For new traffic signal Work, officers are also required. as specified in Section 8-31.3(1)A. The off-duty uniformed peace
30 officer must be provided by the Contractor.

31 On the next Working Day, the Contractor must submit to the Engineer a copy of the daily time card for Traffic Control
32 Peace Officers showing the hours actually worked.

1-10.3(2) TRAFFIC CONTROL PROCEDURES

1-10.3(2)A ONE-WAY TRAFFIC CONTROL

33 The project may require that traffic be maintained on a portion of the roadway during the Work using one-way traffic
34 control. If this is the case, the Contractor's operation must be confined to one-half of the roadway, permitting traffic on the
35 other half. If shown on an approved traffic control plan or directed by the Engineer, one-way traffic control, per the MUTCD,
36 must be provided and conform to the following:
37

- 38 1. In any one-way traffic control configuration, side roads and approaches will be closed or controlled by a flagger or by
39 appropriate approved signing. A side road flagger will coordinate with end flaggers where there is line of sight and
40 with the pilot car where the end flaggers cannot be seen.
41
- 42 2. Queues of vehicles will be allowed to take turns passing through the work zone in the single open lane. When one-
43 way traffic control is in effect, Contractor vehicles must not use the open traffic lane except while under the same
44 rules and routes required of the traffic.
- 45 3. As conditions permit, the Contractor must, at the end of each Day, leave the Job Site in such condition that it can be
46 traveled without damage to the Work, without danger to traffic, and without one-way traffic control. If, in the opinion of
47 the Engineer, one-way traffic control cannot be dispensed with after working hours, then the operation will be
48 continued throughout the Non-Working hours.

1-10.3(2)B LANE CLOSURE SETUP/TAKEDOWN

49 Where allowed by the Contract and where shown on approved traffic control plans or directed by the Engineer, the
50 Contractor must set up traffic control measures to close 1 or more lanes of a multi-lane facility. When this is to occur and
51 called for in the approved traffic control plan, the following sequence must be followed:
52

- 53 1. Advance warning signs are set up on the shoulder of the roadway opposite the lane to be closed;
- 54 2. Advance warning signs are set up on the same shoulder as the lane to be closed;
- 55 3. If required, a transportable attenuator, with arrow board, is moved into place at the starting of the closure taper; and

1 4. Channelization devices are placed to mark the taper and the length of the closure as shown on the traffic control plan.
2 If transportable attenuator /arrow board is required, once the lane is closed, the transportable attenuator /arrow board
3 combination may be replaced with an arrow board without attenuator.

4 If additional lanes are to be closed, they must be closed in sequence with previous lane closures using the same
5 sequence of activities. If an arrow board is required, each closed lane must be marked with a separate arrow board at all
6 times.

7 Traffic control for lane closures must be removed in the reverse order of its installation.

8 **1-10.3(2)C MOBILE OPERATIONS**

9 Where construction operations are such that movement along the length of a roadway is continuous or near-continuous
10 to the extent that a stationary traffic control layout will not be effective, the Contractor must implement a moving, or mobile,
11 traffic control scheme. Such moving control must always be conducted in the same direction as the adjacent traffic.

12 Where shown on an approved traffic control plan or where directed by the Engineer, mobile traffic control consists of
13 portable equipment, moving with the operation. A portable changeable message sign must be established in advance of the
14 operation and far enough back to provide warning of both the operation and of any queue of traffic that has formed during the
15 operation. The advance sign must be continuously moved to stay near the back of the queue at all times. A truck-mounted
16 attenuator, with arrow board, must be positioned and maintained at a fixed distance upstream of the Work. A shadow vehicle,
17 with truck-mounted attenuator, must be positioned and maintained immediately upstream of the Work.

18 **1-10.3(2)D PATROL & MAINTAIN TRAFFIC CONTROL MEASURES**

19 At all times, when temporary traffic control measures are in place, the Contractor must provide for patrolling and
20 maintaining these measures. The Work must consist of resetting mislocated devices, assuring visibility of all devices, cleaning
21 and repairing where necessary, providing maintenance for all equipment, including replacing batteries and light bulbs as well
22 as keeping motorized and electronic items functioning, and adjusting the location of devices to respond to actual conditions,
23 such as queue length, unanticipated traffic conflicts and other areas where planned traffic control has proven ineffective.

24 This Work must be performed by the Contractor, either by or under the direction of the TCS, with vehicles if necessary,
25 must be dispatched so that all traffic control can be reviewed at least once per hour during working hours and at least once
26 during each Non-Working Day.

27 **1-10.3(3) TRAFFIC CONTROL DEVICES**

28 **1-10.3(3)A CONSTRUCTION SIGNS**

29 All construction signs required by approved traffic control plans, as well as any other signs as directed by the Engineer,
30 must be furnished by the Contractor. The Contractor must provide the posts or supports and erect and maintain the signs in a
31 clean, neat, and presentable condition until the need for them has ended. Post mounted signs must be installed as shown on
32 the Standard Plans. When the need for construction signs has ended, the Contractor, upon approval of the Engineer, must
33 remove all signs, posts, and supports from the project.

34 No passing zones on the existing roadway that are marked with paint striping that will be obliterated by construction
35 operations must be replaced by Do Not Pass and Pass With Care signs. The Contractor must provide and install the posts and
36 signs. The signs must be maintained by the Contractor until they are removed or until the Contract is Physically Completed.
37 When the project includes striping by the Contractor, the signs and posts must be removed by the Contractor when the no
38 passing zones are reestablished by striping. The signs and posts become the property of the Contractor. When the Contractor
39 is not responsible for striping and when the striping by others is not completed when the project is Physically Completed, the
40 posts and signs must be left in place and become the property of the Owner.

41 All existing signs, new permanent signs installed under this Contract, and construction signs installed under this Contract
42 that are inappropriate for the traffic configuration at a given time must be removed or completely covered with metal, plywood,
43 or an Engineer approved product specifically manufactured for sign covering during periods when they are not needed.

44 Construction signs will be divided into 2 classes. Class A construction signs are those signs that remain in service
45 throughout the construction or during a major phase of the Work. They are mounted on posts, existing fixed Structures, or
46 substantial supports of a semi-permanent nature. Class A signs will be designated as such on the approved traffic control plan.
47 Do Not Pass and Pass With Care signs are classified as Class A construction signs. Sign and support installation for Class A
48 signs must be per the Contract or the Standard Plans. Class B construction signs are those signs that are placed and removed
49 daily, or are used for short durations which may extend for 1 or more Days. They are mounted on portable or temporary
50 mountings.

51 Where it is necessary to add weight to signs for stability, the only allowed method will be a bag of sand that will rupture
52 on impact. The bag of sand must have a maximum weight of 40-pounds, and must be suspended no more than 1 foot from the
53 ground.

54 Signs, posts, or supports that are lost, stolen, damaged, destroyed, or which the Engineer deems are unacceptable while
55 their use is required on the project must be replaced by the Contractor.

1-10.3(3)B SEQUENTIAL ARROW SIGNS

Where shown on an approved traffic control plan or where ordered by the Engineer, the Contractor must provide, operate, and maintain sequential arrow signs. In some locations, the sign will be shown as a unit with an attenuator. In other locations, the traffic control plan will indicate a stand-alone unit.

1-10.3(3)C PORTABLE CHANGEABLE MESSAGE SIGN

Where shown on an approved traffic control plan or where ordered by the Engineer, the Contractor must provide, operate, and maintain portable changeable message signs. These signs must be available, on-site, for the entire duration of their projected use.

1-10.3(3)D BARRICADES

Where shown on an approved traffic control plan or where ordered by the Engineer, the Contractor must provide, install, and maintain barricades. Barricades must be kept in good repair and must be removed immediately when, in the opinion of the Engineer, they are no longer functioning as designed.

Where it is necessary to add weight to barricades for stability, the only allowed method will be a bag of sand that will rupture on impact. The bag of sand must have a maximum weight of 40-pounds, and must be suspended no more than 1 foot from the ground.

1-10.3(3)E TRAFFIC SAFETY DRUMS

Where shown on an approved traffic control plan, or where ordered by the Engineer, the Contractor must provide, install, and maintain traffic safety drums.

Used drums may be used, provided all drums used on the project are of essentially the same configuration.

The drums must be designed to resist overturning by a weighted lower unit that will separate from the drum when impacted by a vehicle.

Drums must be regularly maintained to ensure they are clean and the drum and reflective material are in good condition. If the Engineer determines a drum has been damaged beyond usefulness, or provides inadequate reflectivity, a replacement drum must be furnished.

When the Engineer determines drums are no longer required, they must be removed from the project and remain the property of the Contractor.

1-10.3(3)F BARRIER DRUMS

Where shown on approved traffic control plans and as ordered by the Engineer, barrier drums must be placed on temporary concrete barrier at the following approximate spacing:

| Concrete Barrier Placement | Barrier Drum Spacing in Feet |
|---|------------------------------|
| Tangents 1/2 mile or less ¹ | 2 times posted speed limit |
| Tangents greater than 1/2 mile ¹ | 4 times posted speed limit |
| Tapers and Curves ² | Posted speed limit |

NOTES:

1. Use a minimum of 3 barrier drums.
2. Use a minimum of 5 barrier drums.

Temporary concrete barrier reflectors may be excluded when using barrier drums.

Both legs of the barrier drums must be completely filled with sand. Do not fill the top oval.

Used barrier drums may be used, provided all barrier drums used on the project are of essentially the same configuration.

Barrier drums must be regularly maintained to ensure they are clean and the barrier drum and reflective Material are in good condition. If the Engineer determines a barrier drum has been damaged beyond usefulness, or provides inadequate reflectivity, a replacement barrier drum must be furnished.

When the Engineer determines drums are no longer required, they must be removed from the project and remain the property of the Contractor.

1-10.3(3)G TRAFFIC CONES

Where shown on an approved traffic control plan or where ordered by the Engineer, the Contractor must provide, install, and maintain traffic cones. Cones must be kept in good repair and must be removed immediately when directed by the Engineer. Where wind or moving traffic frequently displace cones, employ an effective method of stabilizing cones, such as stacking 2 together at each location.

1 1-10.3(3)H TUBULAR MARKERS

2 Where shown on an approved traffic control plan or where ordered by the Engineer, the Contractor must provide, install,
3 and maintain tubular markers. Tubular markers must be kept in good repair and must be removed immediately when directed
4 by the Engineer. Tubular markers are secondary devices and are not to be used as substitutes for cones or other delineation
5 devices without an approved traffic control plan.

6 Where the traffic control plan shows pavement-mounted tubular markers, the adhesive used to fasten the base to the
7 pavement must be suitable for the purpose, as approved by the Engineer. During the removal of pavement-mounted tubular
8 markers, take care to avoid damage to the existing pavement. Any such damage must be repaired by the Contractor at no cost
9 to the Owner.

10 1-10.3(3)I WARNING LIGHTS AND FLASHERS

11 Where shown attached to traffic control devices on an approved traffic control plan or where ordered by the Engineer, the
12 Contractor must provide and maintain flashing warning lights. Lights attached to advance warning signs must be Type B, high-
13 intensity. Lights attached to traffic safety drums, barricades or other signs must be Type C, steady-burning low intensity or,
14 where attention is to be directed to a specific device, Type A, flashing low-intensity units.

15 1-10.3(3)J TRANSPORTABLE ATTENUATOR

16 Where shown on an approved traffic control plan or where ordered by the Engineer, the Contractor must provide,
17 operate, and maintain transportable impact attenuators. These attenuators must be available, on-site, for the entire duration of
18 their projected use.

19 The transportable attenuator must be positioned to separate and protect construction work zone activities from normal
20 traffic flow.

21 During use, the attenuator must be in the full down-and-locked position. For stationary operations, the host vehicle's
22 parking brake must be set.

23 A transportable attenuator may be used instead of a temporary impact attenuator when approved by the Engineer as part
24 of a stage traffic control shift to protect an object such as blunt barrier end or bridge pier column that is located within the work
25 zone clear zone. This use of a transportable attenuator is restricted to a maximum of 3 days or approved extension by the
26 Engineer.

27 1-10.3(3)K PORTABLE TEMPORARY TRAFFIC CONTROL SIGNAL

28 Where shown on an approved traffic control plan, the Contractor must provide, operate, maintain, and remove a portable
29 temporary traffic control signal to provide alternating one-lane traffic operations on a two-way facility. A portable temporary
30 traffic control signal is defined as a traffic control signal that may be trailer mounted, fully self-contained unit and designed so it
31 can be easily transported and deployed at different locations.

32 The Contractor must submit the manufacturer's specifications for the portable temporary traffic control signal to the
33 Engineer for approval at the preconstruction meeting or a minimum of 2 weeks before installation, whichever occurs first. A
34 manufacturer's representative is required to demonstrate the capabilities of the temporary portable signal before approval and
35 provide training to Contractor personnel as necessary. The Contractor must provide a minimum of 1 manufacturer trained
36 operator on-site during all hours of portable traffic control signal operation.

37 Remote manual control of the portable traffic control signal by the TCS or a qualified operator may be allowed if
38 necessitated by Work area or traffic conditions and as approved by the Engineer.

39 Maximum length between signal heads is 1500 feet unless otherwise shown on the Drawings or ordered by the Engineer
40 as specified in Section 1-04.3.

41 The Engineer will inspect the signal system at initial installation/operation and either provide or approve the signal timing.
42 Final approval will be based on the results of the operational inspection.

43 If repairs or adjustments are required, the Contractor must respond immediately and provide flagger traffic control if the
44 roadway cannot be safely reopened to two-way traffic, until such time repairs can be made. The Contractor must either repair
45 the signal or replace with a backup unit within 24 hours.

46 The Engineer will monitor the traffic, signal operation and order adjustments as needed based on traffic conditions.
47 Timing adjustments require the approval of the Engineer.

48 As shown on the traffic control plan, temporary stop bars and Stop Here on Red Signs (R10-6) must be provided at the
49 location traffic is expected to stop during the red display. The stop bar locations must be illuminated at night. The Contractor is
50 responsible for illumination, which must be adjusted to ensure minimal glare to motorists.

51 When not in operation, remove signal heads from the view of traffic or cover signal heads with bags made of non-ripping
52 Material specifically designed for covering signal heads. Do not use trash bags of any type. Remove, cover, fold, or turn all
53 inappropriate signs so that they are not readable by oncoming traffic.

54 The Contractor must provide and install all field wiring to make a complete and operational portable traffic control signal
55 and must maintain the system throughout the life of the Contract.

56 Do not install portable temporary traffic signals within 300 feet of at-grade railroad crossing, or if driveways or roadway
57 access points are located between the portable temporary traffic control signals.

1 **1-10.3(3)L PAINT LINES AND LEGENDS**

2 When paint lines are obliterated due to construction activities or pavement restoration, temporary pressure-sensitive
3 pavement marking tape, traffic buttons, temporary lane markers, or delineators must be installed where designated by the
4 Engineer. These temporary features must be removed only on installation of permanent traffic channelization.

5 Temporary centerline striping must consist of placing strips of pressure sensitive pavement marking tape at 10 to 15-foot
6 intervals along the centerline. Temporary marking tape must be placed in sets of two 12-inch strips of yellow 4-inch wide
7 marking tape set 4 inches apart and parallel to the center line with each set of 1-foot double line spaced 10 to 15 feet along the
8 center line of the roadway, or the equivalent surface area in temporary lane markers. Temporary stop bars must consist of a
9 12-inch wide stop bar made up of three parallel 4-inch strips of temporary pavement marking tape placed at locations
10 designated by the Engineer. All other temporary pavement markings using pavement-marking tape will be designated by the
11 Engineer.

12 Pressure-sensitive pavement marking tape used on the wearing course before installation of permanent lane markers,
13 traffic buttons, or permanent paint striping must be removed from the pavement current with, or immediately after, the
14 installation of permanent pavement markings. Temporary pavement markings must be maintained in serviceable condition by
15 the Contractor for the duration of time it is in use. The Contractor must lay out temporary markings for the permanent marking
16 application and, after installation of the permanent markings, must remove the temporary striping.

17 Temporary pavement marking tape must comply with Section 9-29.4. Damage to the pavement resulting from removal of
18 temporary pavement marking, including the use of high heat sources, must be repaired by the Contractor at no expense to the
19 Owner

20 **1-10.3(3)M LIGHTING DEVICES**

21 Roadway and pedestrian illumination systems must be maintained in operation for all traveled ways open to traffic as
22 specified in Section 8-30.3(1).

23 Barricades or drums used at night must be equipped with approved yellow warning lights. The Contractor must keep
24 existing traffic signal systems and pedestrian and street lighting systems in operation for the benefit and safety of the traveling
25 public during progress of the Work, unless otherwise directed by the Engineer. The Owner will continue the routine
26 maintenance of traffic signal, pedestrian and street lighting systems. The Contractor must repair or replace missing or
27 damaged signal devices or lights.

28 **1-10.3(3)N SPEED AND PARKING CONTROL**

29 In those areas where construction operations have changed road conditions, such additional hazards as reduced lane
30 width, open trenches, and temporary roadway, may be considered as evidence of the need for an alteration of the legal (or
31 posted) speed limit. Construction operations may also require the occupancy of, or restrict access to public parking. In these
32 cases, requests for alteration of the legal speed limits or for parking control on streets within the City of Seattle require a traffic
33 permit.

34 To request covering of parking meters and placing no parking markers on numbered base plates where parking pay
35 stations exist, to reserve metered parking for construction or traffic control use, and to obtain a traffic permit, see Section 1-
36 07.28. Requests for alteration of the legal speed limits or parking control on streets outside the City of Seattle must be
37 submitted to the appropriate governing jurisdiction and copied to the Engineer.

38 All costs related to speed limit revisions and parking control including payment for lost parking revenue are borne by the
39 Contractor at no additional cost to the Owner. This does not apply if this is an SDOT project or if it is otherwise provided for in
40 the Contract.

41 **1-10.4 MEASUREMENT**

42 Measurement for "Maintenance and Protection of Traffic Control including Flagging" will be by the lump sum.

43 Measurement for "Traffic Control Peace Officers" will be by the hour and will be made for the actual hours worked by a
44 uniformed off-duty peace officer as specified in Section 1-10.3(1)C. No measurement will be made for standby time, show-up
45 time, and all other time not as specified in Section 1-10.3(1)C.

46 Class A and Class B signs will not be measured.

47 **1-10.5 PAYMENT**

48 Payment for the cost necessary to complete the Work specified in Section 1-10 will be made at the Bid Item prices Bid
49 only for the Bid Items listed or referenced below:

- 50 1. **"Maintenance and Protection of Traffic Control including Flagging"**, per lump sum

51 Payment for "Maintenance and Protection of Traffic Control including Flagging" includes all costs for the Work required to
52 control traffic as specified in Section 1-10 not including Traffic Control Peace Officers.

- 53 2. **"Traffic Control Peace Officers"**, per hour

54 Payment for "Traffic Control Peace Officers" includes all costs for the Work specified in Section 1-10.3(1)C.

- 55 3. **Other payment information**

1 When the Contractor's employees are called out to provide emergency traffic protection during Non-Working hours,
2 payment for labor, equipment, and Materials deemed necessary by the Engineer will be made as specified in Section 1-04.3.

3
4
5

END OF DIVISION

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1 **DIVISION 2 EARTHWORK**

2 **SECTION 2-01 CLEARING, GRUBBING, AND ROADSIDE CLEANUP**

3 **2-01.1 DESCRIPTION**

4 **2-01.1(1) GENERAL**

5 Section 2-01 describes clearing, grubbing, and roadside cleanup requirements, including protecting from harm all trees,
6 bushes, shrubs, and other objects identified in the Contract or the approved Tree, Vegetation and Soil Protection Plan
7 (TVSPP).

8 **2-01.1(2) CLASSIFICATION**

9 Clearing means removing and disposing of all unwanted material from the ground surface, including but not limited to,
10 trees 6 inches and less in diameter measured at 1 foot above the ground, brush, downed timber, rotted wood, and rubbish;
11 building sheds, fences, and other obstructions interfering with the Work, when removal and disposal of the surface
12 obstructions are not specifically provided for in Section 2-02; and protecting from all harm any trees, bushes, shrubs, or other
13 existing improvement which are to remain. Trees greater than 6 inches in diameter measured 1 foot above the ground must
14 remain unless marked for removal on the Drawings or approved for removal in the TVSPP, see Sections 1-07.16(2), 2-
15 02.3(3)I, Section 8-01 and Section 8-02.

16 Grubbing means removing and disposing of all unwanted vegetative matter from below the ground surface, including but
17 not limited to sod, stumps, roots, buried logs, and timber; and removing and disposing of drains, Culverts, wood catch basins,
18 foundations, stairways, steps, and other obstructions that interfere with the Work when removal and disposal of sub-surface
19 obstructions are not specifically provided for in Section 2-02.

20 Roadside cleanup means cleaning and maintaining the roadside to an attractive appearance.

21 **2-01.2 CLEARING AND GRUBBING DISPOSAL**

22 Requirements for disposal of clearing and grubbing waste and debris are specified in Section 1-07.3.

23 Requirements for borrow sites are specified in Section 2-10.2.

24 Unless otherwise specified in the Contract, the Contractor is allowed to sell all usable material such as timber, chips, or
25 firewood produced by clearing and grubbing. The Contractor must not allow the public to fell trees.

26 **2-01.3 CONSTRUCTION REQUIREMENTS**

27 **2-01.3(1) CLEARING**

28 If pruning is specified or approved in the TVSPP or otherwise deemed necessary to perform the Work included in the
29 Contract, the Contractor must conduct pruning per Section 1-07.16(2).

30 The Contractor must fell trees marked for removal within the area to be cleared. Removal of trees greater than 6 inches
31 diameter must include stump grinding or removal as specified in Section 2-02.3(3)I unless otherwise approved in the TVSPP.
32 Where a tree or tree limb interferes with or is in close proximity to overhead wires, or near Metro or Street Car overhead wires,
33 the Contractor must provide the advance notifications specified in Section 1-07.28.

34 The Contractor must remove and dispose of all buildings, fences, lumber piles, trash, and obstructions, except utility
35 poles, within the area to be cleared. Burning is not allowed.

36 The Contractor must dispose of refuse resulting from the clearing operation at an approved disposal site, as specified in
37 Section 1-07.3. Refuse material must not be left on the Project Site, on abutting properties, or buried in embankments or
38 excavations on the Project Site. See Sections 1-04.10, 1-07.3, 1-07.5, 1-07.15, 1-07.24, and Section 8-01 regarding
39 prevention of pollution, cleanup, and stormwater and erosion control.

40 **2-01.3(2) GRUBBING**

41 The Contractor must remove all stumps, roots, foundations, and planking embedded in the ground, within the limits
42 described in the Contract, to a minimum depth of 2 feet below subgrade or 2 feet below existing ground level, whichever is
43 lower.

44 Removal of tree stumps in improved areas as part of grubbing operations must comply with Section 2-02.3(3)I.

45 **2-01.3(3) LIMITS OF CLEARING AND GRUBBING**

46 The limits of clearing and grubbing is defined in the Contract and/or the approved TVSPP.

47 **2-01.3(4) ROADSIDE CLEANUP**

48 See Section 1-04.10.

49 **2-01.3(5) PROTECTION OF EXISTING IMPROVEMENTS**

50 See Section 1-07.16.

1 **2-01.4 MEASUREMENT**

2 Measurement for "Clearing", "Grubbing", and "Clearing and Grubbing" is by lump sum or by square foot as described in
3 the Bid Form.

4 **2-01.5 PAYMENT**

- 5 1. "Clearing", per square foot, or per lump sum.
- 6 2. "Grubbing", per square foot, or per lump sum.
- 7 3. "Clearing and Grubbing", per square foot, or per lump sum.

8 The Bid Item prices for "Clearing", for "Grubbing", and for "Clearing and Grubbing" include all costs for the specified work.

9 4. **Other payment information**

10 Payment for "Remove Tree" is as specified in Section 2-02.5.

11 All costs involved in securing, operating and maintaining any waste or borrow site, including related final cleanup, and
12 any erosion or anti-pollution controls required in related permits, property owner agreements, grading regulations, or other
13 Contract requirements, are considered included in the Bid Item prices for the Work and no separate or additional payment will
14 be made.

15 If the Bid Form does not include a Bid Item pertaining to the work of "Clearing", "Grubbing", or "Clearing and Grubbing",
16 then this work is considered included in the Bid Item prices of the various Bid Items and no separate or additional payment will
17 be made.

18 **SECTION 2-02 REMOVE, ABANDON, OR RELOCATE STRUCTURES AND OBSTRUCTIONS**

19 **2-02.1 DESCRIPTION**

20 Section 2-02 describes removing and disposing of, salvaging, or abandoning selected items identified in the Contract
21 within a Right of Way or an area of existing improvement. This work also involves backfilling of trenches, holes, or pits
22 resulting from the removal of the existing improvements.

23 For projects within the City of Seattle, actual pavement and related restoration may be modified by the extended limits of
24 restoration required to comply with the current version of the "Street and Sidewalk Pavement Opening and Restoration Rules"
25 at the date of Advertisement for Bids. This document may be obtained at The Street Use Counter, Room 2300, 23rd Floor,
26 Seattle Municipal Tower, 700 Fifth Avenue, Seattle, WA 98104 or found at:

27 http://www.seattle.gov/transportation/stuse_pavementopen.htm

28 Any modifications to the Contract based on the "Street and Sidewalk Pavement Opening and Restoration Rules" must be
29 approved by the Engineer.

30 The Contractor must conduct all removal operations included in this Section per Section 1-07.16(2) when removals fall
31 within the dripline of existing trees to be protected.

32 Projects outside the City of Seattle must comply with the applicable local jurisdiction requirements.

33 **2-02.2 MATERIAL**

34 Cement concrete pavement must comply with the requirements of Section 6-02.

35 Aggregates must comply with Section 9-03. Cement Concrete, Class 3000 must be used for plugging pipe ends and
36 filling inlets.

37 Backfill Material for filling structure voids and Structures other than inlets must be either Mineral Aggregate Type 9 or
38 Type 17 meeting the requirements of Section 9-03, selected Material excavated on the Project Site, or other Material as
39 assigned in the Contract.

40 **2-02.3 CONSTRUCTION REQUIREMENTS**

41 **2-02.3(1) GENERAL REQUIREMENTS**

42 The Contractor must demolish, remove, and dispose of buildings and foundations, Structures, fences, and other
43 obstructions that lie wholly or partially within the Right of Way, unless they are public and private utility-owned equipment or
44 items identified in the Contract to remain.

45 The Contractor must:

- 46 1. Remove abandoned Structures and other infrastructure to a depth of at least 5 feet below finished ground elevation,
47 roadway subgrade elevation, or surfacing subgrade elevation, whichever is lower.
- 48 2. Break up basement floors to promote drainage.
- 49 3. Fill basements or other cavities left by the removal of Structures to match the level of surrounding ground. Complete
50 backfilling as specified in Section 2-10.
- 51 4. Notify the Engineer of construction near existing survey monumentation, or removal of pavement containing existing
52 survey monumentation, as required in Sections 1-07.16(1)A and 1-07.28 Item 17.

- 1 5. Provide protective systems as specified in Section 2-07 when the removal of Structures creates voids greater than 4
2 feet in depth.

3 When salvageable material remains Owner property, the Contract will identify the material and provide removal
4 requirements. The material must either be stored on the Project Site or delivered to a location identified in the Contract.

5 Any material not named in these Specifications or in the Contract as Owner property belongs to the Contractor.

6 The Contractor must dispose of surplus material or debris as specified in Section 1-07.3.

7 When limits are not shown on the Drawings, utility cuts and other openings in Seattle's streets, alleys, and other public
8 places for construction or related activities must comply with the current edition of the "Street and Sidewalk Pavement Opening
9 and Restoration Rules," see Section 2-02.1. The Engineer must approve utility cuts and other openings.

10 Joints and cracks referenced within this Section must include the abutment between differing surface materials such as
11 asphalt, concrete, brick, or cobblestones; roadway surface and curb; non-monolithic curb and sidewalk; separately placed
12 cement concrete slabs such as sidewalks, driveways, and bus shelter foundations; separately placed rigid pavement slabs
13 without overlay; and separately placed rigid pavement base slabs with visible overlay.

14 When working adjacent to a signalized intersection, contact Signal Operations before removing or sawcutting asphalt
15 overlay, pavement, or sidewalk, see Section 1-07.28.

16 **2-02.3(2) REMOVAL OF BRIDGES, BOX CULVERTS AND OTHER DRAINAGE STRUCTURES**

17 During salvage work, the Contractor must prevent unnecessary damage to any steel or wooden bridge that will remain
18 Owner property. Steel members must be match-marked.

19 The Contractor must complete all blasting before the placement of new work. Blasting must be as specified in Section 1-
20 07.22.

21 **2-02.3(3) REMOVAL OF EXISTING STREET IMPROVEMENTS**

22 **2-02.3(3)A REMOVE NON RIGID PAVEMENT AND UNTREATED ROADWAY SURFACES**

23 Non-rigid pavements are defined as streets, driveways, alleys, parking lots, sidewalks, or other surfaces constructed from
24 a bituminous mix or any combination of bituminous mixes or surface treatments, placed directly on the subgrade or over a
25 base material composed of treated or non-treated granular or selected materials. Non-rigid pavement does not contain cement
26 concrete, brick, or cobblestones.

27 The thickness of a non-rigid pavement is measured as the thickness of the bituminous mix, or any combination of
28 bituminous mixes and surface treatments.

29 Non-rigid pavement must be sawcut full depth before removal, to ensure a straight neat line. Full depth precut may be
30 performed using an asphalt cutting wheel at the discretion of the Engineer.

31 When asphalt is removed by planing, edges must be vertical along a neat straight line. Sawcutting is not required.

32 Required sawcutting on the perimeter of full depth non-rigid pavement openings is paid as "Sawcut Asphalt Concrete,
33 Full Depth." All other sawcutting associated with removal of non-rigid pavement is considered incidental to the removal Bid
34 Item. Pavement openings will be shown on the Drawings or determined by the Engineer. Adjacent openings are considered 1
35 opening regardless of the method of Work.

36 No sawcutting is required where pavement removal limits extend to joints or cracks.

37 Untreated roadway surfaces are defined as oil mat, crushed rock, and gravel surfaces. Untreated roadway surfaces are
38 not considered pavements.

39 **2-02.3(3)B REMOVE ASPHALT OVERLAY**

40 When removing an asphalt overlay from a rigid base pavement, the Contractor must use methods and equipment that do
41 not structurally damage the existing rigid base.

42 Sawcutting is not required if the asphalt overlay is removed by planing and edges are vertical along a neat straight line.

43 Required sawcutting on the perimeter of an asphalt overlay removal area will be paid as "Sawcut Asphalt Concrete, Full
44 Depth." All other sawcutting associated with removal of asphalt overlay is considered incidental to the removal Bid Item. Areas
45 of asphalt overlay removal must be as shown on the Drawings or determined by the Engineer. Contiguous asphalt overlay
46 removal areas are considered a single area regardless of the method of Work.

47 No sawcutting is required where pavement removal limits extend to joints or cracks.

48 Planing bituminous pavement is described in Section 5-04.3(3)D.

49 **2-02.3(3)C REMOVE RIGID PAVEMENT**

50 Rigid pavements are streets, driveways, alleys, parking lots, and other pavement structures including cement concrete,
51 brick, cobblestone, or any combination of these materials, and may or may not incorporate an asphalt overlay.

52 The thickness of a rigid pavement is measured as the thickness of the cement concrete, brick, cobblestone, or any
53 combination of cement concrete, brick, or cobblestone. Overlaying asphalt depth is not included in determining the thickness
54 of the rigid pavement.

1 In trenching operations, rigid pavement must be removed at locations shown on the Drawings or on Standard Plan 404a
2 or 404b, if not shown on the Drawings.

3 Unless otherwise specified, rigid pavement must be sawcut or line drilled. Line drilling requires the approval of the
4 Engineer, see Section 2-02.3(6).

5 Required sawcutting on the perimeter of rigid pavement openings is paid as "Sawcut Cement Concrete, 2 inch Minimum
6 Depth" or "Sawcut Cement Concrete, Full Depth." Sawcutting for neat edge removal of the asphalt overlay 12-inch step-back,
7 as shown on Standard Plan 404a and 404b, is paid as "Sawcut Asphalt Concrete, Full Depth." All other sawcutting associated
8 with removal of rigid pavement is considered incidental to the removal Bid Item. Pavement openings will be shown on the
9 Drawings or determined by the Engineer. Adjacent openings are considered 1 opening regardless of the method of Work.

10 No sawing or line drilling is required where pavement removal limits extend to joints or cracks.

11 Use of a "headache ball" or other methods that generate excessive vibrations to break concrete pavement are not
12 permitted.

13 Removal of former street car foundation, abandoned railroad track foundation, or other thickened slabs may be required.
14 Former street car foundation may include rails and ties and rigid pavement extending over 14 inches in depth.

15 **2-02.3(3)D REMOVE CATCH BASIN, SANDBOX, VALVE CHAMBER, MAINTENANCE HOLE, OR INLET**

16 The Contractor must excavate and completely remove the Structure, including casting and outlet trap, concrete
17 encasement, and bricks, as applicable to each removal Bid Item.

18 Plug connecting pipes as specified in Section 2-02.3(5)B. Backfill as specified in Section 2-10.

19 **2-02.3(3)E CURB REMOVAL AND CLASSIFICATION, AND REMOVE CURB AND GUTTER**

20 There are 4 types of curb:

- 21 1. Doweled curb includes mountable and other curb attached to underlying pavement structure
- 22 2. Full depth curb
- 23 3. Curb and gutter
- 24 4. Monolithic curb (cement concrete)

25 Unless the Drawings indicate otherwise, doweled curb, full depth curb, curb and gutter, or monolithic curb removal
26 adjacent to pavement removal is considered part of the pavement removal paid as "Remove Pavement." If doweled curb, full
27 depth curb, curb and gutter, or monolithic curb removal is isolated from full depth pavement removal, then removal of doweled
28 curb, full depth curb, and monolithic curb is considered curb removal, and removal of curb and gutter is considered curb and
29 gutter removal. Monolithic curb is considered the first 6 inches of cement concrete along the curb-line monolithically poured
30 with the existing sidewalk.

31 Sawcut the curb perpendicular to the curb line at the neat line limits of removal, or remove to the nearest joint as shown
32 on the Drawings or directed by the Engineer. Sawcutting at the limits of removal is paid as "Sawcut Cement Concrete
33 Sidewalk, Full Depth" for doweled curb paid as remove curb, as "Sawcut Rigid Pavement, Full Depth" for all other cement
34 concrete curb removal, including doweled curb paid as remove rigid pavement, and as "Sawcut Asphalt Concrete, Full Depth"
35 for all asphalt concrete curb. Sawcutting between limits of curb removal, and all other sawcutting associated with removal of
36 curb, is considered incidental to the removal Bid Item. See Section 2-02.3(7)E for additional requirements when salvage is
37 applicable.

38 **2-02.3(3)F REMOVE SIDEWALK**

39 Sidewalk removal, both asphalt and concrete, is shown on the Drawings. Sawcut must comply with the requirements of
40 Section 2-02.3(6) and must leave straight edges and vertical faces. The minimum width of sidewalk removal, measured
41 longitudinally, is either 2 feet or to the nearest score line as shown on the Drawings or as directed.

42 Required sawcutting on the perimeter of sidewalk removal is paid as "Sawcut Asphalt Concrete, Full Depth" or "Sawcut
43 Cement Concrete, Full Depth," except for sidewalk removal for curb ramp and driveway installations. Sawcutting on the
44 perimeter of new curb ramps, new driveways, and all other sawcutting associated with removal of sidewalk is considered
45 incidental to the removal Bid Item. Sidewalk removal areas are shown on the Drawings or directed by the Engineer. Adjacent
46 sidewalk removal areas are considered 1 area regardless of the method of Work.

47 No sawcutting is required where sidewalk removal limits extend to joints or cracks.

48 See Section 2-02.3(3)K for removal of parking pay stations.

49 **2-02.3(3)G REMOVE ELECTRICAL AND TRAFFIC CONTROL DEVICES**

50 The Contractor must show a schedule for removing the existing traffic control and electrical systems in the CPM
51 schedule and in the weekly 3-week look-ahead. The Contractor must notify and coordinate with the Engineer at least 5
52 Working Days before proceeding with removal.

53 The Contractor must remove equipment from the span wire before the span wire is disconnected from the poles. Release
54 tension from the span before cutting existing span wire.

1 The Contractor must provide the notification described in Section 1-07.28 item 16 for the removal of any part of a loop
2 detector system, whether or not in conjunction with pavement, curb, or sidewalk removal.

3 **2-02.3(3)H REMOVE GUARDRAIL**

4 Removal of the various types of guardrail and anchors includes removal of the rail, cable elements, hardware, posts,
5 concrete bases, and steel tubes. Fill all holes resulting from guardrail removal as specified in Section 2-10. Deliver any
6 removed guardrail items the Engineer deems reusable either to the Charles Street Facility or to the Haller Lake Facility,
7 whichever is nearest the Job Site of removal. The Contractor must dispose of any damaged and unusable items as specified
8 in Section 1-07.3.

9 **2-02.3(3)I REMOVE TREE**

10 Trees greater than 6 inches in diameter at 1 foot above the ground and marked for removal are shown on the Drawings
11 or identified in the approved TVSPP.

12 The Contractor must notify the Engineer at least 2 weeks in advance of tree removal, and must post Engineer-provided
13 placards on trees before removal. The Contractor must comply with Section 1-07.16(2) whenever tree trimming or removal is
14 near overhead wires.

15 In unimproved areas, removal of the tree does not include complete removal of the stump unless directed by the
16 Engineer.

17 In improved areas and/or areas to be paved, stump removal must be completed by grinding and removing the stump to a
18 2-1/2-foot depth below finished grade, unless otherwise specified in the Contract.

19 Approval by the Engineer is required before removing any tree not identified in the Drawings.

20 **2-02.3(3)J REMOVE PAVEMENT MARKING**

21 Pavement paint and thermoplastic stripes and markings, traffic buttons, and lane markers to be removed, as described in
22 the Contract, must be obliterated until blemishes caused by the pavement marking removal conform to the coloration of the
23 adjacent pavement. Grinding to remove painted markings is not allowed. Grinding to remove plastic markings is allowed to a
24 depth just above the pavement surface; water blasting or shot blasting is required to remove the remaining markings. Traffic
25 button and lane marker removal are considered incidental to pavement marking removal. The Contractor is responsible for
26 repairing any material damage caused by pavement marking removal, as specified in Section 1-07.13. Sand or other material
27 deposited on the pavement as a result of removing pavement markings must be removed as the work progresses, to avoid
28 hazardous conditions. See Section 1-07.5 regarding pollution control requirements.

29 **2-02.3(3)K REMOVE SIGN AND POST**

30 Unless the Contract specifies otherwise, SDOT is responsible for removal of parking pay stations, D-22 signage ("Pay L",
31 "Pay R", "Pay H", and "Pay LR" signs and posts) and numbered base plates, and parking meters. Metro is responsible for
32 removal of bus stop signs. See Section 1-07.28 for notification requirements.

33 Removal of the various types of signs, posts, and hardware must include patching the holes with a suitable material flush
34 with the existing surface. Fill holes created by removal of posts in earth as specified in Section 2-10. Removal of posts and
35 concrete foundations from sidewalk or other improvement must include the removal and replacement of surrounding
36 improvements necessary to reasonably accommodate the removal. The Engineer may direct additional removal to a joint or
37 score line. The replacement of improvements must be conducted per the Bid Items in the Bid Form. If Work is not specified in
38 the Bid Form, replacement of improvements must be conducted per Specifications or in-kind to the satisfaction of the
39 Engineer, and incidental. The Contractor must properly dispose of any damaged and unusable items. Salvage of useable
40 Material must be conducted as specified in Section 2-02.3(7).

41 **2-02.3(3)L REMOVAL OF EXISTING STREETLIGHT EQUIPMENT**

42 Removal of streetlight equipment, wiring, or the disconnection of power from street light equipment requires a submittal
43 to the Engineer. The submittal must include the scope of the Work and the schedule for the Work to be performed. The
44 submittal must be submitted to the Engineer 10 Working Days before the planned activities as specified in Section 1-05.3.

45 **2-02.3(4) ABANDON CATCH BASIN, VALVE CHAMBER, MAINTENANCE HOLE, OR INLET**

46 As applicable to each structure designated on the Drawings to be abandoned, the Contractor must: remove the casting
47 and debris; dewater; break down the structure to a depth of the cone sections or 4 feet below the surface, whichever is
48 greater; plug the outlet pipe as specified in Section 2-02.3(5); and fill the remaining structure and void with Mineral Aggregate
49 or concrete as defined in this Section.

50 The Contractor must not abandon any existing water service unless specified otherwise in the Contract. When
51 abandonment of an existing water service is required, the Contractor must first make the notification as specified in Section 1-
52 07.28 item 7.

53 Fill valve chambers, catch basins, and maintenance holes as specified in Section 2-10. Fill old Type 164 inlets with
54 cement Class 3000 concrete, see Section 6-02. Deliver inlet grates to the Owner.

55 The upper portion of abandoned Structures must be replaced with Material matching the existing pavement structure
56 unless specified otherwise in the Contract.

1 2-02.3(5) ABANDON AND FILL, AND PLUG PIPE**2 2-02.3(5)A ABANDON AND FILL PIPE**

3 Fill pipes designated on the Drawings to be abandoned and filled with a pumpable, flowable cement slurry completely
4 filling the pipe, see Section 9-05.15.

5 2-02.3(5)B PLUG PIPE

6 At each end of pipe designated on the Drawings as "abandon and fill" or "plug", the pipe end must be completely plugged
7 with Cement Concrete, Class 3000, see Section 6-02, for a minimum length of 12 inches with no voids.

8 2-02.3(6) SAWING AND LINE DRILLING**9 2-02.3(6)A REMOVAL**

10 When sawcutting cement concrete pavement, cement concrete driveway, cement concrete sidewalk, or other cement
11 concrete slabs, with or without asphalt overlay for removal, the sawcut must be full-depth of the concrete material or rigid
12 pavement unless the Drawings indicate otherwise or the Engineer directs or allows otherwise. Rigid pavements may consist of
13 mortared decorative or other type special pavement units, such as brick, cobblestone or paver block, as well as cement
14 concrete pavement, see Section 2-02.3(3)C. Rigid pavements may also include an asphalt overlay.

15 Curb removal must be sawcut full height and width of curb.

16 Use diamond blades for sawing concrete where a full-depth cut face adjoins new concrete. The Contractor may use
17 carbide cutting wheels to saw concrete that will be overlaid or for full-depth cuts where the cut face does not join the new
18 concrete. Limit penetration of wheel into the subbase to a maximum of 1/2 inch. Do not allow the wheel to cut into pavement
19 that is remaining in place. Discontinue using a wheel saw if the Engineer determines the results are unsatisfactory.

20 Asphalt removal must be sawcut full depth, straight, and the surface must be generally vertical over its full depth.

21 When line drilling, space drilled holes 6 inches center to center maximum with minimum hole diameters of 1-1/2 inches.
22 Holes must be perpendicular to the surface and must penetrate completely through the pavement.

23 Sawcutting is the required method for removals unless otherwise noted in the Contract, in the permit for work in the Right
24 of Way, or if accepted in writing by the Engineer.

25 To thoroughly clean sawcut, the Contractor must use non-polluting methods using, or as effective as using, high pressure
26 water (minimum 1400 psi.) to thoroughly flush the sawcut. See Section 1-07.5(2) Water Quality, "Sawcutting, Planing, and
27 Grinding By-Products:" for sawcutting water quality requirement and considerations.

28 2-02.3(6)B PAVEMENT JOINTS

29 See Standard Plans and Section 5-05 when sawcutting concrete pavement for contraction joints.

30 2-02.3(7) SALVAGE**31 2-02.3(7)A GENERAL**

32 Unless otherwise specified in the Contract, any material identified as salvageable by the Engineer to be removed from
33 the project must be carefully salvaged in its existing condition as amended in the following paragraph. Delivery of salvageable
34 material must be as specified in Sections 2-02.3(7)B through 2-02.3(7)F. Delivery of salvageable guardrail components must
35 be as specified in Section 2-02.3(3)H. The Contractor must remove and dispose of any materials deemed not salvageable by
36 the Engineer.

37 The Contractor must remove all excess concrete, debris and dirt from castings and other materials removed from the
38 project which will not be re-used on the project, but which the Engineer deems suitable for salvage.

39 2-02.3(7)B WATER MAINS AND APPURTENANCES

40 The Contractor must excavate and completely remove hydrants, valves, and any appurtenance where new Water Main
41 and appurtenances are to be installed. Items assigned for salvage are specified in the Contract with specific direction on who
42 to contact, lead time advance notice, how to handle, and where to deliver. Removed Water Main and appurtenances must be
43 disposed of by the Contractor as specified in Section 1-07.3. Backfilling must be as specified in Section 2-10.

44 2-02.3(7)C ILLUMINATION, SIGNALS, ELECTRICAL, AND SIGNS

45 Electrical and traffic control items to be salvaged must include the following:

- 46 1. High pressure sodium, Induction and Light Emitting Diode (LED) luminaires, lamps and photoelectric cells
- 47 2. Aluminum bracket arms
- 48 3. Aluminum lighting poles
- 49 4. Wood and metal lighting poles
- 50 5. Traffic poles, including joint lighting and traffic poles
- 51 6. Mast arms
- 52 7. Pedestals

- 1 8. Traffic signal cabinets
- 2 9. Signal heads
- 3 10. Illuminated signs
- 4 11. Handholes
- 5 12. Junction and terminal boxes
- 6 13. Traffic signs overhead
- 7 14. Traffic sign
- 8 15. Signal appurtenances identified in the Contract
- 9 16. Miscellaneous channelization items

10 The Contractor must deliver items 1 through 4 to City Light South Service Center at Fourth Avenue South and South
11 Spokane Street. Call (206) 386-1766 before delivery of wood poles, or (206) 386-1704 before delivery of metal poles, high
12 pressure sodium, induction and LED luminaires, lamps, photoelectric cells, and aluminum bracket arms.

13 Return items 5 through 16 to SDOT Traffic Shops at 4200 Airport Way South. Call (206) 386-1206 a minimum of 2
14 Working Days before delivery.

15 **2-02.3(7)D REINSTALLING SALVAGED ELECTRICAL MATERIAL**

16 See Section 8-30.3(4).

17 **2-02.3(7)E GUTTER BRICK, PAVEMENT BRICK AND COBBLESTONE, AND GRANITE CURB**

18 When the Bid Item description includes "with salvage," the Contractor must exercise reasonable care in the removal and
19 salvage of existing gutter brick, pavement brick, cobblestone, and granite curb encountered during removal operations. The
20 method of removal must not damage the brick, cobblestone, or granite curb. When necessary, the Contractor must hand
21 excavate to ensure these materials are not damaged. The Contractor must coordinate the loading operations with the SDOT
22 Pavement Supervisor, see Section 1-07.28. The Contractor is responsible for loading, hauling, and unloading of the salvaged
23 material.

24 **2-02.3(7)F DRAINAGE AND SEWER MATERIALS**

25 Inlet, catch basin, maintenance hole, and other Sewer and drainage materials, such as castings, grates, hoods, ladders,
26 and related materials, deemed salvageable by the Engineer must be delivered to the Haller Lake facility, weekdays between
27 the hours of 8:00 a.m. and 3:00 p.m. Contact (206) 684-7507 at least 1 Working Day in advance to arrange delivery.

28 **2-02.3(8) STREET SADDLES AND STEEL PLATES**

29 **2-02.3(8)A GENERAL**

30 When excavations or other openings in the Right of Way cannot be completely backfilled at the end of the Day or as may
31 be required, and traffic must be accommodated over the opening, street saddles or steel plates that meet the following
32 requirements must be used to temporarily cover the excavation or opening.

33 **2-02.3(8)B STREET SADDLES**

34 Saddle boards and irons must only be used on those streets which have concrete pavement or other surface which can
35 safely support them.

36 Saddle board must be made of 4 inches or thicker rough-cut construction grade timbers with no warp. Saddle iron
37 flanges must have minimum dimensions of 6 inches width by 8 inches length. They must be made of minimum thickness 3/4
38 inch steel and have chamfered edges. The support iron must be of adequate size so that there is no significant deflection with
39 traffic. Any time the saddle iron flanges do not receive full bearing on the pavement surface, shims must be used. Saddle
40 boards and irons may be bolted together.

41 Saddle irons and boards must be firmly wedged on sides and ends. The boards must be flush with surrounding
42 pavement. All holes must be cut to provide a good fit and without excessive openings. Saddle boards must be notched to
43 receive the irons, or scabbing added to the sides of the board so that the board is flush along the pavement opening. There
44 must be no more than 3 feet of unsupported board between irons.

45 Shims, where needed, must comply with the requirements of Section 2-02.3(8)C.

46 Street saddles must have a non-skid surface coating capable of providing slip resistance in wet and dry weather for the
47 length of time the saddles are in-place, see Section 1-07.1(3)

48 **2-02.3(8)C STEEL PLATES**

49 In general, where a steel plate covers an excavation or opening, the Contractor must ensure the steel plate withstands
50 the traffic loading, remains in place over the opening, does not rock, does not generate noise, and is fully supported for the
51 length of time the plate is in-place.

52 Steel plates must be capable of withstanding, at minimum, HS-20 loading.

1 All bearing ends of steel plates must overlap existing remaining pavement at least 12 inches. Flanges or angle irons must
2 be welded to the plate underside conforming to the size of the street opening to ensure the plate does not move relative to the
3 opening. The edges of all plates must be highlighted with 12-inch minimum width Safety Orange (Federal Standard 595 Color
4 595 FS 12246 or approved equal) paint.

5 All steel plates must be bedded on temporary pavement patch Material or other suitable Material that extends beyond the
6 plate's edge to form a tapered transition (shim). The taper must provide a smooth, gradual transition between pavement and
7 the plate at least 12 inches in length to accommodate wheelchair, bicycle, and other traffic. The tapered transition shim must
8 be highlighted with paint stripes consisting of the color Safety Orange approximately 2 inches wide on 16-inch centers.

9 Where spans are excessively long or where multiple steel plates are required to cover a long span, adequate additional
10 support beneath the plates must be provided, such as braced steel beams. The space between the steel beam and the plate
11 must be covered with a material, such as an old carpet, to prevent rattling and noise.

12 When directed by the Engineer, the Contractor must use steel pins welded at the corners of the plate. When pins are
13 used, holes must be drilled through an opening in the plate full depth into underlying pavement structure. The pins must be
14 long enough to be driven full depth of pavement and be of cross-section to be snug in the holes. The pin head must be of
15 sufficient area and mass to allow for welding the pin to the plate with sufficient strength of weld ensuring the pin does not pop
16 up, come loose, or separate from the plate at any time.

17 Steel plates must have a permanent non-skid surface in both dry and wet conditions, see Section 1-07.1(3). Non-skid
18 coatings are not acceptable.

19 Any crosswalk containing steel plates or saddles may be closed at the discretion of the Engineer.

20 **2-02.4 MEASUREMENT**

21 When specified for payment in the Contract, measurement for sawcutting is by the linear foot along the slope of the
22 surface cut. When acceptable full depth precut is performed using an asphalt cutting wheel, and where payment for sawcutting
23 is specified, it will be measured as sawcutting. Sawcutting not specified for payment in the Contract will not be measured. No
24 measurement will be taken for line drilling.

25 Unless otherwise specified: sawcutting of cement concrete pavement (or rigid pavement) at the limits of removal will be
26 measured as "Sawcut Rigid Pavement, Full Depth"; Sawcutting of cement concrete sidewalk at the limits of removal will be
27 measured as "Sawcut Cement Concrete Sidewalk, Full Depth"; Sawcutting of asphalt concrete at the limits of removal will be
28 measured as "Sawcut Asphalt Concrete, Full Depth"; sawcutting of curb at the limits of removal (end points of removal
29 segments) will be measured as "Sawcut Cement Concrete Sidewalk, Full Depth" for doweled curb paid as curb removal, as
30 "Sawcut Rigid Pavement, Full Depth" for all other cement concrete curb including doweled curb paid as rigid pavement
31 removal, and as "Sawcut Asphalt Concrete, Full Depth" for all asphalt concrete curb.

32 Measurement for openings in pavement structure is based on the removal and replacement limits as shown on the
33 Drawings, as determined by the Engineer, or, if not shown on the Drawing, as shown on Standard Plan 404a or 404b as
34 modified by the extended limits of restoration required to comply with the "Street and Sidewalk Pavement Opening and
35 Restoration Rules".

36 "Remove Asphalt Pavement" with an average thickness less than 6 inches is measured by the square yard except when
37 the removal is required to install underground utilities. There will be no measurement for asphalt pavement removal to install
38 underground utilities.

39 Abandon pipe will not be measured.

40 "Abandon and Fill Pipe" is measured by linear feet of pipe abandoned and filled.

41 "Remove Pavement Marking" and "Remove Pavement Marking, Thermoplastic" is measured by the actual linear foot.
42 Unpainted skips in pavement marking removal, and removal of traffic buttons and lane markers incidental to pavement
43 marking removal, will not be measured.

44 "Remove Pavement Marking Legend/Symbol" and "Remove Pavement Marking Legend/Symbol, Thermoplastic" is
45 measured per each.

46 Removal of cement concrete sidewalk is measured by the square yard except the monolithic curb (the 6 inches adjacent
47 the roadway).

48 Unless the Drawings indicate otherwise, curb and gutter, doweled curb and full depth curb, and monolithic curb removal
49 adjacent to pavement removal paid as "Remove Pavement" is considered part of the pavement removal paid as "Remove
50 Pavement" and will be included in the surface area measurement.

51 Doweled curb, full depth curb, and monolithic curb isolated from pavement removal paid as "Remove Pavement" is
52 measured by the linear foot along the curb face as "Remove Curb".

53 Curb and Gutter isolated from pavement removal paid as "Remove Pavement" is measured by the linear foot along the
54 curb face as "Remove Curb and Gutter".

55 "Abandon Existing Water Service" is measured per each service permanently retired and disconnected from the existing
56 Water Main.

57 Removal of former street car foundation or abandoned railroad track foundation is measured per square yard using the
58 Bid Item "Remove Pavement, Over Fourteen Inch Depth, Including Rails and Railroad Ties" or "Remove Pavement, Over

1 Fourteen Inch Depth, Including Railroad Ties". No separate measurement will be made for the removal of rails and railroad
2 ties.

3 Removal of rigid pavement over 14 inches is measured per square yard using the Bid Item "Remove Pavement, Over
4 Fourteen Inch Depth". No separate measurement will be made for the removal of overlaying asphalt.

5 For all pavement removal including rigid pavement, overlaying asphalt is excluded from the measurement of the
6 pavement depth and is incidental to the removal Bid Item. "Average thickness" is determined by the Engineer using 3 to 7
7 randomly selected locations per sub-lot or representative area.

8 **2-02.5 PAYMENT**

9 1. "Remove (Item)", per square yard.

10 2. "Remove (Item)", per linear foot.

11 3. "Remove (Item)", per each.

12 4. "Remove (Item)", per lump sum.

13 The Bid Item price for "Remove (Item)" includes all costs for the work required to completely remove and dispose of or
14 salvage the item as applicable. The removal (item) will include "with salvage" when salvage of brick, cobblestone, granite curb
15 or a combination of brick, cobblestone or granite curb is required. Salvage of other materials will not require the "with salvage"
16 in the Bid Item description.

17 Payment for removal of items not listed in the Bid Form and not specified in this Section will be included in the Bid Item
18 prices of the various Bid Items and no separate or additional payment will be made.

19 Removal of non-rigid pavement less than or equal to 6 inches in average thickness will be measured and paid as
20 "Remove Asphalt Pavement", with the following exception: when excavating through non-rigid pavement less than or equal to
21 6 inches in average thickness to install underground facilities, the costs of removal of non-rigid pavement is considered
22 incidental to and included in the Bid Item price of installing the new underground facility.

23 Payment for removal of rigid pavement, whether as a rigid base or as a surface course, averaging greater than 4 inches
24 in thickness, or averaging greater than 6 inches in thickness when combined with the overlaying asphalt, will be paid as
25 "Remove Pavement".

26 Removal of non-rigid pavement greater than 6 inches in average thickness will be measured and paid as "Remove
27 Pavement".

28 Removal of non-rigid pavement without removal of any underlying rigid pavement base will be paid as "Remove Asphalt
29 Overlay".

30 When rigid base is to be removed, the removal of the 12-inch asphalt overlay step-back as shown on Standard Plans
31 404a and 404b is considered included in the removal Bid Item. Payment for removal of rigid base includes the removal of the
32 overlaying asphalt in the removal Bid Item.

33 Payment for removal of rigid pavement, whether as a rigid base or as a surface course, averaging 4 inches or less will be
34 paid as "Remove Cement Concrete Sidewalk", unless the average thickness of the rigid pavement base combined with the
35 overlaying asphalt is greater than 6 inches in average thickness.

36 Payment for removal of untreated roadway surfaces will be paid as "Common Excavation".

37 Removal, including stump grinding of trees 6 inches or greater in diameter as measured 1 foot above the ground surface
38 will be paid as "Remove Tree". Removal of trees less than 6 inches in diameter as measured 1 foot above the ground surface
39 will be paid as specified in Section 2-01.

40 Payment for all minor utility devices such as meter boxes, handholes, inlets, sandboxes and pipe marked for removal in
41 the Contract and which are within the excavation area between pipe trench neat lines or within the neat line area of a structural
42 excavation shown on the Drawings, is considered incidental to and included in the Bid Item price for installation of pipe or for
43 structural excavation. Removal of catch basin and maintenance hole will be paid for at the Bid Item price Bid for their removal.

44 Costs for sidewalk thickened edge removal are considered incidental to and included in the cement concrete sidewalk
45 removal Bid Item price.

46 Payment for removal of traffic sign posts includes all costs for the removal of the post, traffic sign, mounting hardware
47 and restoration of the surface where sign posts were removed.

48 The Bid Item price for; "Remove Pavement Marking", "Remove Pavement Marking, Thermoplastic", "Remove Pavement
49 Marking Legend/Symbol" and "Remove Pavement Marking Legend/Symbol, Thermoplastic" includes all costs for the work
50 required to remove and dispose of pavement marking including traffic buttons and lane markers. Pavement materially
51 damaged by Contractor removal methods requiring restoration of the damaged pavement will be at the sole expense of the
52 Contractor and no separate or additional payment will be made. No payment will be made for removal of pavement marking
53 when the underlying pavement is removed.

54 The Bid Item prices for "Remove Luminaire" and "Remove Luminaire and Bracket Arm" includes all costs for the work
55 required to remove the existing luminaire, or luminaire and bracket arm and its ballast, wiring and appurtenances.

56 The Bid Item price for "Remove Pole, Metal" includes all costs for the work required to remove and salvage the pole.

57 The Bid Item price for "Remove Pole, Wood" includes all costs for the work required to remove and salvage the pole, and
58 to backfill and compact the void left after pole removal.

1 The Bid Item price for "Remove Pole, Concrete or Fiberglass" includes all costs for the work required to remove the pole,
2 and, if direct buried, to backfill and compact the void left after pole removal.

3 The Bid Item price for "Remove Foundation, (Type)" includes all costs for the work required to remove and dispose of the
4 foundation, and to backfill and compact the void left after removing the foundation.

5 5. "Sawcut Rigid Pavement, Full Depth", per linear foot.

6 6. "Sawcut Cement Concrete Sidewalk, Full Depth", per linear foot.

7 7. "Sawcut Asphalt Concrete, Full Depth", per linear foot.

8 The Bid Item price for sawcutting includes all costs for the work required to sawcut cement concrete or asphalt concrete.
9 No payment will be made for sawcutting concrete or asphalt done at the option of the Contractor when indicated or specified
10 as incidental in the Contract, or when specified as being included in the payment of other Bid Items. Sawcutting will only be
11 paid at the limits of removal specified for payment in the Contract.

12 Sawcutting for neat edge removal of the 12-inch asphalt overlay step-back as shown on Standard Plans 404a and 404b,
13 will be paid per the Bid Item "Sawcut Asphalt Concrete, Full Depth".

14 No separate payment will be made for sawcutting through asphalt overlay when the underlying rigid pavement is being
15 removed.

16 8. "Abandon (Item)", per each.

17 The Bid Item price for "Abandon (Item)" includes all costs for the work required to abandon the specified item.

18 9. "Abandon and Fill Pipe", per linear foot.

19 The Bid Item price for "Abandon and Fill Pipe", includes all costs for the work required to plug the pipe where shown on
20 the Drawings and furnish and fill the pipe with cement slurry.

21 No payment will be made to abandon pipe or other subsurface items identified on the Drawings and for which no work is
22 required. Plugging the exposed or open ends of pipes to be abandoned is considered incidental to and included in the Bid Item
23 price for the installation of new pipe.

24 10. "Remove Signalization (Location)", per lump sum.

25 The Bid Item price for "Remove Signalization (Location)" includes all costs for the work required to complete the removal,
26 disposal, and salvage work per the Contract including salvaging, stockpiling and delivering equipment as determined by the
27 Engineer and disposal of removed items not salvaged.

28 Removal of former street car foundation or abandoned railroad track foundation will be paid for as "Remove Pavement,
29 Over 14 Inch Depth, Including Rails and Railroad Ties" per square yard. No separate payment will be made for sawcutting, or
30 removal of the overlying asphalt. Depth excludes overlying asphalt, see Section 2-02.3(3)C. If railroad ties are found to be
31 Contaminated Material, ties must be disposed of as specified in Section 1-07.29(3), the disposal costs will be paid for
32 separately as specified in Section 1-04.3.

33 Removal of rigid pavement over 14 inches in depth will be paid for as "Remove Pavement, Over 14 Inch Depth" per
34 square yard. No separate payment will be made for the removal of overlying asphalt. Depth excludes overlying asphalt, see
35 Section 2-02.3(3)C.

36 No payment will be made for the removal of the 12-inch asphalt overlay step-back as shown on Standard Plans 404a and
37 404b associated with pavement patching.

38 When existing Type 164 Inlet is to be removed with the removal of concrete pavement, the removal of the inlet is
39 considered incidental to the cost of "Remove Pavement".

40 Unless the Drawings indicate otherwise, full depth removal of traffic islands is considered included in the Bid Item prices
41 for "Remove Pavement", "Common Excavation", or "Remove Concrete Sidewalk" applicable to the underlying pavement
42 structure combined with the traffic island being removed.

43 Traffic islands consisting of monolithic curb and sidewalk will be paid as "Remove Cement Concrete Sidewalk", except
44 the 6 inches adjacent the curb-line will be paid as "Remove Curb" or "Remove Pavement" in accordance to this Section.

45 Traffic islands curb over pavement removal is considered "Remove Curb", or "Remove Curb and Gutter" when curb
46 removal is not adjacent to or overlying pavement removal paid as "Remove Pavement".

47 All costs for coordination and delivery of salvageable material must be included in the various Bid Item prices.

48 All costs for disposal must be included in the various Bid Item prices for the Work.

49 **SECTION 2-03 STRUCTURAL DEMOLITION**

50 **2-03.1 DESCRIPTION**

51 This Section describes demolition of an existing Structure as shown on the Drawings. The Contractor is responsible for
52 determining the actual demolition quantities and limits of work. All removal operations included in this Section within the
53 dipline of existing trees to be protected must be conducted as specified in Section 1-07.16(2).

1 2-03.2 RESERVED**2 2-03.3 CONSTRUCTION REQUIREMENTS**

3 Demolition must be done safely and must avoid damaging any portions of the Structure that are to remain. federal, local
4 and state codes, including WAC 296-155 "Safety Standards for Construction Work" Part S "Demolition", must be observed at
5 all times. Explosives must not be used. The Contractor must review all Drawings of the existing Structure noted in the
6 Contract.

7 Drawings for the existing Structure may be available at the Seattle Public Utilities Records Vault: Seattle Municipal
8 Tower, 700 Fifth Avenue, 47th Floor, or PO Box 34018, Seattle, Washington 98124-4018. Phone: (206) 684-5132.

9 For the purposes of this Section a "competent person" means one who is capable of identifying existing and predictable
10 hazards in the surroundings and working conditions which are unsanitary, hazardous, or dangerous to employees, and who
11 has authorization to take prompt corrective action to eliminate those hazards.

12 Before starting demolition, the Contractor's competent person must perform an engineering survey of the Structure to
13 determine structural integrity and the possibility of unplanned collapse of any portion of the Structure. Any adjacent Structure
14 that may be affected by the demolition must be similarly checked. The Contractor must have written evidence that this survey
15 has been performed.

16 Hazardous materials must be removed or safely contained before starting demolition. These materials include, but are
17 not limited to, asbestos, lead or other heavy metals, and flammable or explosive materials.

18 Any material to be removed that will cause dust formation must be sprinkled with water to control dust.

19 Demolition must not proceed until electric, gas, water, steam and other utilities are located, relocated, shut-off, capped or
20 otherwise controlled.

21 The Contractor must demonstrate to the satisfaction of the Engineer that the methods and equipment for demolition are
22 safe, adequate for the intended purpose, and will provide satisfactory results. The Contractor must submit a demolition plan
23 with Shop Drawings to the Engineer for approval. This plan must show:

- 24 1. Each stage in the demolition required by the Contract.
- 25 2. Methods and equipment used in each stage of the demolition.
- 26 3. The area of influence for each stage of the demolition. The area of influence is that area of the Project Site where
27 safety precautions must be taken to prevent injuries due to the demolition activities.
- 28 4. Methods and equipment used to contain any hazardous materials that are in the area of influence during demolition.
- 29 5. Methods and equipment used to contain, collect, and dispose of debris.
- 30 6. Adjoining Structures that could be compromised by demolition activities. The Contractor must also provide a support
31 system plan, prepared by a registered Professional Engineer, and submitted to the Engineer for review and approval
32 as specified in Section 1-05.3.
- 33 7. Protocol for communications between all personnel working within the area of influence of the demolition.

34 A copy of the competent person's engineering survey of the demolition and the demolition plan must be maintained on
35 the Project Site.

36 The Contractor must not start demolition without the Engineer's written approval of the demolition plan and support
37 system plan. A meeting to review these plans must be held before starting demolition. Workers performing the demolition,
38 others working within the sphere of influence of the demolition, the Contractor's competent person, and the Engineer must all
39 attend the plan review meeting.

40 During demolition, the Contractor's competent person must make continuing inspections, at least daily, to ensure the
41 demolition plan is being followed, and to assess all hazards resulting from demolition activities. If hazards are found,
42 demolition must stop until the hazards are corrected.

43 If hazardous materials not previously identified are found during demolition, demolition must stop until the newly identified
44 hazards are safely contained or removed and are addressed in a revised demolition plan, reviewed by the Engineer and
45 returned with no exceptions taken.

46 2-03.4 MEASUREMENT

47 "Demolition (Structure Name)" is measured by lump sum.

48 2-03.5 PAYMENT

49 The Bid Item price for "Demolition (Structure Name)" will be full payment for all labor, material, and equipment required to
50 complete the removal, hauling, disposal, and salvage work as specified and as shown on the Drawings.

51 All costs associated with the preparation and implementation of the demolition plan and the support system plan must be
52 included in the Bid Item price of "Demolition (Structure Name)".

53 No adjustments except for approved changes will be made in Bid Item price for "Demolition (Structure Name)", even
54 though items not listed above may be shown on the Drawings or specified elsewhere in these Specifications, or encountered
55 in field.

1 **SECTION 2-04 EXCAVATIONS**

2 **2-04.1 DESCRIPTION**

3 **2-04.1(1) GENERAL**

4 Section 2-04 describes excavation, removal, and disposal of all formations, debris, and materials, natural or man-made,
5 irrespective of nature or condition, encountered within the neat line limits defined in Section 2-04.4 and that is necessary for
6 the construction of roadways, Structures and utilities. This work also includes stockpiling suitable material and disposing of
7 excess or unsuitable material.

8 This work must be done in reasonable close conformity with the lines, grades, and dimensions shown on the Standard
9 Plans, Drawings, or as established by the Engineer.

10 **2-04.1(2) CLASSIFICATION**

11 Excavations are classified as solid rock excavation, unsuitable foundation excavation, or common excavation.

12 Solid rock excavation consists of the removal and disposal of solid rock, such as ledge rock that requires systematic
13 drilling and blasting for its removal and boulders exceeding 1/2 cubic yard in volume as determined by the Engineer. Hard pan,
14 hard clay, or glacial till are not classified as solid rock excavation. Sandstone, siltstone, shale, or other sedimentary rocks
15 which are soft, weathered, or extensively fissured are not classified as solid rock excavation. Soft rock is defined as an earth
16 material that has a modulus of elasticity of less than 200,000 psi.

17 Unsuitable foundation excavation consists of the removal and disposal of unstable material, including but not limited to
18 peat, muck, and swampy or other unsuitable materials such as buried logs and stumps, but only when removal is specified in
19 the Contract and included in the Bid Form, or is specifically directed in writing by the Engineer.

20 Common excavation consists of all other material not classified as solid rock excavation, unsuitable foundation material
21 excavation, or excavation which is considered to be incidental to other Bid Items identified in other parts of the Contract.
22 Widening of roadway cuts and ditches and excavation 3 feet or less below the designated subgrade elevation, when directed
23 by the Engineer, are considered common excavation.

24 **2-04.1(3) PROTECTION OF EXISTING IMPROVEMENTS**

25 During excavation, the Contractor must protect existing improvements, including but not limited to sidewalk, pavement,
26 appurtenant Structure, adjacent improvement, and underground installations as specified in Section 1-07.16. For excavations
27 more than 4 feet in depth, the Contractor must construct and maintain protective systems as specified in Section 2-07.

28 The Contractor must prevent stockpiled materials, debris from the Work area, and materials from roadway excavation
29 from entering existing drainage Structures and water courses, as required in Sections 1-07.5, 1-07.15, and Section 8-01.
30 These materials must be removed, recycled, or disposed of as required in Sections 1-07.3 and 1-04.10.

31 All material must be stockpiled to minimize inconvenience to public travel, and provisions made for merging traffic where
32 necessary. Clear access to all fire hydrants, water valves, and meters is required.

33 **2-04.2 RESERVED**

34 **2-04.3 CONSTRUCTION REQUIREMENTS**

35 **2-04.3(1) GENERAL REQUIREMENTS**

36 All excavations must be performed in compliance with Chapter 296-155 WAC as well as all other applicable local, state,
37 and federal laws and regulations.

38 The excavation size in the Right Of Way within paved roadway, sidewalk, or other improved area and where near to a
39 structure or underground installation or other improvement, must not exceed the maximum neat line width as shown on the
40 Drawings or in the Standard Plans.

41 Outside the Right Of Way and in unimproved areas, the size of the excavation may exceed the excavation size shown on
42 the Drawings or on the Standard Plans by sloping or benching, at the Contractor's option. However, the Contractor is solely
43 responsible for meeting all requirements for excavating, handling and disposing of excavated material, and placing and
44 compacting suitable replacement backfill that is conducted outside of the neat line limits. The cost for the excavation Work in
45 excess of that shown on the Drawings must be at the Contractor's sole expense.

46 Control grading and other activities nearby to prevent surface water from flowing into the excavations.

47 The Contractor must notify the Engineer when an excavation is completed, and Material must not be placed until
48 permission to proceed is provided by the Engineer. The Contractor must bear all costs to remove materials placed before the
49 Engineer's inspection of the subgrade, and all costs to replace backfill following the inspection.

50 **2-04.3(1)A STOCKPILING AND REUSE OF EXCAVATED MATERIAL**

51 If necessary, Material can be stockpiled at locations approved by the Engineer. Thereafter, Material must be removed
52 from stockpile and used when needed. Excavated Material stockpiled for use as selected Materials must be protected from
53 contamination by other materials or damage by weather, and must be prevented from producing sediment by covering with
54 waterproof sheeting or other means as the Contractor deems necessary. Selected materials stockpiled and later found
55 unsuitable by the Engineer must be disposed of and replaced with Material acceptable to the Engineer.

1 Selected Material must be stockpiled at no more than a 1 foot per linear foot slope, with the toe of the stockpile no closer
2 than 2 feet from the edge of any excavation. The material must be protected from becoming unsuitable. Within Seattle City
3 limits, stockpile height must not exceed 10 feet, per current City of Seattle Grading Code.

4 **2-04.3(1)B DISPOSAL OF SURPLUS AND UNSUITABLE MATERIAL**

5 Recycling or disposing of surplus and unsuitable material from other than the excavation must be conducted as specified
6 in Section 1-07.3.

7 Material obtained from all excavations within the Project Site must not be wasted unless the Engineer designates the
8 excavated material unsuitable for use.

9 Reclamation of Contractor-supplied quarry, pit, and borrow sites must conform to the requirements of Section 3-03.

10 **2-04.3(1)C WASTING MATERIAL**

11 If the Contractor wastes excavated material which is deemed suitable by the Engineer for reuse, and Material is later
12 needed, the Contractor must replace the wasted material, at no cost to the Owner, with Material meeting the Engineer's
13 approval.

14 **2-04.3(1)D DEPOSIT OF ROCK FOR OWNER'S USE**

15 At the Engineer's direction, the Contractor must deposit excavated rock at the Project Site or elsewhere. If this requires
16 the Contractor to use Material that would otherwise have been used as backfill on the project, the Owner will pay for the extra
17 cubic yards of excavation needed to complete the backfill. Any such rock deposit will become Owner property. The Contractor
18 is responsible for safe-keeping the deposit until the Owner has removed it or until the Contract Completion Date.

19 **2-04.3(1)E OVERBREAK**

20 Overbreak includes that part of any material excavated, displaced, or loosened outside the staked or reestablished slope
21 or grade. Such material is considered overbreak whether its movement resulted from blasting, from the character of the
22 material itself, or from any other cause. Overbreak does not include material from slides as specified in Section 2-04.3(1)F.

23 If the Engineer does not approve use of the overbreak, the Contractor must remove, haul, and dispose of it, at no
24 expense to the Owner. In this case, the Contractor must comply with the procedure for handling surplus Material specified in
25 Section 2-04.3(1)B.

26 If the Engineer approves, the Contractor may use overbreak as backfill.

27 **2-04.3(1)F SLIDES**

28 If a slide occurs on the Project Site or elsewhere as a result of construction activities, the Contractor must notify the
29 Engineer immediately before removing the slide material, and must protect the area to prevent additional sliding.

30 In the event of a slide, the Contractor must provide a plan to address the area affected, for the Engineer's review.

31 **2-04.3(1)G EXCAVATIONS NEXT TO STREAMS**

32 When excavations are in or adjacent to streams including lakes, Puget Sound, or other waterways, the Contractor must:

- 33 1. Comply with all applicable laws and regulations and regulatory permit requirements.
- 34 2. Comply with the requirements of Section 2-05.
- 35 3. Excavate inside cofferdams, caissons, or sheet piling unless dredging or open pit excavation is permitted.
- 36 4. Not disturb the natural stream bed adjacent to the Structure.
- 37 5. Backfill after foundations are placed inside cofferdams and any open pit or dredged area behind sheet piling. Backfill
38 must be level with the original stream bed and must prevent scouring.
- 39 6. Remove any excavation material deposited in or near the stream, so that the stream bed is free from obstruction.
- 40 7. Maintain water depth and horizontal clearances required for traffic to pass on navigable streams, furnishing any
41 channel signals or lights required during construction.
- 42 8. Place riprap around the outside of cofferdams to repair local scour.

43 **2-04.3(1)H SLUICING**

44 The Contractor must not excavate by sluicing unless the Contract specifies it.

45 **2-04.3(1)I UNSUITABLE FOUNDATION EXCAVATIONS**

46 Where the native subgrade is determined to be unsuitable by the Engineer, and is not already addressed in the Contract,
47 the Engineer will provide direction on how to proceed.

48 All additional excavation directed or specified in the Contract beyond the neat line limits shown on Standard Plans 284,
49 285, and 350, is considered "Extra Excavation."

50 Replacement of unsuitable material to return the area to grade will be specified in the Contract or directed by the
51 Engineer, and is considered "Backfill Compaction" as specified in Section 2-11.

1 Material from the excavations is not classified as Unsuitable Foundation Excavation, as defined by Section 2-04.1(2),
2 unless the removal is accomplished by special excavation methods requiring different equipment from that used for roadway
3 excavation, as determined by the Engineer.

4 **2-04.3(1)J OBJECTS ENCOUNTERED**

5 The Contactor must remove and dispose of stumps, railroad ties, buried pavement, and other objects encountered in the
6 excavation. Removal of these objects is considered incidental unless one or more of the following conditions are met:

- 7 1. The objects cannot be removed by the equipment or excavation method at hand; or
- 8 9. The excavation width or depth must be increased, causing extra work.

9 In the event the Contractor meets one or more of these conditions, removal of the object will be paid as specified in
10 Section 1-04.6.

11 **2-04.3(2) PERMANENT SLOPE TREATMENT**

12 The tops of all permanent excavated slopes, except in solid rock, must be rounded per Standard Plan 140.

13 If a layer of earth covers a rock cut, the slope must be rounded above the rock as if it were an earth slope.

14 When the Contractor removes stumps or any embedded Material from the rounded area, the void must be backfilled and
15 stabilized to prevent erosion.

16 **2-04.3(3) HILLSIDE TERRACES**

17 Unless the Contract specifies otherwise, the Contractor must terrace the original ground or embankment on hillsides, on
18 the sides of existing embankments, and in transitions from cuts to fills. Each terrace must penetrate the slope at least 5 feet
19 and must not be more than 5 feet high. The horizontal face of the terrace must slope outward at approximately 0.05 feet per
20 linear foot. The Engineer may direct the Contractor to place gravel backfill, pipe drains, or both to drain any seepage.

21 **2-04.3(4) SOLID ROCK EXCAVATION**

22 The Contractor must avoid breaking down, loosening, or damaging the rock under the subgrade line. If necessary,
23 conduct excavations from the top, lift by lift, to protect the rock bench that remains. The Contractor is responsible for methods
24 used and for any damage caused to the subgrade, regardless of any previous approvals by the Engineer.

25 **2-04.3(4)A SCALING AND DRESSING**

26 The Contractor must leave rock cuts in a safe, stable condition, by scaling and dressing them and removing all loose
27 fragments and rocks not firmly fastened to the rock slope. The Contractor must also remove any overhanging rock the
28 Engineer designates as hazardous.

29 If the Engineer requires it, the Contractor must remove loose fragments and rocks lying outside the slope stakes,
30 including loading and hauling. See Section 1-04.3 regarding extra work.

31 **2-04.3(4)B STEPPED SLOPE CONSTRUCTION**

32 When shown on the Drawings, the Contractor must shape slopes cut in soft rock to a stepped pattern conforming closely
33 to the typical cross-section shown on the Drawings. Each step must be 1 to 2 feet high. The treads must be approximately
34 level in all directions. The ends of the steps must be blended into the natural ground, with loose Material removed from
35 transitional areas. The steps must be blended into the rock if the Contractor cannot rip a rock outcropping within a cut. Large
36 rocks and Material that may fall into the ditch line or onto the roadway must be removed, but scaling is not required.

37 The horizontal depth of each step depends on its relationship to the staked slope ratio. The approximate midpoint of each
38 horizontal tread must occur on the staked slope line.

39 The compaction for seeding requirements in Section 8-01.3(5)C do not apply to stepped slope construction.

40 **2-04.3(5) STRUCTURE EXCAVATIONS**

41 The Contractor must not start excavating until after the stakes have been placed to locate or outline the structure and
42 cross-sections, to determine how much Material to remove. The Engineer will occasionally inspect material taken from, and
43 material remaining in, the excavation.

44 With written approval of the Engineer, the Contractor may omit forms when the earthen sides of a footing excavation can
45 stand vertically. In this case, the Contractor may excavate to the neat line dimensions of the footing and pour concrete against
46 the undisturbed earth. If the hole is larger than neat line dimensions, the Contractor is responsible for the cost of all extra
47 Material and work.

48 The Engineer may stop the excavation to conduct bearing tests at any time. The Contractor must assist with these tests
49 in any way the Engineer requires.

50 During any test period, the Contractor must, at no expense to the Owner, maintain ordinary working conditions at the
51 bottom of the hole. A single bearing test will not exceed 72 hours.

2-04.3(6) UTILITY EXCAVATIONS

When utility invert or other elevations are shown on the Drawings, the Contractor must excavate to that depth plus any additional excavation necessary to accommodate the Contract-specified class of bedding. When no invert or other elevation is specified in the Contract, the Contractor must excavate to a depth sufficient to provide the minimum cover specified, including additional excavation as necessary for the class of bedding specified in the Contract. When utility elevations are specified in the Contract, any excavation below that needed to install the utility and bedding must be backfilled with Material as specified in Section 2-10, and compacted as specified in Section 2-11.3(1) Method A, at the Contractor's sole expense.

Minimize the length of trench excavation in advance of Water Main installation operations. Trench length must not exceed 150 feet in urban areas.

Minimize the length of Storm Drain and Sewer trench excavation in advance of pipe installation. Trench length must not exceed 150 feet.

The maximum trench width in the Right of Way must not exceed the neat line trench width, as shown on Standard Plans 284, 285, and 350.

The Contractor must provide over excavation for bells, such that pipe barrels and bells along the utility are uniformly supported full-length.

Excavation for valve chambers and other Water Main Structures must be sufficient to provide a minimum of 12 inches between their exterior surfaces and the sides of the excavation.

Remove all ledge rock, boulders, stones, and any object larger than 3 inches in any dimension, within 6 inches in any direction from the pipe.

The maximum size of aggregate within 6 inches of the pipe must not exceed 1 inch per linear foot of pipe diameter and in no case exceed 3 inch.

2-04.3(7) DRAIN PIPE EXCAVATIONS

The clear width of the trench must be 24 inches or 1 foot greater than the outside diameter of the pipe, whichever is greater. Width is measured at the springline of the pipe in place. Standard Plan 284 is not applicable to drain pipe and subsurface drain pipe.

Filter Material must not be mixed with backfill Material.

2-04.3(8) SNOW REMOVAL

The Contractor must remove any snow deep enough to interfere with work that covers a cut or an embankment, to outside the slope stakes. Snow removal must be done at least 100 feet ahead of excavation and embankment work.

2-04.4 MEASUREMENT

Excavation is measured by the cubic yard in its original position by cross-sectioning or through the use of digital terrain-modeling techniques. Quantities will be computed to the neat lines of the cross-sections as staked or thereafter modified by the Engineer, except where such modification is the result of excavating beyond the limits established to remove and replace Material which has become unsuitable because of the Contractor's neglect, negligence, or method of operation.

The vertical neat line limits for measuring a structure excavation will be a vertical plane 1 foot (measured horizontally) outside of and parallel to the neat line of a pile cap, footing, or seal. No measurement as "Structure Excavation" will be made for material removed outside of vertical neat lines of a pile cap, footing, or seal, more than 3 feet beyond the roadway side of a wing wall, and more than 1 foot beyond the other sides and end of a wing wall.

Measurement for unsuitable foundation excavation is measured by the cubic yard in its original position by cross-sectioning.

Measurement for the amount of common excavation is specified in Section 2-04.1(2).

Measurement for extra excavation is by the cubic yard of material actually removed beyond the standard trench neat lines shown on Standard Plans 284, 285, and 350.

Measurement for stepped slope excavation is by the cubic yard as defined by the staked slope line and the existing slope.

2-04.5 PAYMENT

1. "Common Excavation", per cubic yard.
2. "Solid Rock Excavation", per cubic yard.

The Bid Item prices for "Common Excavation" and for "Solid Rock Excavation" include all costs for the work specified in Section 2-04 and not otherwise provided for below. Payment for such types and classes of excavation listed above will be full payment for excavating, loading, hauling, stockpiling, placing as backfill, or disposing of the material as specified here.

Payment for earthwork or for solid rock excavation required by the Contract where a Bid Item is not provided in the Bid Form will be as specified in Section 1-04.1(2).

3. "Unsuitable Foundation Excavation", per cubic yard.

1 The Bid Item price for "Unsuitable Foundation Excavation" includes all costs for the work required to excavate or displace
2 unsuitable foundation material as specified in Section 2-04.3(1)I. These costs include disposal of the unsuitable material, and
3 leveling the upheaved Material outside the excavation when the unsuitable material is displaced. Replacement Materials will
4 be paid for as a separate Bid Item.

5 See Section 1-04.1(2) if the Bid Form does not have a Bid Item for unsuitable foundation excavation.

6 4. **"Structure Excavation"**, per cubic yard

7 The Bid Item price for "Structure Excavation" includes all costs for the work required in Section 2-04.3(5) but not
8 otherwise provided for in this payment Section and which is necessary to complete the excavation within the neat line limits
9 specified. Any additional excavation outside these limits, having been made for the Contractor's benefit, is considered
10 incidental to the various Bid Items comprising this improvement. All costs for preserving and protecting excavated Materials to
11 be used for backfilling structure excavation and all costs for disposal (including haul) of material obtained from structure
12 excavation which is not used for backfill are considered incidental to and included in the Bid Item price for "Structure
13 Excavation".

14 All costs for storing, protecting, handling, and placing stockpiled Material as specified in Section 2-04 must be included in
15 the Bid Item price for "Structure Excavation".

16 5. **"Extra Excavation"**, per cubic yard.

17 The Bid Item price for "Extra Excavation" includes all costs for the work required to remove, haul and dispose of the
18 excavated material.

19 6. **"Stepped Slope Construction"**, per cubic yard.

20 The Bid Item price for "Stepped Slope Construction" includes all costs for the work required to build stepped slopes
21 including disposal of excess material.

22 7. **Other payment information**

23 All costs for excavation, backfill, and compaction of sampling pits and utility trenches are considered included in the Bid
24 Item prices for the various Bid Items and no separate or additional payment will be made.

25 Payment for overbreak Material used instead of borrow will be made at the Bid Item price for the type of borrow specified.

26 If the Contractor has dressed a permanent excavation per Section 2-04.3(4)A before the Engineer orders it widened, the
27 Owner will pay for the resloping as provided in Section 1-09.4.

28 Excavation below grade required to remove a portion of the subgrade made unsuitable by the Contractor's operations or
29 failure to adequately protect the subgrade is at the Contractor's sole expense and at no additional cost to the Owner.

30 If a slide occurs in an open pit as specified in Section 2-04.3(1)F, all costs related to removing slide material and
31 restoring a slide area is at the Contractor's sole expense.

32 All work required to complete slope treatment, including excavation, haul, and slope rounding, must be included in the
33 Bid Item price for roadway excavation.

34 All costs for building terraces as specified in Section 2-04.3(3) must be included in the Bid Item prices for other applicable
35 Bid Items.

36 All costs to remove, haul, and dispose of overbreak material which is deemed unsuitable for use by the Engineer is at the
37 sole expense of the Contractor.

38 When excavated Material unexpectedly falls short of the quantity required to complete an embankment, the Owner will
39 pay the roadway excavation Bid Item price for the volume of Material the overbreak replaces. However, no payment will be
40 made if overbreak is used when other Material is available within the neat lines of the roadway prism.

41 If an undue quantity of excavated Material deemed suitable by the Engineer is wasted by the Contractor, the Contractor
42 must provide replacement material of the type acceptable to the Engineer at the Contractor's sole expense.

43 The cost of any permits and approvals required in this Section will be included in the Bid Item prices for the applicable
44 Bid Items of Work and no separate or additional payment will be made.

45 All costs associated with hauling, storing, and reusing selected Material, except in backfill compaction, are included in the
46 Bid Item prices of the various applicable Bid Items.

47 Payment for reconstruction of surfacing and paving within the limits of structure excavation will be at the applicable Bid
48 Item prices for the Bid Items involved.

49 Whenever excavation is carried below the elevation shown on the Drawings without written approval from the Engineer,
50 all costs for Materials, labor and equipment necessary to bring excavation back to the elevation shown on the Drawings is at
51 the sole expense of the Contractor. Replacement must be made with concrete or other Material acceptable to the Engineer.

52 Snow removal is at the sole expense of the Contractor.

53 All labor and materials the Contractor provides for the bearing tests as specified in Section 2-04.3(5) will be paid as
54 specified in Section 1-04.1(2).

1 SECTION 2-05 DITCH AND CHANNEL CONSTRUCTION**2 2-05.1 DESCRIPTION**

3 Section 2-05 describes constructing and reshaping ditches and channels. This work may also include installation of
 4 geotextile, filter blanket, riprap, streambed aggregate, weir, in-stream log, scour protection, and other construction. This work
 5 also includes disposal of excess and unsuitable material.

6 2-05.1(1) CLASSIFICATIONS

7 Ditch excavation includes all excavation for the flow of surface water less than 8 feet wide at the bottom.

8 Channel excavation includes all excavation for the flow of surface water 8 or more feet wide at the bottom.

9 2-05.2 MATERIALS

10 Materials must comply with the requirements of the following Sections:
 11

| Material | Section |
|---------------------|--------------|
| Streambed Aggregate | 9-03.3 |
| Filter Material | 9-03.10(4) |
| Matting | 9-14.5 |
| In-stream Log | 9-14.15 |
| Geotextile | Section 9-37 |

12 Erosion control, scour control, and ditch lining geotextile are specified in the Contract.

13 The filter blanket must comply with the gradation requirements for the ballast specified in the Contract.

15 2-05.3 CONSTRUCTION REQUIREMENTS**16 2-05.3(1) GENERAL**

17 Work in ditches and channels over 4 feet deep are subject to the safety provisions of Section 2-07.

18 The Contractor must have ESCBMPs in place before any ditch or channel construction, and must have completed
 19 necessary clearing and grubbing as specified in Section 2-01. The Contractor may use excavated material for temporary dikes
 20 and berms as addressed in the CSECP.

21 Ditch and channel excavation, shaping, and construction must produce a finished product complying with the lines,
 22 grades, and shapes as shown on the Drawings, or as established by the Engineer, and must accommodate in-stream
 23 installations as specified in the Contract.

24 2-05.3(2) IN-STREAM LOG

25 In-stream logs of the size and shape specified in the Contract must be placed at the locations shown on the Drawings,
 26 and may require additional excavation and shaping of the ditch or channel. An existing tree identified for re-use as in-stream
 27 log must be cut, pruned, and limbed to the size and shape indicated. The Contractor must provide the Engineer at least 1
 28 Working Day advance notice before removing a tree identified in the Contract for re-use as in-stream log, and before placing
 29 the in-stream log.

30 2-05.3(3) STREAMBED AGGREGATE

31 Streambed aggregate of the type specified in the Contract must be placed at the locations and to the dimensions and
 32 thicknesses shown on the Drawings. Additional excavation and shaping may be required to accommodate stream bed
 33 aggregate.

34 2-05.3(4) GEOTEXTILE – DITCH LINING AND SCOUR CONTROL

35 See Section 2-15.

36 2-05.3(5) SCOUR CONTROL MATTING

37 Scour control matting must be conducted as specified in Section 8-01.3(7).

38 2-05.3(6) IN-STREAM WEIR

39 In-stream weir must be constructed at the location and to the dimensions specified in the Contract. Unless the Contract
 40 specifies otherwise, both wings of the weir must slope gently toward the center section of the weir to allow fish passage over
 41 the weir during low flow. The Contract may require placement of weir rock, ecology block, or other Material, to specified
 42 elevations and contours, and may require excavation for the base and use of a geotextile for scour control.

43 Placement of weir components must provide non-rocking contact. As necessary, spacer rock or other suitable material
 44 must be used to ensure interlocking of weir components; this material must be sized and placed to resist the forces and scour

1 of the design maximum stream flow. Openings within the weir Structure must be plugged securely with shaped rock or other
2 suitable material as necessary to minimize any flow through the weir below the top surface.

3 **2-05.3(7) IN-STREAM BYPASS**

4 To accommodate in-stream construction, the Contractor may be required to install a stream bypass as specified in the
5 Contract. Stream bypass must be coordinated with fish bypass.

6 The Contractor may be required to excavate a trench and install a temporary bypass Culvert to divert the stream around
7 the area of in-stream work. The Culvert must be sized to accommodate the maximum in-stream flow specified in the Contract.
8 The Contractor may need to make use of pumping with adequate capacity to ensure all stream flow is diverted through the
9 bypass. The Contract may require non-pumping alternatives to accommodate the diversion of fish.

10 A temporary dam may be required to divert water into the stream bypass including excavation and shaping to allow for
11 installation of the temporary dam. The dam must have controls in-place for leakage, seepage, scour, and other Project Site-
12 specific needs. The Contractor may need to install an impermeable barrier material, which must be secured in front of and
13 against the dam to ensure no passage of stream flow.

14 Unless the Contract specifies otherwise, when the stream bypass is no longer needed, the Contractor must remove all
15 bypass material, backfill with native material including compaction of backfill, and restore the areas to the finish grades
16 specified in the Contract.

17 Cofferdam or bypass channel requirements will be addressed in the Contract.

18 **2-05.3(8) FISH BYPASS**

19 The Contract will identify all channels, ditches, streams, and other surface flow channels containing fish where
20 construction is required. Fish bypass must be coordinated with stream bypass.

21 The Contractor must first remove fish from the area of proposed work. The Contractor may need to install a fish screen
22 on the upstream end to prevent the migration of fish into the proposed stream work area, and to divert the fish through the
23 stream bypass, returning the fish downstream to the original stream channel. The Contractor may need to have personnel
24 travel from upstream to downstream splashing and using netting to coax fish to relocate downstream. The Contractor may use
25 nets to capture fish in isolated pools and in the area of the downstream silt control, and relocate these fish farther downstream.

26 Straw bales or other means may be required at the downstream end of the proposed stream work area to prevent silt and
27 other sediment from being transported beyond the work area. If the Contract does not specify the means of preventing silt and
28 other material and debris from going beyond the construction area, the Contractor must submit the means to the Engineer at
29 least 5 Working Days in advance of their implementation.

30 The Contractor must frequently monitor the work area for fish and other water creatures to retrieve and relocate them.

31 **2-05.3(9) FISH SCREEN**

32 Fish screens must be furnished and installed as specified in the Contract.

33 **2-05.3(10) MAINTENANCE REQUIRED DURING CONSTRUCTION**

34 In streams with fish, and where stream bypass, fish bypass, screen, or other measures are required, the Contractor must
35 perform maintenance as specified in the Contract.

36 **2-05.3(11) SCOUR PROTECTION**

37 Where the Contract specifies scour protection, the stream bank, stream bedding and invert, and other stream containing
38 features must be protected from erosion by measures that may include groins, buried groins, barbs, engineered log jams, drop
39 structures, and porous weirs. These measures may be permanent or temporary.

40 **2-05.4 MEASUREMENT**

41 Measurement for ditch and channel excavation is by the cubic yard in-place based on neat lines of staked cross-sections
42 as determined by the Engineer. Other local excavation or shaping required to accommodate in-stream log, streambed
43 aggregate, ditch lining and scour control, erosion control matting, in-stream weir, stream bypass, and fish bypass will not be
44 measured and must be included in their respective Bid Items.

45 Measurement for in-stream log and for in-stream weir is per each.

46 Measurement for streambed aggregate and for filter Material is by the ton.

47 Measurement for geotextile and for ditch lining is as specified in Section 2-15.4.

48 Measurement for in-stream bypass and for fish bypass is by lump sum.

49 Measurement for scour control is by component Bid Items in the Standard Specifications.

50 Measurement for scour control matting not part of a CSECP, and used specifically for in-stream scour control is
51 measured as geotextile for ditch lining as specified in Section 2-15.4.

52 Measurement for safety systems in ditches and channels over 4-foot depth, not including Division 7 pipe installation, is by
53 lump sum.

1 **2-05.5 PAYMENT**

2 1. **“Ditch Excavation”**, per cubic yard.

3 2. **“Channel Excavation”**, per cubic yard.

4 The Bid Item prices for “Ditch Excavation” and for “Channel Excavation” include all costs for the work required for
5 excavation, shaping, loading, placing, stockpiling, and disposing for the applicable excavation.

6 3. **“Safety Systems in Ditch and Channel Excavation”**, per lump sum.

7 The Bid Item price for “Safety Systems in Ditch and Channel Excavation” includes all costs for the work required to
8 provide safety systems for ditch and channel excavation over 4 feet in depth. See Division 7 for payment of trench safety
9 systems where ditch and channel work requires pipe and related Structure work.

10 4. **“In-Stream Log (Number)”**, per each.

11 The Bid Item price for “In-Stream Log (Number)” includes all costs for the work required to furnish, to fell, and to cut, limb,
12 and prune; to shape the area to receive the in-stream log; to place and anchor the log; and to remove and dispose of debris
13 and material for each in-stream log as may be necessary.

14 5. **“Streambed Aggregate, (Type)”**, per ton.

15 The Bid Item price for “Streambed Aggregate (Type)” includes all costs for the work required to furnish and install the
16 type streambed aggregate specified in the Contract including excavating, shaping, and disposal of debris.

17 6. **“In-Stream Weir, (Type), (Number)”**, per each.

18 The Bid Item price for “In-Stream Weir” includes all costs for the work required to furnish and install a complete in-stream
19 weir per the Drawings.

20 7. **“In-Stream Bypass”**, per lump sum.

21 The Bid Item price for “In-Stream Bypass” includes all costs for the work required to furnish, install, maintain, and remove
22 a complete bypass including any necessary restoration work.

23 8. **“Fish Bypass”**, per lump sum.

24 The Bid Item price for “Fish Bypass” includes all costs for the work required to divert and relocate all fish around the work
25 area and to monitor the work area for fish and other water creatures.

26 9. **Other payment information**

27 Filter Material will be paid as “Mineral Aggregate, (Type)” as specified in Section 4-01.5.

28 Unless the Contract specifies otherwise, payment for restorations beyond temporary constructions to accommodate in-
29 stream work are considered incidental to the various Bid Items and no separate or additional payment will be made.

30 Payment for geotextile of the type specified will be as specified in Section 2-15.5.

31 No separate or additional payment will be made for additional excavation and shaping to accommodate in-stream log,
32 streambed aggregate, ditch lining and scour control, erosion control matting, in-stream weir, in-stream bypass, and fish
33 bypass.

34 **SECTION 2-06 HAUL**

35 **2-06.1 DESCRIPTION**

36 Section 2-06 describes transporting excavated Material from its original site or borrow site to its designated location on
37 the Project Site or to a waste or recycle site.

38 **2-06.2 RESERVED**

39 **2-06.3 CONSTRUCTION REQUIREMENTS**

40 Off-highway earthmoving equipment must not haul on or across any street not being improved in the Contract.

41 **2-06.4 MEASUREMENT**

42 Haul work will not be measured.

43 **2-06.5 PAYMENT**

44 Payment for the cost necessary to complete the work specified in Section 2-06 is considered incidental to the various Bid
45 Items comprising the Work and no separate or additional payment will be made.

46 **SECTION 2-07 PROTECTIVE SYSTEMS**

47 **2-07.1 DESCRIPTION**

48 Section 2-07 describes sloping or shoring an excavation to protect workers and the public from injury, and nearby
49 infrastructure from damage, as a result of the excavation.

1 **2-07.2 RESERVED**

2 **2-07.3 CONSTRUCTION REQUIREMENTS**

3 **2-07.3(1) GENERAL**

4 Where excavations are deeper than 4 feet, the Contractor must construct and maintain safety systems that comply with
5 the requirements of the Washington Industrial Safety and Health Act (RCW Chapter 49.17), including compliance with WAC
6 Chapter 296-155.

7 Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional
8 engineer, see Section 1-05.3(12).

9 Sloping or benching as a means of stabilizing excavations is not permitted within paved roadway, sidewalk, or other
10 improved areas.

11 In unimproved areas, the size of the excavation may, at the Contractor's option, exceed the excavation size shown on
12 the Drawings or on the Standard Plans by sloping or benching. However, the Contractor is solely responsible for meeting all
13 requirements for excavating, handling, and disposing of excavated material, as well as placing and compacting suitable
14 replacement backfill that is conducted outside of the neat line limits at the Contractor's expense.

15 **2-07.3(2) SAFETY SYSTEMS**

16 The Contractor's safety system must be designed and maintained by a competent person and must comply with
17 accepted engineering requirements or practices. This safety system may require the use of a support system even in locations
18 not designated in the Contract as requiring a support system.

19 The safety system must provide safe working conditions in the excavation. The Contractor may use a shield system for
20 trenches. All Work required by the Engineer outside neat line limits, including: handling and disposal of excavated material;
21 additional backfill beyond neat line limits; or additional surface restoration beyond limits specified in the Contract; as well as
22 repair of damage to adjacent structure, improvement, or underground installation caused by the Contractor's operations, will
23 be at the Contractor's sole expense and at no additional or separate cost to the Owner. Neat line limits for trenches are shown
24 on Standard Plans 284 and 350. For structural excavation neat line limits see Section 2-04.4.

25 The Contractor must prevent water from entering an excavation per Section 2-08.3(1).

26 When the work in the excavation is complete, the protective system must be removed from the trench or structural
27 excavation using a method that allows reconsolidation of the bedding, backfill, or side support Material without disturbance to
28 Structures or utilities.

29 The use of horizontal strutting below a pipe barrel or the use of a pipe as support for trench bracing is not permitted.

30 **2-07.3(3) SUPPORT AND SAFETY SYSTEMS**

31 In addition to worker safety specifications in Section 2-07.3(2): where trench or structural excavations are to be laterally
32 supported as specified in the Contract at locations shown on the Drawings, the lateral support system must be as specified in
33 WAC 296-155-650. Trench boxes do not meet the requirements of a support system. Support systems may consist of
34 underpinning, bracing, shoring, sheeting, or any other protective system, or combination of protective systems, which provides
35 support to an adjacent structure, underground installation, and the sides of an excavation. The support system must also
36 include the control of groundwater as specified in Section 2-08. The Contractor must use methods of installing, maintaining,
37 and removing the system that cause the least disturbance as determined by the Contractor and approved by the Engineer.
38 Both during and after system installation, the Contractor must fill all voids behind the support system as necessary to prevent
39 loss of native soils or loss of soil support. When removing the support system, the Contractor must coordinate reconsolidation
40 of bedding as necessary with backfilling to minimize disturbance.

41 All costs for this work will be paid by the Bid Item "Support and Safety System."

42 The Contractor must submit Shop Drawings per Section 1-05.3 and design calculations per Section 1-05.3(12) of the
43 proposed support system, including loading calculations, structural member and system calculations, and sufficient details of
44 installation, maintenance, and removal concurrent with excavation, installation, removal, and backfilling. Calculations must
45 also address adjacent structures and/or underground installations and construction related loads imposed on the support and
46 safety system.

47 The Contractor must not disturb bedding or backfill when removing any protective system. Where bedding or backfill is
48 disturbed, the Contractor must recompact the material as specified.

49 The Contractor must submit for acceptance by the Engineer Shop Drawings prepared by a professional engineer as
50 specified in Section 1-05.3 showing proposed methods and construction details of shoring or cofferdams. The Contractor must
51 not start construction until the submittal has been returned by the Engineer. The Contractor is responsible for acceptable
52 results. Calculations supporting the shoring or cofferdam design must be submitted with the Shop Drawings. The Shop
53 Drawings must contain details such as member sizes, plate thickness, weld details, and bolted connections, and must be per
54 AASHTO Specifications.

55 **2-07.4 MEASUREMENT**

56 Measurement for "Safety Systems in Trench Excavation" is by the square foot. The square foot quantity equals the area
57 of a vertical plane through the pipe centerline, calculated by multiplying the average of the trench end depths by the length of

1 trench between points 4 or more feet deep. Depth is measured from existing surface grade at the time of excavation to pipe
2 invert.

3 Measurement for "Support and Safety System" is by the square foot. The square foot quantity equals the area of a
4 vertical plane through the pipe centerline, calculated by multiplying the average of the trench end depths by the length of
5 trench. Depth is measured from existing surface grade at the time of excavation to pipe invert. No measurement will be made
6 for support and safety system beyond designated locations shown on the Drawings.

7 Measurement for "Safety Systems in Structural Excavation" is per lump sum.

8 No measurement will be made for "Extra Excavation" associated with installing and removing protective systems beyond
9 the neat lines as shown on Standard Plans 284 and 350, or as shown on the Drawings.

10 **2-07.5 PAYMENT**

11 1. **"Safety Systems in Trench Excavation"**, Minimum Bid = \$0.80 per Square Foot.

12 The Bid Item price for "Safety Systems in Trench Excavation", includes all costs for the work required to provide,
13 construct, maintain and remove safety systems in trench excavations equal to or exceeding a depth of 4 feet as specified in
14 Section 2-07; and all costs for excavation, backfill and compaction beyond the neat lines as shown on Standard Plans 284,
15 350 or as shown on the Drawings.

16 No additional payment for "Extra Excavation" as specified in Section 2-04 will be allowed for Work specified in Section 2-
17 07 Protective Systems.

18 The minimum Bid Item price for "Safety Systems in Trench Excavation", will be \$0.80 per square foot. The Contractor's
19 Bid must equal or exceed that amount. If the Contractor's Bid is less than the minimum specified amount, the Owner will
20 unilaterally change the Bid amount to the minimum specified amount and recalculate the Contractor's total Bid amount. The
21 corrected total Bid amount will be used by the Owner for Award purposes and to fix the amount of the Payment and
22 Performance Bond.

23 2. **"Support and Safety System"**, per square foot.

24 The Bid Item price for "Support and Safety System" includes all costs for the work required to design, provide construct,
25 maintain, and remove the support and safety system at the designated locations on the Drawings as specified in Section 2-07;
26 and all costs for excavation, backfill and compaction beyond the neat lines as shown on Standard Plans 284 and 350.

27 No additional payment for "Extra Excavation" as specified in Section 2-04 will be allowed for Work specified in Section 2-
28 07 Protective Systems.

29 There will be no separate or additional payment for "Support & Safety System" outside of the locations specified on the
30 Drawings. No payment for "Safety Systems in Trench Excavation" will be made for locations where payment is made for
31 "Support and Safety System.

32 3. **"Safety Systems in Structural Excavation"**, per lump sum.

33 The Bid Item price for "Safety Systems in Structural Excavations" includes all costs for the work required to design,
34 provide, construct, maintain and remove the safety system in the structural excavation at the designated locations shown on
35 the Drawings as specified in Section 2-07 and all costs for excavation, backfill and compaction beyond the neat lines as
36 specified in Section 2-04.

37 There will be no separate or additional payment for "Safety Systems in Structural Excavation" outside of the locations
38 specified on the Drawings. No payment for "Safety Systems in Trench Excavation" will be made for locations where payment is
39 made for "Safety Systems in Structural Excavation."

40 **SECTION 2-08 DEWATERING**

41 **2-08.1 DESCRIPTION**

42 Section 2-08 describes maintaining a dry excavation by diverting or removing both groundwater and surface water.

43 **2-08.2 RESERVED**

44 **2-08.3 CONSTRUCTION REQUIREMENTS**

45 **2-08.3(1) GENERAL REQUIREMENTS FOR DEWATERING**

46 Excavations must be kept free of water. The Contractor must control surface run-off and groundwater so as to prevent
47 entry or collection of water in excavations and to maintain the undisturbed state of the native subgrade.

48 The Contractor must submit the method and installation of the dewatering system to the Engineer at least 10 Working
49 Days before dewatering starts. This submittal must include details and indicate the number and type of equipment and
50 pipelines, including capacity, dewatering pits and locations, water discharge locations, an estimate of advance time to dewater
51 the excavation before work in the excavation when necessary, and any other information necessary to verify acceptable
52 control and performance.

53 The Contractor must furnish, install, and operate all necessary equipment to keep excavations free from water during
54 construction. The control of groundwater must prevent softening of the bottom of excavations, or formations of soil boiling,
55 quick sand or soil, and heaving soil conditions. Dewatering systems must be designed and operated so as to prevent any

1 removal or flowing of native soils. In the event the native subgrade is compromised as a result of the Contractor's dewatering
2 methods, the Contractor is fully responsible for restoring the integrity of the subgrade to preexisting conditions.

3 Disposal of the water must not cause injury to public or private property, or nuisance to the public. Sufficient pumping and
4 power equipment in good working condition must be available at all times for all emergencies, including power outage.
5 Competent personnel must be available at all times for the operation of the dewatering system. Water discharge locations
6 must comply with required permits from the City of Seattle and/or King County, other local jurisdictions, state and federal
7 agencies as appropriate, and be conducted per Section 8-01.

8 The dewatering system must be designed to prevent loss of foundation support to adjacent structure, underground
9 installation, improvement, or the sides of an excavation, and may require recharging the groundwater outside the excavation.

10 The dewatering system must be installed and operated so that the groundwater level outside the excavation is not drawn
11 down to an extent that would damage or endanger adjacent Structure, underground installation, sidewalk, pavement, other
12 improvement, or property.

13 The release of groundwater to its static level must be performed in a way that maintains the undisturbed state of the
14 natural foundation soils and supported soils, prevents disturbance of compacted bedding and backfill, and prevents flotation or
15 movement of Structures, pipelines, Sewers, and Storm Drains.

16 All costs associated with dewatering the excavation and controlling groundwater must be included in the various Bid
17 Items, provided the groundwater can be controlled using dewatering equipment from within the excavation. No separate or
18 additional payment will be made unless the Contract specifies otherwise.

19 The Contractor is fully responsible for controlling groundwater.

20 **2-08.3(2) COFFERDAMS**

21 The Contractor may elect to use cofferdams as a means of groundwater cut off instead of dewatering the excavation.

22 Cofferdams are classified as any water tight enclosure that surrounds the excavated area, used in conjunction with a
23 concrete footing seal. Within the protection of the cofferdam, the excavation is carried to the desired level and the concrete
24 seal is poured, then the enclosure is dewatered.

25 If the Contract requires a cofferdam and the Engineer determines that seals are not required due to water conditions at
26 the time of construction, the Engineer may specify that seals be omitted.

27 Excavation outside the cofferdam must not continue below the elevation of the top of the seal, or if no seal is used, below
28 the top of the footing. The Contractor must anchor or otherwise hold the cofferdam in place and secure it against tipping or
29 displacement.

30 Cofferdams must be constructed to protect newly placed concrete against damage from sudden rising of the water and to
31 prevent damage to the foundation by scour, erosion, or uplift. Do not leave any timber or bracing that extends into the
32 substructure in the cofferdams.

33 The Contractor must submit Shop Drawings, prepared by a professional engineer per Section 1-05.3, showing proposed
34 methods and construction details of cofferdams. The Contractor must not start construction until the submittal has been
35 returned by the Engineer. The Contractor is responsible for acceptable results. Calculations supporting the shoring or
36 cofferdam design must be submitted with the Shop Drawings. The Shop Drawings must contain details such as member sizes,
37 plate thickness, weld details, and bolted connections, and must be per AASHTO Specifications.

38 **2-08.3(3) PLACING CONCRETE IN FOUNDATION SEALS**

39 If the Drawings require a concrete seal, the Contractor must place the concrete underwater inside a water tight
40 cofferdam, tube, or caisson. Place seal concrete in a compact mass in still water and keep it undisturbed and in still water until
41 fully set. While seal concrete is being deposited, the water elevation inside and outside the cofferdam must remain equal to
42 prevent any flow through the seal in either direction. Vent the cofferdam at the vent elevation shown on the Drawings. The
43 thickness of the seal is based on this vent elevation.

44 The seal must be at least 18 inches thick unless the Drawings show otherwise.

45 To place seal concrete underwater, the Contractor must use a concrete pump or tremie. The tremie must have a hopper
46 at the top that empties into a water tight tube at least 10 inches in diameter. The discharge end of the tube on the tremie or
47 concrete pump must include a device to seal out water while the tube is first filled with concrete. Tube supports must allow the
48 discharge end to move freely across the entire Work area and to drop rapidly to slow or stop the flow. 1 tremie may be used to
49 concrete an area up to 18 feet per side. Use 1 additional tremie for each additional area of this size.

50 Throughout the underwater concrete placement operation, the discharge end of the tube must remain submerged in the
51 concrete, and the tube must always contain enough concrete to prevent water from entering. The concrete placement must be
52 continuous until the Work is completed, resulting in a seamless, uniform seal. If the concreting operation is interrupted, the
53 Engineer may require the Contractor to prove that the seal contains no voids or horizontal joints, by core drilling or other tests.
54 If testing reveals voids or joints, the Contractor must repair them or replace the seal at no expense to the Owner.

55 Cement Concrete, Type 4000W must be used for seals, and must comply with Section 6-02.3(4)C.

1 2-08.3(4) DEWATERING CONCRETE SEALS AND FOUNDATIONS

2 After a concrete seal is constructed, the Contractor must pump the water out of the cofferdam and place the rest of the
3 concrete in the dry. This pumping must not start until the seal has set enough to withstand the hydrostatic pressure (3 days for
4 gravity seals and 10 days for seals containing piling or shafts). The Engineer may extend these waiting periods to ensure
5 structural safety, or to comply with a condition of the operating permit.

6 If weighted cribs are used to resist hydrostatic pressure at the bottom of the seal, the Contractor must anchor them to the
7 foundation seal. Any method used, such as dowels or keys, must transfer the entire weight of the crib to the seal.

8 No pumping is allowed during or for 24 hours after concrete placement, unless done from a suitable sump separated
9 from the concrete Work by a water tight wall. Pumping must be done in a way that prevents any concrete being carried away.

10 2-08.4 MEASUREMENT

11 When used in the seals of underwater cofferdams, concrete will be measured by the cubic yard, on the basis of the
12 actual volume deposited as determined by the average cross-sectional area of the inside of the cofferdam. No measurement
13 will be made for the volume so determined outside of an area bounded by vertical planes 1 foot outside of the neat lines of the
14 seal. The limiting vertical planes must be parallel to the location of the neat lines, based on the traverse and longitudinal
15 centerlines of the seal as shown on the Drawings.

16 2-08.5 PAYMENT**17 1. "Cofferdam", per lump sum.**

18 The Bid Item price for "Cofferdam" includes all costs for the work required to furnish, install, maintain, and remove the
19 cofferdam including dewatering.

20 2. Other Payment Information

21 Concrete that is placed in water for foundation seals, and that on testing as required by the Engineer reveals voids or
22 joint(s), must be repaired or replaced by the Contractor at no additional cost to the Owner.

23 All costs associated with dewatering the excavation and controlling groundwater are included in the various Bid Items
24 provided the groundwater can be controlled using dewatering equipment from within the excavation. Therefore, no separate or
25 additional payment will be made unless the Contract specifies otherwise.

26 SECTION 2-09 SUBGRADE PREPARATION AND PROTECTION**27 2-09.1 DESCRIPTION**

28 Section 2-09 describes preparation and protection of the subgrade for pavements, Structures and utilities. All subgrade
29 preparation Work must be conducted as specified in the Contract and in close conformity with the lines, grades, and typical
30 cross-sections shown on the Standard Plans, Drawings, or as established by the Engineer.

31 Subgrade preparation for sidewalk must be conducted as specified in Section 8-14.3(2). All removal operations included
32 in this Section within the dripline of existing trees to be protected must be conducted as specified in Section 1-07.16(2).

33 2-09.2 RESERVED**34 2-09.3 CONSTRUCTION REQUIREMENTS****35 2-09.3(1) GENERAL**

36 The Contractor must notify the Engineer on completing any excavation. No material may be placed until the Engineer has
37 accepted the prepared subgrade.

38 Once exposed, the Contractor must protect the subgrade from adverse weather, the Contractor's operations, and traffic.
39 The Contractor is responsible for all costs of subgrade protection, and any other costs resulting from insufficient protection,
40 such as soft spot repair, over excavation, material replacement, and compaction.

41 The Contractor must maintain the subgrade by blading and compacting as frequently as necessary. All cuts, ruts, and
42 breaks in the subgrade surface must be repaired as acceptable to the Engineer, before placing any Materials.

43 Subgrade protection measures may include, but are not limited to, the use of plastic polyethylene sheeting to protect the
44 subgrade from inclement weather, planking to protect the subgrade from the Contractor's equipment, and placing paving
45 Materials or base Materials from an adjacent area of work instead of operating equipment over the prepared subgrade.

46 Hauling over the finished subgrade is limited to that essential for construction purposes. Equipment used for transporting
47 Materials over the prepared subgrade must be equipped with pneumatic tires. Equipment used for hauling over the prepared
48 subgrade which, in the opinion of the Engineer, causes undue damage to the subgrade or to the underlying Materials must be
49 removed from the Work on request of the Engineer. If approved by the Engineer, the Contractor may plank the subgrade
50 before hauling Materials or operating equipment over it.

51 During extended periods of seasonal inclement weather in which the Engineer deems it impractical or infeasible to
52 protect the prepared subgrade with plastic sheeting or planking, and where the Contractor is required to operate equipment
53 over the prepared subgrade, the Engineer may direct the use of a ballast Material to stabilize and protect the subgrade. The

1 ballast must be either Mineral Aggregate Type 2 or Type 14, whichever the Engineer assigns. Ballast can be used for
2 subgrade stabilization only when designated by the Engineer.

3 **2-09.3(2) SUBGRADE FOR ROADWAY SURFACING**

4 In preparing the roadbed for surfacing, the Contractor must:

- 5 1. Remove all brush, weeds, vegetation, grass and other debris from the roadbed immediately before placing surfacing
6 Material
- 7 2. Dispose of all debris.
- 8 3. Drain water from all low spots or ruts.
- 9 4. Shape the entire subgrade to a uniform surface running true to the line, grade, and cross-section per the Contract or
10 as established by the Engineer.
- 11 5. Process the subgrade in cut areas to remove materials too coarse for mechanical trimming and compaction, if
12 necessary.
- 13 6. Compact the subgrade to a depth of 6 inches. Compaction must achieve 95 percent of maximum density determined
14 by tests specified in Section 2-11. All portions of the surface on the subgrade that are inaccessible to large compactor
15 units must be thoroughly compacted with smaller compactor units or mechanical tampers.
- 16 7. Remove excess Material that does not drift to low spots during blading and shaping. The Contractor must dispose of
17 this excess by placing it where the subgrade lacks Material or by wasting it.
- 18 8. Add Materials where necessary to bring the subgrade up to grade. The Contractor must water and compact these
19 added Materials as needed to produce a true finished subgrade.
- 20 9. Complete all underground work in the area of the subgrade, including properly backfilling and compacting, before
21 subgrade work is started. This includes any work performed by the Owner or others.
- 22 10. Stabilize the subgrade, as directed by the Engineer, if the underlying subgrade is soft, spongy, or yielding and does
23 not allow proper compaction.
- 24 11. Set stakes anywhere normal crown sections are being constructed. Stakes must be set at convenient offsets at
25 intervals not to exceed 50 feet and at closer intervals where necessary, such as at street and alley intersections. The
26 Contractor is responsible for setting any centerline grades that may be needed.
- 27 12. Keep the full width of the roadway well sprinkled with water before and during the process of rolling the subgrade.
- 28 13. Secure grade and line from the reference stakes, throughout the stages of constructing the subgrade. The subgrade
29 must be maintained in the finished condition until the first course of surfacing is placed on it.

30 If the Contract requires trimming equipment, the equipment must maintain the grade and transverse slopes automatically
31 through sensors that respond to reference lines on both edges of each roadway, and create a smooth, uniform surface free
32 from chatter and ripples. Equipment is subject to the Engineer's approval.

33 **2-09.3(3) SUBGRADE FOR PAVEMENT**

34 When Drawings call for concrete pavement to be placed directly on the subgrade, the Contractor must prepare the
35 subgrade as outlined in Section 2-09.3(2). This work includes:

- 36 1. Removing subgrade for increased thickness of pavement, for pavement headers, and for increased thickness at
37 pavement edges. This may be done just before the concrete is placed.
- 38 2. Scarifying old gravel or macadam, where pavement is to be constructed over an old subgrade composed of gravel
39 and macadam. The Contractor must uniformly spread and thoroughly compact the Material.
- 40 3. Compacting the subgrade, which must extend to at least 1 foot beyond the pavement edge or to a width that
41 accommodates the paving machine without visible distortion of the subgrade. The subgrade must be compacted both
42 before and after the forms are set.

43 Thoroughly wetting the subgrade with water from 12 to 48 hours before the concrete is to be placed, and maintaining this wet
44 condition until the concrete is placed.

45 **2-09.3(4) SUBGRADE IN ROCK**

46 When the Contractor encounters rock or other hard Material at the subgrade elevation of roadways and utilities, it must
47 be excavated the full width of the roadbed or to at least 6 inches below subgrade, then backfilled with rock fragments, gravel,
48 or other free-draining Material not more than 4 inches in diameter.

49 If the Contractor uses a subgrade trimmer, the backfill must be rock, gravel, or other free-draining Material not more than
50 2 inches in diameter. The Contractor must save the finer granular Material from excavations or borrow pits to use in backfilling
51 the top 6 inches of the subgrade. All Material must be approved by the Engineer.

52 When a structure foundation will rest on rock, the Contractor must cut the bottom of the excavation to a firm surface,
53 level, stepped, or serrated as specified in the Contract, and remove all loose Material.

1 2-09.3(5) SUBGRADE FOR STRUCTURE

2 For an arch abutment, the back face must be trimmed to true lines so that concrete can be poured against undisturbed
3 material.

4 If concrete will rest on any excavated surface except solid rock, the Contractor must not disturb the bottom of the
5 excavation. The Contractor must also remove all loose or soft Material before pouring the concrete.

6 2-09.4 MEASUREMENT

7 No measurement will be made for the Work required by Section 2-09.

8 2-09.5 PAYMENT

9 Unless otherwise specified in the Contract, all costs for the subgrade preparation will be included in the Bid Item prices
10 Bid for the various Bid Items included in the Contract.

11 Mineral Aggregate backfill of the Type directed by the Engineer used instead of native material will be paid as "Mineral
12 Aggregate, (Type)" as specified in Section 4-01.

13 SECTION 2-10 BACKFILLING**14 2-10.1 DESCRIPTION**

15 Section 2-10 describes backfilling or filling for pavements, Structures and utilities. All backfilling work must be conducted
16 as specified in the Contract and in close conformity with the lines, grades, and typical cross-sections shown on the Drawings,
17 in the Standard Plans, or as established by the Engineer.

18 2-10.2 MATERIALS

19 Mineral Aggregate (Type) must comply with the requirements of Section 9-03.

20 2-10.2(1) SELECTED MATERIAL

21 Selected Material is Material designated by the Engineer as suitable for fill applications. Selected Material is obtained
22 from the excavations on the Project Site and must be used first before importing new borrow Material.

23 Excavated Material is considered suitable for general fill applications that do not require a Material meeting specific
24 Mineral Aggregate Type Specifications, as found in Section 9-03. Selected Material must still be capable of attaining the
25 degree of compaction specified in Section 2-11, must be within ± 3 percent of optimum moisture content, as determined per
26 ASTM D 1557, and must be free from deleterious Material. Selected Material must not contain more than 5 percent total, by
27 volume, organic Material, clay, frozen lumps, rocks, concrete, asphalt, or other debris and rubble having a dimension greater
28 than 6 inches.

29 Selected Material can be used for any of the following purposes as determined by the Engineer: embankment
30 construction; instead of Mineral Aggregate (Type), meeting the requirements of Section 9-03; trench backfill; planting soil,
31 complying with Section 8-02.3(2); and other approved uses.

32 Excavated material in excess of the needs of the project must be recycled or disposed of as specified in Section 1-07.3.

33 Selected Material must be placed and compacted per the requirements for the type of work for which the Material is
34 being used.

35 Unless the Contract specifies otherwise, the Engineer may identify any Material excavated within the Project Site as
36 Selected Material. Where the Contract specifies Material excavated from the Project Site to be labeled as Reused Amended
37 Site Soil, Section 8-02.3(2)C applies.

38 2-10.2(2) BORROW

39 Borrow is imported Material obtained from sources except the Project Site. When suitable native excavated Material is
40 insufficient, borrow can be used to the neat lines shown on the Drawings.

41 Borrow is classified as "Unclassified Borrow" or "Borrow (Type)" as follows:

42 Unclassified Borrow is imported soil that meets the suitability requirements in Section 2-10.2(1)

43 Borrow (Type) is imported soil that meets the suitability requirements in Section 2-10.2(1), and meets all gradation and
44 other requirements in Section 9-03 for the Mineral Aggregate Type specified (e.g. "Borrow, Mineral Aggregate Type 17).

45 2-10.2(2)A BORROW SITES

46 Sources of borrow Material, the selection of borrow sites and their operation, and the borrow Material itself are subject to
47 the approval of the Engineer. The Contractor must not use a borrow site until obtaining the proper grading permits and
48 property owner agreements, and submitting copies to the Engineer. Utilization of a borrow site without a legal grading permit, a
49 Consent Agreement from the property owner, and approval of the Engineer, is considered unauthorized.

50 Borrow sites located within the City limits of Seattle must be per Seattle Municipal Code, Chapter 22.170 and require
51 a grading permit issued to the property owner by the director of the Seattle Department of Construction and Inspections.

Borrow sites located outside the City limits of Seattle but within unincorporated King County must comply with the specifications of King County Code, Title 16 Building and Construction Standard. Borrow sites may also be subject to rules and regulations of a local governmental authority if located within its jurisdiction.

2-10.2(3) CONTROLLED DENSITY FILL

When specified in the Contract or when approved by the Engineer, the Contractor must supply controlled density fill (CDF) as backfill Material. The Engineer may also require the Contractor to use CDF.

2-10.2(3)A CONTROLLED DENSITY FILL (CDF)

For filling pipe and for filling the annular space between 2 pipes, see Section 9-05.15.
CDF Materials must comply with the requirements of the following sections:

| CDF Application | Section |
|--|--------------|
| Portland and Hydraulic Cement | Section 9-01 |
| Aggregates for Portland Cement Concrete | 9-03.1 |
| Curing Materials and Admixtures | Section 9-23 |
| Fly Ash | 9-23.6 |
| Ground Granulated Blast Furnace Slag (GGBFS) | 9-23.7 |
| Water | Section 9-25 |

The volume of water and fine aggregate for CDF may be adjusted as required to provide the desired workability within the specified limits. The specific gravity of mixing water must not exceed 1.03.

2-10.2(3)A1 CONTROLLED DENSITY FILL FOR PIPE BEDDING

For pipe bedding, the following CDF mix design must be used:

| CDF Mix Design | Quantity/Cubic Yard |
|--|---------------------|
| Portland Cement Type I II | 94 lbs |
| Fly Ash Cl. F; or Fly Ash Cl. C | 2.2 cf 1.1 cf |
| Mineral Aggregate Type 7 w/ Cl. F Fly Ash Mineral Aggregate Type 7 w/ Cl. C Fly Ash | 16.8 cf 17.9 cf |
| Water | 4.8 cf |
| Air Entrainment | 2.7 cf |

Slump must not exceed 7 inches.

2-10.2(3)A2 CONTROLLED DENSITY FILL FOR TRENCH BACKFILL

For trench backfill, the following CDF mix design must be used:

| CDF Mix Design | Quantity/Cubic Yard |
|--|------------------------------------|
| Portland Cement Type I II | 30 pounds |
| Fly Ash Cl. F; or Fly Ash Cl. C | 2.2 cubic feet 1.1 cubic feet |
| Mineral Aggregate Type 7 w/ Cl. F Fly Ash Mineral Aggregate Type 7 w/ Cl. C Fly Ash | 17.1 cubic feet 18.2 cubic feet |
| Water | 4.8 cubic feet |
| Air Entrainment | 2.7 cubic feet |

Slump must not exceed 7 inches.

The Contractor may propose an alternate CDF formulation and must make a submittal on the alternate formulation as specified in Section 1-05.3(5). This submittal must include the following information:

1. Reason for alternate formulation and impact on application;
2. Mix design components and component quantities for a 1 cubic yard batch;
3. Strength data at 24 hours, 7 days, and 28 days. The strength at 24 hours must not be less than 15 psi when tested per ASTM D 4832. The strength at 28 days must not be less than 50 psi, with a maximum 100 psi when tested per ASTM D 4832.

In addition, the slump must not exceed 7 inches, and the mixture must not produce excessive bleed water.

An exception to one or more of these requirements may be allowed if the reason provided in item 1 confirms that no harm will result from the use of the alternate CDF mix formulation. Use of alternate CDF formulation is not allowed unless the Engineer provides written acceptance of the alternate formulation submittal.

2-10.2(3)A3 CONTROLLED DENSITY FILL FOR STRUCTURE BACKFILL

For structural backfill, the following CDF mix design must be used:

| CDF Mix Design | Quantity/Cubic Yard |
|------------------------------------|--|
| Portland Cement Type I II | 50 pounds |
| Fly Ash Cl. F; or Fly Ash Cl. C | 2.2 cubic feet 1.1 cubic feet |
| Mineral Aggregate Type 6 or Type 7 | 17.2 cubic feet w/ fly ash class F, or 18.1 cubic feet w/ fly ash class C |
| Water | 4.8 cubic feet |
| Air Entrainment | 2.7 cubic feet |

2-10.2(3)A4 CONTROLLED DENSITY FILL MANUFACTURER'S CERTIFICATE OF COMPLIANCE

For all CDF materials, the producer must provide a manufacturer's certificate of compliance for each truckload of controlled density fill. The manufacturer's certificate of compliance must verify the delivered Material is in compliance with the mix design and must include the following:

1. Contract number
2. Date
3. Truck number
4. Batched weights of each ingredient
5. Signature of the Supplier affirming the accuracy of the information provided

2-10.3 CONSTRUCTION REQUIREMENTS

2-10.3(1) GENERAL REQUIREMENTS

During all phases of the backfilling operations and testing as outlined here, the Contractor must protect infrastructure, provide for the maintenance of traffic as may be necessary, and provide for the safety of property and people.

If water is present and prevents the Contractor from properly placing and compacting backfill as determined by the Engineer, it must be removed as specified in Section 2-08.

Excavations must be backfilled as soon as possible. Backfill must not be placed against any new concrete Structure until the concrete has attained 90 percent of its design strength and has cured for at least 14 Days. However, the Contractor may backfill footings and columns as soon as forms have been removed, so long as the backfill is brought up evenly on all sides.

Before backfilling, all form lumber and debris must be removed. The protective system used by the Contractor must be systematically removed to allow for acceptable backfilling.

Where it is required to place a blanket of selected Material or bank run gravel on top of the native backfill, the backfill must be placed to the elevation shown on the Drawings, and must be leveled to provide a uniform thickness of the selected Material. Compaction is required and must be performed before placing the selected Material.

Backfill must be compacted as specified in Section 2-11.

2-10.3(2) FILLING ABANDONED STRUCTURES

Structures, valve chambers, catch basins, and maintenance holes must be filled with Mineral Aggregate Type 9 or Type 17, crushed concrete, or another selected Material approved by the Engineer, and compacted as specified in Section 2-11.

2-10.3(3) UTILITY BACKFILL

When backfilling, the Contractor must take all necessary precautions to protect the pipe from any damage or shifting.

1 Utility backfill must not be placed until all Material capable of damaging the pipe or its coating or its electrolysis
2 monitoring system, such as rock not capable of passing a 3-inch sieve or similar objectionable Material, has been removed
3 from the backfill Material.

4 Where Class D bedding is required, backfill up to 6 inches over the top and both sides of the utility must be evenly and
5 carefully placed.

6 The Contractor must backfill to a uniform depth of 1 foot above ductile iron pipe before starting compaction and to a
7 uniform depth of 2 feet above concrete pipe before starting compaction.

8 Walking on the pipe is not allowed until at least 1 foot of cover has been placed on the pipe.

9 **2-10.3(4) STRUCTURE BACKFILL**

10 Unless otherwise stated in the Contract, structure backfill is the material within a 1 horizontal to 1 vertical slope from the
11 base of the structure to the ground surface.

12 Special precautions must be taken to prevent any wedging action against Structures. If the excavation has sloping sides,
13 the slopes must be broken up by stepping or serrating to prevent wedge action before the backfill is placed. Fill placed around
14 Culverts, piers or underground utilities must be deposited on both sides to approximately the same elevation at the same time.

15 Unless otherwise specified, gravel backfill Material for foundations must be Class A or Class B, as specified in Section 9-
16 03.10(1). When not specified by Class or Type in the Contract, gravel backfill Material for foundations must be Mineral
17 Aggregate Type 2, as specified in Section 9-03.10(1)A.

18 Unless otherwise specified, gravel backfill Material for walls (non-mechanically stabilized earth) must be Mineral
19 Aggregate Type 17, as specified in Section 9-03.10(2).

20 **2-10.3(5) BACKFILLING AT BRIDGE AND TRESTLE ENDS**

21 This work consists of filling around the ends of trestles and bridges. The Contractor must start and complete this work as
22 soon as possible after each bridge is completed or when the Engineer requires.

23 To prevent the bridge from being distorted or displaced, the Contractor must place Material evenly around all sides and
24 parts of the Structure. The Contractor must not backfill any abutment before placing the superstructure. After the
25 superstructure is in place, small compactors may be required. Embankments must be layered and compacted concurrently at
26 either end of the Structure. The difference in embankment height from one end to the other must not exceed 2 feet.

27 The Contractor must build the embankment under the bridge to the dimensions specified in the Contract.

28 **2-10.3(6) END SLOPES**

29 The Engineer will determine when and where to build end slopes, whether these occur at the start or end of a project, at
30 the borders of excavation or embankments, at bridge ends, or elsewhere. The Contractor must build end slopes not detailed
31 on the Drawings to the line and grade as established by the Engineer, regardless of center line limits shown on the Drawings.
32 All work to complete and maintain these end slopes is considered Work to be performed under the Contract.

33 **2-10.3(7) CONTROLLED DENSITY FILL**

34 Compaction of controlled density fill will not be required. If water is present and prevents the Contractor from properly
35 placing controlled density fill as determined by the Engineer, it must be removed by pumping or other means.

36 Special precautions must be taken to prevent any wedging action against abutments and wing walls. If the excavation
37 has sloping sides, the slopes must be broken up by stepping or serrating to prevent wedge action before the backfill is placed.
38 Fill placed around Culverts, piers or underground utilities must be deposited on both sides to approximately the same elevation
39 at the same time.

40 **2-10.4 MEASUREMENT**

41 "Selected Material" is measured by the cubic yard for the quantity placed.

42 "Borrow (Type)" and "Unclassified Borrow" is measured by the ton at the point of delivery as specified in Section 1-09.1.

43 "Controlled Density Fill" is measured by the cubic yard for the quantity of Material placed except when Controlled Density
44 Fill is specified as pipe bedding, as specified in Section 7-17.4.

45 Compaction will not be measured.

46 See Divisions 7 and 8 for measurement information associated with excavation, backfill and compaction of utility
47 trenches.

48 **2-10.5 PAYMENT**

49 1. "Selected Material", per cubic yard.

50 The Bid Item price for "Selected Material" is used for all costs associated with the placement and compaction of this
51 material when the costs are not included in other various Bid Items elsewhere in this specification. Payment for excavation
52 backfill and compaction of utility trenches will be per Divisions 7 and 8.

53 2. "Unclassified Borrow", per ton.

1 3. **“Borrow (Type)”**, per ton.

2 The Bid Item prices for “Unclassified Borrow” and for “Borrow (Type)” include all costs for the work required to excavate,
3 haul, stockpile, place and compact the Material as specified in the Contract.

4 4. **“Controlled Density Fill”**, per cubic yard.

5 The Bid Item price for “Controlled Density Fill” includes all costs for the work required to furnish and place the CDF as
6 specified. Payment for Controlled Density Fill used as bedding for utility trenches will be paid as specified in Section 7-17.5.

7 5. **Other Payment Information**

8 If the Contract does not include a Bid Item for Mineral Aggregate (Type) for rock embankment construction, any payment
9 will be as specified in Section 1-04.3.

10 Stockpiled excavated Material for use as backfill that is intermingled with unsuitable Material and/or weather damaged
11 must be disposed of and replaced with sound, untainted fill Material at the Contractor’s sole expense.

12 When directed by the Engineer to use controlled density fill in backfilling around piers and in front of abutments and
13 walls, any payment will be as specified in Section 1-04.3.

14 Costs related to all bridge embankment and trestle work specified in Section 2-10.3(5) is considered incidental to the
15 Work and must be included in the Bid Item prices for applicable Bid Items.

16 All costs not defined in Section 2-10 that relate to providing, placing, and compacting backfill must be included in the Bid
17 Item prices of the applicable Bid Items.

18 See Divisions 7 and 8 for payment information associated with excavation, backfill and compaction of utility trenches.

19 **SECTION 2-11 COMPACTION**

20 **2-11.1 DESCRIPTION**

21 Section 2-11 describes compacting material used for backfilling or filling for pavements, Structures and utilities. All
22 compaction Work must be conducted as specified in the Contract and in close conformity with the lines, grades, and typical
23 cross-sections shown on the Standard Plans, Drawings or as established by the Engineer.

24 **2-11.2 RESERVED**

25 **2-11.3 CONSTRUCTION REQUIREMENTS**

26 **2-11.3(1) GENERAL REQUIREMENTS**

27 The Contractor must not operate tractors or other heavy equipment within 2 feet of a structure or utility. Where
28 compaction is required within 2 feet of a structure or utility, or is inaccessible by large equipment, the Contractor must use
29 smaller, lighter equipment and smaller lifts to achieve the required compaction so as not to damage the structure or utility.

30 The Contractor must determine the lift thickness and compaction effort based on the equipment being used for
31 compaction and the material being compacted, so that the compaction standard is met. The lift thickness must not be greater
32 than 12 inches at any time.

33 Should excessive moisture threaten the stability of backfill, the Engineer may direct the Contractor to change the
34 operation.

35 The Contractor must use 1 of the following 2 methods (A and B) when backfilling. The Contractor must use Method A
36 when the Contract does not specify another method.

37 Method A: Within 2 feet of pavement or a structure, the backfill must be compacted to 95 percent of the maximum
38 density, as determined by the compaction control tests specified in Section 2-11.3(2). All Material beyond this 2-foot range
39 must be compacted to 90 percent of the same maximum density.

40 Method B: all material must be compacted to 95 percent of the maximum density, as determined by the compaction
41 control tests specified in Section 2-11.3(2).

42 If the required compaction density has not been obtained, the Contractor must remove the backfill and recompact using
43 an improved technique, thinner lifts, heavier compaction equipment, or more effort. This process must be repeated until the
44 Contractor has established a procedure that provides the required degree of compaction. The Contractor will then be permitted
45 to proceed with backfilling and compacting under the approved compaction procedure.

46 The moisture content must not vary more than 3 percent above or more than 3 percent below the optimum moisture
47 content as determined by test method ASTM D1557.

48 The Engineer may allow the Contractor to place Materials having higher moisture content than specified in this Section if
49 the Contractor can indicate the compaction standard can still be met. However, the Engineer may at any time require the
50 Contractor to return to specified moisture-content levels.

51 The Owner will consider all costs of drying Material to be incidental to other Work and at no additional cost to the Owner.

52 If weather prevents drying excavation or borrow Materials to the required moisture content, the Engineer may direct the
53 Contractor to change normal procedures or equipment.

1 The Contractor must repair any partial or complete backfilled area that loses stability because of continued hauling
2 across it. Evidence of lost stability includes pumping or rutting. The Contractor must also change hauling equipment or
3 procedures to prevent further damage.

4 If it appears that rain or snow is likely to soak an area that has been aerated, the Contractor must temporarily seal it
5 against the weather. Should the Contractor fail to do so, any additional aeration required to restore the area to its previous
6 condition must be done at no expense to the Owner.

7 **2-11.3(2) COMPACTION CONTROL TESTS**

8 Maximum density and optimum moisture content for materials placed are determined by one of the following methods:

- 9 1. Materials less than 30 percent retained on the 3/4 inch sieve are determined by ASTM D 1557 (AASHTO T 180
10 Method D).
- 11 2. Materials with 30 percent or more retained on the 3/4 inch sieve may be determined by rolling pattern using in-place
12 density, determined using ASTM D6938 (AASHTO T 310).

13 The Engineer will determine which test procedure to use.

14 The Contractor must provide the Engineer a minimum 2 Working Days advance notification when field soil or Mineral
15 Aggregate density reading or compaction testing is required.

16 The Contractor must re-establish the compaction procedure if routine in-place densities show the specified compaction is
17 not being attained. In no case will placement of Material be allowed to proceed until the specified compaction is attained.

18 Water settling is not allowed as a method for compaction.

19 **2-11.4 MEASUREMENT**

20 Compaction will not be measured.

21 **2-11.5 PAYMENT**

22 When the Engineer directs a change in construction, the Owner will not increase the Bid Item price, but will increase the
23 Bid Item quantity at the Bid Item prices for the Bid Items that apply, as specified in Section 1-04.5.

24 Density testing by Owner forces will be performed at no charge to the Contractor for the first test series at each Engineer
25 designated location. If these tests indicate a failure to achieve required densities, re-testing must take place after
26 recompaction. Engineer expenses related to retesting will be charged to the Contractor as specified in Section 1-05.7.

27 All costs and expenses involved in drying Materials with whatever method is appropriate are considered incidental to the
28 various Bid Item prices and at no additional cost to the Owner.

29 See Divisions 7 and 8 for payment information associated with excavation, backfill and compaction of utility trenches.

30 **SECTION 2-12 WATERING**

31 **2-12.1 DESCRIPTION**

32 Section 2-12 describes furnishing, hauling, and applying water for settling, constructing subgrade, placing of crushed
33 surfacing, dust control, flushing, and testing as the Contract requires.

34 **2-12.2 RESERVED**

35 **2-12.3 CONSTRUCTION REQUIREMENTS**

36 **2-12.3(1) GENERAL**

37 The Contractor must apply water to streets using tank trucks equipped with spray bars. Spray controls must ensure that
38 water is applied uniformly and at a rate of coverage for the intended purpose. When the source of water within the Work area
39 is hydrants, the Contractor may, with approval of the Engineer, apply water with a hose and reduced pressure principle
40 backflow assembly, see Section 9-30.13(5), approved by the Washington State Department of Social and Health Services
41 (WSDSHS certification) and directly connected to the hydrant. The Contractor must have a copy of the WSDSHS certification
42 on board the vehicle drawing water from the hydrant. Before drawing water, the Contractor must first obtain approval of the
43 assembly and hook-up by making the advance notification specified in Section 1-07.28 item 7D. The Contractor must furnish
44 the hose, equipment, or tank truck necessary for required watering, and strictly comply with the provisions of the permit.

45 **2-12.3(2) SOURCE OF WATER SUPPLY, REQUESTING HYDRANT PERMIT, AND REGULATIONS PERTAINING
46 TO HYDRANT USE**

47 Within the SPU Water Operations direct service area, the source of water used on a project must be approved by the
48 Engineer. When the source of water is a hydrant, a hydrant use permit must be obtained from SPU Development Services
49 Office, and any applicable use fees paid.

50 The Contractor must only use water sources or hydrants approved by the Engineer, and must be in strict accordance
51 with the requirements of City of Seattle Ordinance 65877 and the conditions of the permit.

1 Information on SPU hydrant use permits can be obtained at (206) 684-3333, or by visiting the 27th floor of the Seattle
2 Municipal Tower, 700 Fifth Avenue, Seattle, WA.

3 Outside of the SPU Water Operations direct service area, the Contractor must comply with the requirements of that local
4 jurisdiction.

5 **2-12.4 MEASUREMENT**

6 Water used in conjunction with work involving the water distribution system will not be measured.

7 Water used in conjunction with work except the water distribution system will be measured.

8 **2-12.5 PAYMENT**

9 All costs associated with obtaining a hydrant use permit and providing and applying water to Work not involving the water
10 distribution system are considered incidental to the various Bid Items comprising the improvement and no separate or
11 additional payment will be made. See Section 4-07.5 for an exception where the Owner will pay for water.

12 All costs associated with providing and applying water to Work involving the water distribution system will be borne by the
13 Owner, including the hydrant use permit fee.

14 Where the Work involves both water distribution work and other work, no reimbursement of the hydrant permit fee will be
15 made. Costs for City non-water distribution work are considered incidental to the various non-water distribution Bid Items and
16 no separate or additional payment will be made except as specified in Section 4-07.5.

17 Water costs are based on the prevailing rates as listed in Seattle Public Utilities' current standard charges.

18 **SECTION 2-13 ROCK FACING**

19 **2-13.1 DESCRIPTION**

20 Section 2-13 describes constructing, rebuilding, and relocating rock facings used for erosion control or the containment of
21 cuts and embankments. Work must be performed per Standard Plan 141, and as designated in the Contract. Rock facing used
22 for fire hydrant wall requirements as shown on Standard Plan 313 must comply with the requirements of Section 2-13.3(5).

23 **2-13.2 MATERIALS**

24 Materials must comply with the requirements of the following Sections:
25

| Material | Section |
|-----------------------|--------------|
| Rock Facing Material | 9-03.15 |
| 2" to 4" Quarry Spall | 9-13.6 |
| Geotextile | Section 9-37 |

26
27 Crushed gravel with at least 90 percent of the total required quantity having 2 or more fractured surfaces each piece and
28 also meeting the grading requirements of quarry spalls may be used instead of ledge rock.

29 Where needed, the geotextile between the native soil behind the rock facing and the quarry spall backfill must comply
30 with the requirements of a geotextile for separation on Table 3 of Section 9-37.

31 **2-13.3 CONSTRUCTION REQUIREMENTS**

32 **2-13.3(1) ROCK FACING**

33 **2-13.3(1)A GENERAL**

34 Rock facings except fire hydrant wall requirements per Standard Plan 313 must be constructed, rebuilt, or relocated at
35 the locations and to the limits shown on the Drawings. Walls higher than 8 feet must be designed by a Professional Engineer
36 as specified in Section 1-05.3 and must be submitted to the Engineer. The subgrade elevation and location of the rock facing
37 must be as shown on the Drawings or established by the Engineer.

38 **2-13.3(1)B ROCK FACING KEYWAY**

39 Once clearing and general Job Site preparation is complete, the Contractor must excavate a keyway for the base course
40 of rock facing. The keyway must be 3 to 12 inches deep as shown on Standard Plan 141 extending over the entire length of
41 the rock facing, and must incline slightly downward toward the face of the cut or fill being protected, by an approximate 4
42 horizontal to 1 vertical slope. The keyway width must be at least 40 percent of the height of the proposed rock facing.

43 **2-13.3(1)C ROCK SELECTION**

44 The Contractor must have sufficient working space so individual rock selection from a number of stockpiled rocks can
45 satisfy the needs of the project. The stockpile area must not be placed on traffic lanes or driveways. Rocks must be of a
46 generally cubical, tabular or rectangular shape, as opposed to rounded or tetrahedral forms, and must be placed to match as

1 closely as possible the spaces afforded by the next lower course of rocks. One-man rocks must not be used on rock facings
2 more than 3 feet high.

3 **2-13.3(1)D ROCK PLACEMENT**

4 The thickness of the rock facing, including the filter layer behind it, must be approximately 40 percent of its height. Where
5 required in the Contract, a 6-inch subsurface drain pipe must be installed in a keyway behind the rock facing, with sufficient
6 gradient to initiate flow, and be piped to an approved discharge point as shown on the Drawings, such as a surface, ditch, curb
7 above inlet or CB grate, or separate CB with no roadway discharge.

8 The Contractor must place the first course of rock on firm, unyielding soil having a minimum load bearing capacity of
9 2000 pounds per square foot, at base elevations specified in Standard Plan 141. There must be full contact between the rock
10 and soil. This may require shaping of the ground surface, or slamming or dropping the rocks into place when appropriate, so
11 that the soil foundation conforms to the shape of the rock face bearing on it. As an alternative, it may be necessary to place
12 and compact crushed rock into the subgrade to increase its load bearing capacity. Before placing the next level of rock facing,
13 the Contractor must place and compact filter Material behind and to the top of the rocks previously placed.

14 The Contractor must use rock sizes as specified in Section 9-03.15, using the largest rocks at the bottom and
15 progressively smaller rocks toward the top. The rocks must be placed so there are no continuous joint planes in either the
16 vertical or lateral direction. Each rock must bear on at least 2 rocks below it, must have at least 3 contact surfaces, and must
17 be set stable with no rocking.

18 Rocks must be placed so there is some bearing between flat rock faces rather than on joints. Horizontal joints between
19 rock courses must slope downward towards the embankment being protected.

20 The batter of the rock facing must be 1 horizontal to 4 vertical and must be uniformly the same throughout the length of
21 the rock facing. The face of individual rocks may vary no more than 3 inches from the batter or slope line of the rock facing.

22 Where voids greater than 4 inches in dimension exist in the rock facing, they must be visually examined to determine if
23 contact between the rocks exists within the thickness of the rock facing. If there is contact, no further action is required. If there
24 is no rock contact within the rock facing thickness, some resetting is required. If there is a void measuring 6 inches or more
25 near the inside face of the rock facing, use a smaller piece of rock to fill the void. This filler rock must be placed with the
26 longest dimension perpendicular to the face.

27 If stability of an unprotected cut slope is a concern, the rock facing must be constructed in short lengths. The final course
28 must have an even appearance and must be placed to minimize erosion of the protected embankment.

29 **2-13.3(1)E FILTER MATERIAL**

30 The Contractor must place a drainage filter of 2-inch to 4-inch quarry spall between the face of the embankment and the
31 rear of the rock facing. The drainage filter must be a minimum 6 inches in thickness.

32 **2-13.3(1)F GEOTEXTILE**

33 If surface water or groundwater seeping from the slope could cause erosion of the native soil during the life of the rock
34 facing, a separation geotextile meeting the requirements in Table 3 of Section 9-37 must be placed between the filter material
35 and the native soil.

36 **2-13.3(1)G SLOPE ABOVE ROCK FACING**

37 The slope of the terrain above the rock facing must be no steeper than 3 horizontal to 1 vertical to minimize an earth
38 surcharge on the rock facing. Additional surcharge such as a building, parking area, other traffic area, and other loading above
39 the rock facing, requires a rock facing design by a licensed civil engineer as specified in Section 1-05.3, which must be
40 submitted to the Engineer. Hydroseed the unimproved area above the rock facing for erosion control.

41 **2-13.3(2) REBUILD ROCK FACING**

42 This work consists of dismantling an existing rock facing and reconstructing the facing in the same location.
43 Reconstruction work must be conducted as specified in the requirements of Section 2-13.3(1). Rock dismantled from the
44 existing facing may be used in reconstructing the rebuilt rock facing if the rock is approved by the Engineer as meeting the
45 rock quality requirements of Section 9-03.15. Additional rock required by the Engineer to complete the facing must be
46 furnished by the Contractor, and must meet the requirements of Section 2-13.2. Existing drainage rock behind the existing
47 rock facing must be replaced with 2-inch to 4-inch quarry spall for the rebuilt rock facing.

48 The Contractor must sequence the removal and rebuild to limit the length of exposed slope. Each Working Day, a length
49 of up to twice the height of the existing rock facing may be removed. Each Working Day, rebuilding the rock facing must
50 proceed in a manner providing the shortest length of unfinished rock facing full height. The removal and rebuild must be
51 coordinated to limit the exposure of unrocked embankment.

52 **2-13.3(3) RELOCATE ROCK FACING**

53 This work consists of dismantling an existing rock facing and rebuilding a similar rock facing in a different location using
54 the rock obtained from the dismantled facing. Work must be conducted as specified in the requirements of Sections 2-13.3(1)
55 and 2-13.3(2). The Contractor must furnish additional rock as directed by the Engineer to complete the facing. New rock must

1 meet the requirements of Section 2-13.2. Existing drainage rock behind the existing rock facing must be replaced with 2-inch
2 to 4-inch quarry spall for the relocated rock facing.

3 **2-13.3(4) CONTRACTOR REQUIRED EXPERIENCE**

4 The rock facing Contractor or Subcontractor must furnish written evidence of at least 5 rock facing constructions within
5 the 2 years preceding the date of Advertisement for Bids and must invite inspection of at least 2 of these rock facings that are
6 similar to the proposed rock facings in the Contract, as determined by the Engineer.

7 **2-13.3(5) ROCK FACING FOR HYDRANTS**

8 Where rock facings are required as wall requirements for fire hydrants, as shown on Standard Plan 313, the rock facing
9 construction must be conducted as specified in Section 2-13.3(1), with the following exceptions:

- 10 1. The depth of the keyway must be 1 foot minimum;
- 11 2. The filter Material behind the rock facing must be Mineral Aggregate Type 2 with a minimum thickness of 6 inches.
- 12 3. The maximum height of rock facing must not exceed 5 feet as measured from finished grade to top of rock facing.
- 13 4. The sizes of rock facing must comply with the requirements of the table listed on Standard Plan 141, with "h"
14 measured from finished grade to top of rock facing.
- 15 5. The maximum slope behind the rock facing must not be steeper than 2 horizontal to 1 vertical.
- 16 6. Finished grade in front of the rock facing must be within a minimum 6-inch compacted depth of Mineral Aggregate
17 Type 2.
- 18 7. No weep holes and no subsurface drain are required behind the rock facing.
- 19 8. Each rock facing rock must bear on at least 3 points without rocking. Voids greater than 4 inches on either the outside
20 face or inside face must be filled with a smaller rock ensuring stability of the rock facing.

21 **2-13.4 MEASUREMENT**

22 "Rock Facing" and for "Relocate Rock Facing" is measured by the square foot of rock face for the new rock facing or for
23 the relocated rock facing.

24 "Rebuild Rock Facing" is measured by the square foot based on measurement of the finished rock facing.

25 Measurement will include the entire front face of the constructed rock facing including the keyway.

26 Measurement for quarry spall drainage Material is by the ton.

27 Measurement for filter Material except quarry spall is by the cubic yard, as specified in Section 4-01.4.

28 **2-13.5 PAYMENT**

29 1. "Rock Facing", per square foot.

30 The Bid Item price for "Rock Facing" includes all costs for the work required to furnish and place the rock and geotextile,
31 excavation of keyway and of embankment.

32 Payment for drainpipe, when called for in the Contract, will be paid as "Subsurface Drain" as specified in Section 7-01.

33 2. "Rebuild Rock Facing", per square foot.

34 3. "Relocate Rock Facing", per square foot.

35 The Bid Item prices for "Rebuild Rock Facing" and for "Relocate Rock Facing" include all costs for the work required to
36 dismantle and reconstruct the rock facing as specified using the existing rock. It also includes temporary stockpiling of the
37 rock, excavation as may be necessary to rebuild or relocate the rock facing, disposal of existing rock or drainage aggregate,
38 and furnishing additional drainage aggregate and geotextile as necessary.

39 Costs required to import and place additional rock, or replace existing rock to rebuild or relocate rock facing are
40 addressed in Section 1-09.4.

41 4. **Other payment information**

42 Payment for quarry spall or other filter Material specified for drainage filter Material will be as specified in Section 8-15.

43 **SECTION 2-14 TRIMMING AND CLEANUP**

44 **2-14.1 DESCRIPTION**

45 Section 2-14 describes dressing and trimming the roadways specified in the Contract, including frontage roads,
46 connecting ramps, auxiliary lanes, and approach roads. This work extends to shoulders and ditches.

47 **2-14.2 RESERVED**

48 **2-14.3 CONSTRUCTION REQUIREMENTS**

49 The Contractor must:

- 1 1. Trim shoulders and ditches to produce smooth surfaces and uniform cross-sections that conform to the grades set by
- 2 the Engineer.
- 3 2. Open and clean all channels, ditches, and gutters to ensure proper drainage.
- 4 3. Dress the back slope of any ditch or borrow pit that will remain adjacent to the roadway. Round off the top of the back
- 5 slope and distribute the Material evenly along its base.
- 6 4. Remove and dispose of all weeds, brush, refuse, and debris that lay on the roadbed, shoulders, ditches, and slopes.
- 7 5. Remove all loose rocks and gravel from paved shoulders.
- 8 Distribute evenly along the embankment any Material not needed to bring the shoulders to the required cross-section.
- 9 Restoration must be conducted as shown on the Drawings and the requirements in Section 8-02.
- 10 The Contractor must not use heavy equipment (tractors, graders) to trim the shoulders of an existing or new bituminous
- 11 surface, or drag, push, or scrape shoulder Material across completed surfacing or pavement.
- 12 When the Contract requires rebuilding part of a roadway, only the rebuilt areas must be trimmed and cleaned up.
- 13 Trimming and cleanup in ditches and channels over 4 feet deep requires safety systems, as specified in Section 2-07.

14 **2-14.4 MEASUREMENT**

15 Work specified in Section 2-14 will not be measured.
16 Measurement for safety systems related to cleanup of ditches and channels over 4 feet deep is specified in Section 2-
17 07.4.

18 **2-14.5 PAYMENT**

19 Payment for safety systems related to ditch and channel cleanup will be as specified in Section 2-07.5.

20 **SECTION 2-15 CONSTRUCTION GEOTEXTILE**

21 **2-15.1 DESCRIPTION**

22 Section 2-15 describes furnishing and placing construction geotextile as specified in the Contract.

23 **2-15.2 MATERIALS**

24 Construction Geotextile must comply with the requirements of Section 9-37.

25 Geotextile roll identification, storage, and handling must comply with ASTM D 4873. During periods of shipment and
26 storage, the geotextile must be stored off the ground. The geotextile must be covered at all times during shipment and storage
27 to fully protect it from ultraviolet radiation including sunlight, Job Site construction damage, precipitation, chemicals including
28 strong acids or strong bases, flames including welding sparks, temperatures in excess of 160 °F, and any other environmental
29 condition that may damage the physical properties of the geotextile.

30 Geotextile required for underground drainage must be "Moderate Survivability" and "Drainage Class C" and geotextile for
31 permanent erosion control must be "High Survivability" and "Drainage Class C."

32 **2-15.3 CONSTRUCTION REQUIREMENTS**

33 **2-15.3(1) GENERAL**

34 The area to be covered by the geotextile must be graded to a smooth, uniform condition free from ruts, potholes, and
35 protruding objects such as rocks or sticks. The geotextile must be spread immediately ahead of the covering operation. Do not
36 leave the geotextile exposed to sunlight during installation for more than 14 Calendar Days. The geotextile must be laid
37 smooth without excessive wrinkles. The geotextile must not be dragged through mud or over sharp objects which could cause
38 damage. The cover material must be placed on the geotextile so that the minimum required initial lift thickness remains
39 between the equipment tires or tracks and the geotextile at all times. Construction vehicles on the first lift above the geotextile
40 are not permitted.

41 Soil piles or the manufacturer's recommended method can be used as needed to hold the geotextile in place until the
42 specified cover material is placed.

43 Should the geotextile be torn, punctured, or the overlaps or sewn joints disturbed, as evidenced by visible geotextile
44 damage, subgrade pumping, intrusion, or roadbed distortion, the backfill around the damaged or displaced area must be
45 removed and the damaged area repaired or replaced by the Contractor at no expense to the Owner. The repair must consist
46 of a patch of the same type of geotextile, placed over the damaged area by the minimum required overlap for the application.

47 If geotextile seams will be sewn, whether in the field or at the factory, the seams must consist of 1 row of stitching unless
48 the geotextile does not have a selvage edge where the seam would be sewn. If a selvage edge is not present, the seams must
49 consist of 2 parallel rows of stitching, or a J-seam, Type SSn-1, using a single row of stitching. The 2 rows of stitching must be
50 1 inch apart with a tolerance of ±1/2 inch and must not cross except for restitching. The stitching must be a lock-type stitch.
51 The minimum seam allowance (the minimum distance from the geotextile edge to the stitch line nearest to that edge) must be
52 1-1/2 inches if a flat or prayer seam, Type SSa-2, is used. The minimum seam allowance for all other seam types must be 1

1 inch. The seam, stitch type, and the equipment used to perform the stitching must be as recommended by the manufacturer of the geotextile and as approved by the Engineer.

3 The seams must be sewn in a manner that the seam can be inspected readily by the Engineer or a representative. The
4 seam strength will be tested and must comply with the requirements stated here.

5 **2-15.3(2) UNDERGROUND DRAINAGE**

6 See Section 7-01.2 and 7-01.3(2) for geotextile type and construction requirement for subsurface drain pipe.

7 Trench walls must be smooth and stable. The geotextile must be placed in a manner that ensures intimate contact
8 between the soil and the geotextile (no voids, folds, or wrinkles).

9 The geotextile must either be overlapped a minimum of 12 inches at all longitudinal and transverse joints, or the
10 geotextile joints must be sewn for moderate survivability drainage applications. In those cases where the trench width is less
11 than 12 inches, the minimum overlap is the trench width.

12 In moderate survivability geotextile underdrain applications, the minimum overlap is 12 inches, or the geotextile joints
13 must be sewn, except where the geotextile is used in area drains. An area drain is defined as a geotextile layer placed over or
14 under a horizontal to moderately sloping layer of drainage aggregate. For area drains, the geotextile must be overlapped a
15 minimum of 2 feet at all longitudinal and transverse joints, or the geotextile joints must be sewn together. The minimum initial
16 lift thickness over the geotextile in the area drain is 12 inches.

17 In all cases, the upstream geotextile sheet must overlap the next downstream sheet.

18 **2-15.3(3) SEPARATION**

19 For separation, the geotextile must either be overlapped a minimum of 2 feet at all longitudinal and transverse joints, or
20 the joints must be sewn together. The initial lift thickness must be 6 inches or more.

21 **2-15.3(4) SOIL STABILIZATION**

22 For soil stabilization, the geotextile must either be overlapped a minimum of 2 feet at all longitudinal and transverse
23 joints, or the joints must be sewn together. The initial lift thickness must be 12 inches or more. Compaction of the first lift above
24 the geotextile must be by Method A (Section 2-11.3). No vibratory compaction is allowed on the first lift.

25 **2-15.3(5) PERMANENT EROSION CONTROL AND DITCH LINING**

26 Unless otherwise specified in the Contract, the geotextile must either be overlapped a minimum of 2 feet at all
27 longitudinal and transverse joints, or the joints must be sewn together. If overlapped, the geotextile must be placed so the
28 upstream strip of geotextile overlaps the next downstream strip. When placed on slopes, each strip must overlap the next
29 downhill strip.

30 Placement of aggregate and riprap or other cover material on the geotextile must start at the toe of the slope and
31 proceed upwards. The geotextile must be keyed at the top and the toe of the slope as shown on the Drawings. The geotextile
32 must be secured to the slope, but loosely enough so the geotextile does not tear when the riprap or other cover material is
33 placed on the geotextile. The geotextile must not be keyed at the top of the slope until the riprap or other cover material is in
34 place to the top of the slope.

35 All voids in the riprap or other material through which the geotextile is visible must be backfilled with quarry spalls or filter
36 material as designated in the Contract, so the geotextile is completely covered. When an aggregate cushion between the
37 geotextile and the riprap or other cover material is required, it must have a minimum thickness of 12 inches.

38 An aggregate cushion must be placed on the geotextile when hand placed riprap or sack riprap is specified.

39 Grading of slopes after placement of the riprap or other cover Material is not allowed if grading results in stone movement
40 directly on the geotextile. Never allow stones with a weight of more than 100 pounds to roll downslope. Stones must not be
41 dropped from a height greater than 3 feet above the geotextile surface if an aggregate cushion is present, or 1 foot if an
42 aggregate cushion is not present. Lower drop heights may be required if geotextile damage from stones is evident, as
43 determined by the Engineer. If the geotextile is placed on slopes steeper than 2 horizontal to 1 vertical, the stones must be
44 placed on the slope without free-fall for moderate survivability, high survivability, and ditch lining geotextiles.

45 **2-15.3(6) TEMPORARY SILT FENCES**

46 See Section 8-01.3(10).

47 **2-15.4 MEASUREMENT**

48 Measurement for construction geotextile, with the exception of temporary silt fence geotextile and underground drainage
49 geotextile used in trench drains, is measured by the square yard for the ground surface area actually covered. No additional
50 measurement will be made for overlap.

51 Measurement for underground drainage geotextile used in trench drains is measured by the square yard for the
52 perimeter of drain actually covered. No additional measurement will be made for overlap.

53 **2-15.5 PAYMENT**

- 54 1. **“Construction Geotextile for Underground Drainage”**, per square yard.

- 1 2. “Construction Geotextile for Separation”, per square yard.
- 2 3. “Construction Geotextile for Soil Stabilization”, per square yard.
- 3 4. “Construction Geotextile for Permanent Erosion Control”, per square yard.
- 4 5. “Construction Geotextile for Ditch Lining”, per square yard.

5 The Bid Item prices for “Construction Geotextile (Use)” include all costs for the work required to furnish, install, maintain,
6 and remove the geotextile for the use as specified.

7 Additional geotextile required by the Engineer will be addressed as specified in Section 1-04.3.

8 **SECTION 2-16 DIRECTIONAL DRILLING**

9 **2-16.1 GENERAL**

10 For underground construction or trenchless construction except directional drilling, see Section 7-17.3(2)H.

11 Directional drilling is an underground excavation method using a steerable system for installing pipe, conduit and cable
12 using a surface-launched drill rig. A fluid-filled pilot bore is drilled using a fluid-driven motor, and the bore is then enlarged by
13 prereaming when necessary, and back reaming to the size required for product pipe installation. The drill head steers the pilot
14 boring. The location, depth, and dimension of existing underground facilities within and near the proposed bore path are
15 identified and located, including appurtenances as may exist, and the bore path alignment and profile through these
16 underground facilities is planned. The location and depth of the drill head following this planned bore path is monitored and
17 known at all times. Notifications and coordination with others whose underground facilities exist along the bore path are pre-
18 arranged and timely.

19 **2-16.2 MATERIALS**

20 Product pipe, and casing pipe when required, must be as specified in the Contract.

21 The tensile strength of product pipe joints, and of casing pipe joints when casing is required or proposed, must be of
22 sufficient strength to withstand installation stresses and frictional resistance for the size, length, and curvature of the bore.

23 **2-16.3 CONSTRUCTION REQUIREMENTS**

24 **2-16.3(1) EXPERIENCE**

25 See Section 2-16.3(6)B for submittal requirements.

26 In addition to requirements listed elsewhere in the Contract, the directional drilling crew, whether Contractor or
27 Subcontractor, must demonstrate:

- 28 1. Acceptable training.
- 29 2. Operational experience.
- 30 3. A thorough understanding and working knowledge of all functions of the drilling operation.
- 31 4. The ability to promptly identify and correct anything out of the ordinary when it becomes obvious.
- 32 5. Experience in coordinating drilling operations with facility owners whose facilities may be near or along the bore path.
- 33 6. Knowledge of all legal and regulatory requirements that apply to the entire drilling operation.

34 Acceptable training is interpreted as being in possession of and following the “Horizontal Directional Drilling Good
35 Practices Manual” as developed by a consortium of 6 industry associations including the North American Society for
36 Trenchless Technology (NASTT), or having and practicing directional drilling guidelines as developed by a consortium of
37 designated and recognized industry organizations with expertise in horizontal directional drilling, drilling equipment, and
38 Supplies associated with drilling, or attendance at seminars, meetings, and training sessions specific to or including directional
39 drilling.

40 Acceptable operational experience is interpreted as both the operator, and the locator tracking the drill head, each having
41 no less than 3 full years recent directional drilling experience including working knowledge of any industry advances related to
42 directional drilling. The crew must have in place a coordinated communications system and method of operations to maintain
43 control at all times, and readily and promptly recognize and respond to problems.

44 The drilling Contractor or Subcontractor must have written guidelines and procedures defining duties and responsibilities
45 of all crew members, including procedures for identifying and avoiding “strikes” on any type of underground facility including
46 appurtenances. These procedures may include a description of partnering with owners of underground facilities to prevent
47 underground strikes.

48 The Contract may require additional evidence of experience, where drilling is required in sensitive areas, such as critical
49 habitat area with threatened or endangered species, wetland, under a river or stream, where existing underground
50 infrastructure is dense or critical, and as may apply in other situations.

51 **2-16.3(2) DRILLING EQUIPMENT**

52 All drilling equipment, whether direct or supporting, must be well maintained, kept reasonably clean, have fresh oil, and
53 good working parts and packings. Hoses and hose connectors must be in good working order and have no flaws, with hose

1 connections recommended by the manufacturer. Flow meters and pressure reading gauges must be calibrated per
2 manufacturer's recommendations.

3 The drilling Contractor or Subcontractor must have a preventative maintenance program in-place. This program must
4 address regular inspection and maintenance of the drill head, drill frame, engine, hydraulic system, drilling fluid pump, drill pipe
5 and downhole tools, and walk-over tracking system. The drilling Contractor or Subcontractor must also have a maintenance
6 log showing dates and types of maintenance for the various components. This log must also show repairs if and when needed,
7 which equipment part or parts were repaired, what the repair consisted of, and when the repair occurred.

8 A competent crew member must inspect and verify each segment of drill string as structurally sound with no cracks, no
9 excessive wear, continuous threads, and no flaws whatsoever before incorporating for use in the drilling operation. Defective
10 drill string is not allowed and will be considered unauthorized work.

11 The drilling Contractor or Subcontractor must be qualified to perform necessary and reliable equipment operation and
12 inspection including the reliability of the drill head locating system. The driller must also be qualified or have ready access to
13 qualified expertise as may be necessary, in maintaining and repairing the equipment.

14 **2-16.3(3) PROPOSED BORE PATH - PREPARATORY REQUIREMENTS**

15 **2-16.3(3)A GENERAL**

16 Before any directional drilling activity starts, the Contractor must make preparatory measures as applicable and as
17 specified in Section 2-16.3(3), and as specified in the Contract.

18 The proposed bore path alignment and profile must be shown on a plan and profile Shop Drawing including showing drill
19 head and drill string clearances from all identified underground facilities, see Section 2-16.3(20).

20 **2-16.3(3)B EXISTING UNDERGROUND FACILITIES**

21 The Contract will identify the plan and profile locations of known existing underground facilities and their appurtenances,
22 and other underground features and improvements, along and near the proposed bore path.

23 When the Contract specifies a minimum depth of bore and indicates the proposed bore path is below existing
24 underground facilities identified in the Contract, the information provided in the Contract will also identify locations, dimensions,
25 depths, and lengths of permanent ground anchors and deadman systems as may exist.

26 **2-16.3(3)C ONE NUMBER LOCATOR SERVICE – ADDITIONAL REQUIREMENTS**

27 In addition to the requirements of Section 1-07.17, the excavator, in its notification to One Number Locator Service, must
28 provide the following information:

- 29 1. That the type of excavation is directional drilling.
- 30 2. A brief description of the proposed bore path location full length, including its start and finish locations, and the range
31 of proposed bore depths.
- 32 3. That the proposed bore path will be adequately surface-marked its entire length, to aid One Number Locator Service
33 utility locators.
- 34 4. If applicable, a request for "marking" of service laterals and appurtenances, as may be near or along the proposed
35 bore path.

36 Before notifying One Number Locator Service, surface mark the proposed bore path at regular and frequent intervals
37 unless surface features require increasing or decreasing an interval spacing. These surface markings must be per the APWA
38 Uniform Color Code. In areas where surface markings must not be accommodated or are not allowed, stakes must be used.
39 The excavator must alert One Number Locator Service of staking.

40 **2-16.3(3)D EXPOSING EXISTING UNDERGROUND FACILITIES**

41 The Contractor must be prepared to expose underground facilities along the proposed bore path, if the location and
42 depth of a facility is indicated near the proposed bore path as can reasonably be done. This exposure may include a
43 sufficiently sized excavation to allow adequate visual inspection of the underground facility and its environment, including
44 determining the utility's depth, dimensions, type bedding, appurtenances, and foundation support.

45 In addition, the Contractor must be prepared to expose any portion of select underground facilities to a dimension to
46 accommodate examination for damage, as law may require.

47 This exposure may be required in advance of the drill head reaching the vicinity of the facility, so that compliance of the
48 drill head specified clearance can be visually verified.

49 **2-16.3(3)E UNDERGROUND FACILITIES – NO DEPTH INFORMATION OR UNLOCATABLE**

50 For identified but unlocatable underground facilities, and where a facility's depth, dimensions, or associated
51 appurtenances are unknown, the Contractor must request the facility owner to provide the best available information.

52 Where an underground facility is identified and its depth, dimension, or associated appurtenances are unknown, the
53 Contractor must request the facility owner to provide the best available information.

54 The Contractor must be prepared to excavate to expose such facilities, as needed to verify location, depth, dimension,
55 any existing appurtenances, and any bedding (rigid and otherwise), as they relate to the proposed bore path.

2-16.3(3)F SERVICE LATERAL CONSIDERATIONS

The Contractor must be aware that an owner of underground facilities is not required to indicate the presence of existing service laterals or appurtenances if the presence of existing service laterals or appurtenances on the Job Site of the construction project can be determined from the presence of other visible facilities, such as buildings, maintenance holes, or meter and junction boxes on or adjacent to the construction site.

The Contract will show the existence of service laterals known to exist to the Engineer at the Project Site.

Proposed directional drilling requires that identified service lateral facilities be visually identified if near the bore path, see Section 2-16.3(3)C.

The Contract may require advance notification and coordination with public and private underground facility owners with service laterals in the vicinity of proposed bores. In addition, underground facility owners may also require the excavator to provide advance notification, coordination, and exposure of a facility.

2-16.3(3)G SELECT UNDERGROUND FACILITIES – SPECIAL REQUIREMENTS

Unless the Contract specifies otherwise, in preparing for drilling and when advancing the drill head, it may be necessary to adequately expose certain underground facilities and applicable appurtenances, to verify the drill head safely clears the underground facility. These exposure locations must be in alignment with the proposed bore path or advancing drill head. In addition, other underground facility owners may also request this exposure. This exposure may also apply to service laterals.

Clearance requirements listed in this Specification may be greater than those listed in Section 1-07.17(2). If they are greater, these listed clearances have precedence. If no clearance is specified, the clearances specified in Section 1-07.17(2) apply.

Select underground facilities that may require visual verification include:

1. Seattle City Light electrical transmission and distribution facilities: No directional drilling is allowed within the clearance limits of a Seattle City Light underground electrical facility, as specified in Section 1-07.17(2), unless SCL has pre-approved the drilling in writing. If drilling is within or appears to possibly be within this clearance, the Contractor must make the notification required in Section 1-07.28 item 8C at least 10 Working Days in advance of entering said clearance. Unless the Contract specifies otherwise, the Engineer may require an Electrical Safety Observer be present when the drill head is within this clearance, see Section 1-05.2(2).
2. Fiber optic and other communications facilities: Owners of fiber optic and other underground communication facilities will specify any clearance, notification, and other requirement when such facilities exist at the Project Site. These communication facilities also include data transmission and control systems that may exist as appurtenances associated with pump stations, electrical stations, Water Main valves, and other facilities.
3. Gas facilities: Except “pipeline” or “pipeline system,” the owner of underground gas facilities may specify clearance, notification, and other requirements regarding their facilities at the Project Site. Also see Section 1-07.17(1), 1-07.17(2)D, and 1-07.28 item 18 for PSE gas facility clearances and notifications, respectively.
4. “Pipeline” or “pipeline system”: The Contractor must comply with Chapter 19.122 RCW.
5. MetroKC Sewer and Storm Drain: MetroKC will specify any clearance, notification, and other construction requirement when MetroKC Storm Drain, or Sewer exist at the Project Site.
6. Water Main: Clearance from Water Main, appurtenances, and surrounding bedding must be a minimum of 3 feet beyond the neat line dimensions, as shown on the 300-series Standard Plans.
7. Underground ground support systems: Ground support systems and deadman anchor systems may exist within the Project Site and may be in the vicinity of a proposed bore path. These ground support systems may be tiebacks, ground anchors, soil nails, deadman systems, and other similar systems. These ground support systems are used for both permanent and temporary purposes, and may be loaded or unloaded. The Contractor must plan the bore path to avoid ground support systems. Permanent ground support systems known by the Owner to exist at the Project Site will be described in the Contract.

The Contract may specify clearances, notifications, and other requirements for other underground facilities not listed above.

The Contractor must also be prepared to accommodate any request of the owner of an underground facility the Contract does not address, where the proposed or actual bore path crosses or is within a clearance as defined by that facility owner. When this happens, the Contractor must promptly notify the Engineer.

2-16.3(3)H VERIFICATION OF FACILITIES - EXISTING AND AS DESCRIBED IN THE CONTRACT

In preparing a drilling bore path alignment and profile, the Contractor must verify and compare the underground facility locations, depths, dimensions, and appurtenances, as specified in the Contract, with the actual facility locations, depths, dimensions, and appurtenances, and with the proposed bore path alignment and profile.

Where conflict is indicated, such conflict must be resolved before drilling can start.

2-16.3(4) PROGRESS SCHEDULE CONSIDERATION

The Contractor’s progress schedule must take into consideration the 2 phases of directional drilling:

1 Phase 1: This preparatory phase must accommodate exploration and discovery, and may require possible suspension
2 for this portion of Work, or suspension of the Work, to address a safe and coordinated drilling operation and bore path
3 alignment and profile.

4 Phase 2: The actual drilling operation.

5 Drilling must be completed in 1 continuous and uninterrupted operation, unless conditions arise that require interruption.
6 Such conditions may include health and safety, damage or the potential for damage, environment, permit, and "frac outs."

7 **2-16.3(5) ACTIVE AND PASSIVE INTERFERENCES AND DRILLING EQUIPMENT**

8 In preparing for drilling, the Contractor must walk the proposed bore path with locating equipment as it relates to tracking
9 the drill head, and must identify areas of active interferences and passive interferences that may impact location readings of
10 the drill head by the Contractor's locating equipment.

11 Such interference areas must be identified on the proposed bore path alignment and profile Shop Drawing.

12 The Contractor must be prepared to discuss how the actual drill head location, depth, and direction will be determined,
13 and be kept on the proposed alignment, and along the proposed profile, where such interferences exist.

14 The Contractor locator must locate the drill head in all indicated interference areas and must record the readings in the
15 daily log and as-built Drawings.

16 **2-16.3(6) SUBMITTAL**

17 **2-16.3(6)A GENERAL**

18 Unless the Contract specifies otherwise, the submittal on experience must be returned by the Engineer to the Contractor
19 (Section 2-16.3(6)B) before the Contractor submits the preparations required before beginning drilling (Section 2-16.3(6)C).
20 The experience submittal may be required as part of the pre-award information process (Section 1-03.1(4)).

21 **2-16.3(6)B SUBMITTAL – EXPERIENCE**

22 At least 10 Working Days in advance of starting preparatory requirements, the Contractor must provide the following
23 information:

- 24 1. Identity of the directional drilling crew, including operator, locator, and mudperson, if applicable. Include a description
25 of directional drilling experience, training, and qualifications to perform a safe and acceptable installation. Unless the
26 Contract specifies otherwise, provide a list of the most recent 3 directional drilling projects for these crew members. 1
27 of these projects must be similar to Job Site conditions and contractual constraints similar for this project to assist the
28 Engineer in evaluating experience. The project list must show:
 - 29 a. Each project's name and total price paid by the project owner for the drilling;
 - 30 b. The project owner, an owner contact person knowledgeable of the drilling, current contact phone number, and
31 email address;
 - 32 c. Type and size of pipe installed, and if casing used, size and type of casing including annular space filler if used;
 - 33 d. Length and range of depths of bore, and if any curvature in the bore path, why and what were the circumstances;
 - 34 e. Site conditions for each project including underground infrastructure density and types, active and passive
35 interferences and how dealt with, groundwater and controls, and a description of drill head depth and location
36 verification procedure as it related to the proposed bore path alignment and profile;
 - 37 f. Any specific constraints required of the drilling, such as drilling on a slope or in a critical habitat area or under a
38 body of water or in a very dense underground infrastructure environment or near critical underground
39 infrastructure, and how addressed; and
 - 40 g. Problems encountered, including whether they were identified before the drilling began or were encountered
41 during the drilling, and how resolved.
- 42 2. List and description of equipment and Supplies as they relate to the directional drilling. The submittal must indicate
43 that all equipment is safe, fully operational, maintained as recommended by the equipment manufacturer, and is in a
44 condition to acceptably and safely perform the drilling. Describe how the operator maintains control of the drill head
45 and how the operator knows the condition and status of all conditions associated with the drill head to maintain the
46 proposed bore path alignment and profile. The submittal must include the manufacturer, make, model, and year
47 purchased for the drill rig, and its parts if not of the same manufacturer. The submittal must also include the drilling
48 equipment manufacturer's recommended, as well as the actual, maintenance and repair program.
- 49 3. Description of the locate equipment and procedure used by the locator to track the drill head. Describe how the
50 Contractor ensures the "located" drill head location and depth readings match the actual location and depths in areas
51 of passive interference, in areas of active interference, and in non-interference areas. Describe equipment or portions
52 of equipment used by the operator to know the location, depth and attitude of the drill head, and how the drill head's
53 projected bore path relates to avoiding identified underground facilities, including clearances and applicable
54 appurtenances. Describe the type and strength of battery used in the drill head, the calibration of drill head transmitter
55 with Contractor locator receiver, and how the Contractor evaluates these needs for Project Site conditions and
56 proposed bore.

2-16.3(6)C SUBMITTAL - PREPARATIONS REQUIRED BEFORE STARTING DRILLING

After the Engineer returns the experience submittal to the Contractor without requiring resubmittal, the Contractor must submit the following information to the Engineer, at least 10 Working Days before starting drilling operations:

1. Plan and profile Shop Drawing of the proposed bore path alignment and profile, full length, showing all existing underground facilities as they relate to the drilling including any known appurtenances, clearances as required, areas of active and passive interference, locations of launch and receiving locations or pits, and safe working zone. Also see Section 2-16.3(20)C for as-built drawing requirements.
2. Written explanation of how, in areas of active and passive interference, those interferences may impact locating the drill head, knowing the direction, depth, and attitude of the drill head, the degree of uncertainty, and how the drill operator or Contractor intends to compensate for interferences and uncertainty to ensure the drill head follows the proposed bore path alignment and profile.
3. Description of the bend radius capability and limitations of the drilling equipment, including drill head, drill string, product pipe, casing if required, product pipe joints, and drill string joints. Describe how the Contractor will ensure stresses at pipe joints do not exceed joint strengths recommended by the drill string and product pipe manufacturer.
4. List of all underground facilities' owners where notification, coordination, and uncovering arrangements have been arranged, including the contact persons, how contact is made, and any pre-arranged requests of these owners.
5. Description of the drilling mud and component parts; in particular, monitoring mud quality, filtering the mud, and adjusting the mud for filter cake and gel strength needs as the drill head advances and mud conditions indicate.
6. Description of controls to prevent environmental pollution, to stay within environmental constraints where specified in the Contract (such as drilling under bodies of water or in wetlands or in critical habitat area or other area as defined in SMC 25.05.098), and the proposed approach to containing drill waste in the launch and receiving locations or pits. If groundwater is indicated and may exist at the launch or receiving areas, describe proposed treatment facilities and discharge methods.
7. Description of controls to maintain safe working conditions and safe conditions where the public may be at risk, such as at the launch and receiving locations.
8. Any requirements for drilling on a slope, per Section 2-16.3(17).
9. MSDS for all Supplies and materials that may be used.
10. If the proposed bore path is deep to avoid underground utilities, description and locations of permanent ground support systems, underpinnings, and deadman systems, and how the proposed bore path does not interfere with or damage such ground support systems.
11. Copies of all permits required and obtained for the drilling operation if not required by other Specifications.
12. No drilling is allowed until the Engineer has reviewed and returned this submittal, with no requirement for resubmittal.

2-16.3(7) SUBMITTAL – REQUIRED AFTER COMPLETION OF DRILLING

Within 5 Working Days of completing the installation of product pipe in the bore, the Contractor must submit a copy of the daily log and as-built Drawing as specified in Section 2-16.3(20).

2-16.3(8) PRE-DRILL MEETING AND OTHER MEETINGS

Before the Contractor starts directional drilling, and on each day of directional drilling, the Contractor must hold a pre-drill meeting with the drill operator and locator, and the Engineer. Such meeting may include the briefing/tailgate conference with the Electrical Safety Observer as specified in Section 1-05.2(2), and may include other utility owners.

The intent of the meeting is to verbally walk through all elements of the proposed bore path and drilling operation including:

1. Notifications and coordination.
2. Location-specific controls and monitoring.
3. Open communication channels between the driller, Contractor, and Engineer.
4. Required entries to the daily log and updating of the as-built drawings.
5. Ensuring the drilling is conducted safely and is under control.
6. Confirm the actual drilling alignment and profile matches the proposed submitted bore path alignment and profile.
7. Other matters as the Engineer may determine, or as the Contractor may need to know.

2-16.3(9) MONITORING THE BORE

The Contractor must verify to the Engineer that the actual bore path of the drill head follows the proposed bore path in both alignment and profile, that the indicated readings of depth and location of the drill head by the Contractor's locator match the actual location and depth of the drill head as verified by exploratory or other type excavation, and that all underground facilities are identified, their locations confirmed, and the bore path indicates clearances with all underground facilities.

1 Unless the Contract specifies otherwise, the Contractor must make a surface locate reading of the drill head location and
2 depth, and mark the surface directly over the indicated drill head location with the read location and read depth, within the first
3 50 feet of the launch location or pit and at additional locations determined by the Engineer.

4 At locations of active interference and at locations of passive interference, the Contractor must make surface readings of
5 the drill head location and depth, and mark the surface directly over the indicated drill head with the locator indicated location
6 and depth.

7 At any time and at any location, the Engineer may require the Contractor to locate the drill head and read its depth, and
8 mark the surface as specified.

9 At any of these drill head reading locations and as the depth of the drill head may allow, the Engineer may require the
10 Contractor to provide exploratory or other type excavation in advance of the drill head to enable visual verification of the drill
11 head passing through the excavation including verifying drill head depth.

12 Any discrepancy identified, such as the indicated reading of the location or the depth of the drill head differing from the
13 proposed bore path alignment or proposed profile, or the indicated reading of the drill head's location or depth differ from the
14 actual visual verification of drill head location or depth, may be considered defective work or unauthorized work.

15 Directional drilling discrepancies that reasonably appear to create an unsafe or potentially unsafe condition; result in
16 damage or the potential for damage; be in violation of law, regulation, code, or other condition of the Contract; or any other
17 unacceptable condition, may be cause for the Engineer to direct the drilling operation stopped in its entirety.

18 When such a condition occurs, the Contractor must submit a remedy that addresses, as applicable:

- 19 1. Controls or adjustment of controls that indicate the drill head can proceed with the attitude of staying on the proposed
20 alignment and profile.
- 21 2. Correction of the current drill head attitude to return the drill head to the proposed alignment and profile.
- 22 3. Controls or adjustments to locating and tracking equipment ensuring locator indicated drill head location and depth
23 accurately match actual drill head location and depth.

24 If the difference in actual location or depth of the drill head and the proposed alignment and depth of the drill head is
25 significant, and underground facilities are indicated near or in the path of the advancing drill head, then the Contractor may be
26 allowed to propose a corrected bore path alignment and profile from its existing location to return to the submitted bore path
27 alignment and profile, and must indicate both the return location and that the attitude of the drill head at the proposed return
28 location is aligned with the proposed bore path alignment and profile. Such remedy may require additional applicable
29 preparatory work, as necessary, as specified in Section 2-16.3(3) ensuring clearance with all underground facilities.

30 If the difference in actual location or depth of the drill head and the proposed alignment and depth of the drill head is
31 significant, and underground facilities are indicated near or in the path of the advancing drill head, then the Contractor may be
32 allowed to propose pullback and re-drill, see Section 2-16.3(21).

33 The Contractor may resume drilling after the Engineer returns the proposed remedy without requiring resubmittal.

34 Should the Contractor be unable to restart drilling, this is considered defective work.

35 All Contractor located drill head location and depth readings, and actual visually verified depth and location readings,
36 must be shown on the plan and profile Shop Drawing as it relates to the proposed bore path, and must be recorded in the daily
37 log.

38 If and where necessary, the Contractor must also step outside the proposed bore path to aid in making more accurate
39 locate readings of actual depth and actual location of the drill head where interferences exist.

40 **2-16.3(10) LOCATE TRACKING SYSTEM**

41 The drill head locate system must be of the strength and type for tracking, with the greatest confidence, the drill head
42 following the intended bore path alignment and profile, including providing readings in areas of indicated active and passive
43 interferences. The batteries in the transmitter and receiver must be fresh, and of the strength and type required for the
44 conditions expected of the proposed bore path and Project Site conditions. The transmitter at the drill head must be
45 adequately calibrated with the receiver to overcome indicated interferences including obtaining readings that may be required
46 on either side of the bore path where such information increases confidence of the readings.

47 Tracking and locating equipment must be calibrated at the start of each shift, and at the start of each Day.

48 Locator readings, exploratory and other type excavation verification, and the status of batteries and locating equipment,
49 including any repair, must be recorded in the daily log and on the as-built drawings, as applicable, see Section 2-16.3(20).

50 **2-16.3(11) LAUNCH AND RECEIVING LOCATIONS AND PITS**

51 Unless the Contract specifies otherwise, the Contractor must select the locations of the launch, or entry, and the
52 receiving, or exit, locations best suited for the directional drilling operation. Such entry and exit locations may be pits or
53 excavations. If and where necessary, such locations must include:

- 54 1. Adjacent area for safe working zone (Section 2-16.3(19)).
- 55 2. Support, staging, and related needs.
- 56 3. Bend radius considerations (Section 2-16.3(13)).
- 57 4. Bore path alignment and profile, and clearances with existing underground infrastructure (Section 2-16.3(3)).

- 1 5. Depth of the launch pit and the receiving pit to allow for entry and exit angles.
- 2 6. Entry and exit pipe elevation.
- 3 7. Containment of drill waste (spoils), and groundwater treatment and discharge.
- 4 8. Other considerations that may be identified for safe and acceptable performance.

5 **2-16.3(12) MATCH SITE CONDITIONS**

6 The Contractor must match the drill equipment and Supplies to the soils and Project Site conditions.

7 **2-16.3(13) BEND RADIUS**

8 The Contractor must take into consideration the allowable bend radius capabilities of drill string, product pipe, casing pipe
9 when applicable, and the drilling equipment. Bending at any joint of drill string or any pipe must be within that product
10 manufacturer's recommended tolerances.

11 Bend radius must be taken into consideration in proposing the bore path alignment and profile, including expected
12 directional adjustments along bore path. The allowable bend radius of product pipe, of casing pipe when applicable, of drill
13 string, and of drill equipment must be compatible and must not present a condition for overstressing pipe, joint, casing when
14 applicable, drill string, or equipment.

15 **2-16.3(14) PRERREAMING AND BACK REAMING**

16 Prereaming may be necessary to incrementally enlarge a pilot bore to a size to accommodate acceptable product pipe
17 installation. Back reaming enlargement of the bore hole must allow for minimizing frictional resistance during installation of the
18 product pipe, and for allowing removal of spoils while installing the product pipe. Pipe joint tensile and bend strengths must not
19 be exceeded during product pipe installation.

20 **2-16.3(15) DRILLING MUD**

21 The Contractor must maintain and adjust filter cake and gel strength needs; have adequate monitoring equipment and
22 Supplies in-place to clean mud for re-use; amend mud with additives as progress and conditions dictate; and maintain
23 adequate quantity of mud as the bore progresses and as the mud quality indicates.

24 The Contractor must continuously monitor mud quality and spoils content as they relate to filter caking and gel strength.

25 When excessive spoils content in the mud is indicated for a relatively short length of bore progress, the Contractor must
26 note such in the daily log, including the location and depth of the drill head when such condition is noticed, any underground
27 facilities that are near or over or under the drill head, the type spoils or description of spoils to indicate the material being lost,
28 and the date and time of day this occurs. The Contractor must also immediately notify the Engineer of this condition and be
29 prepared to stop the drilling if an excessive loss of soil may have detrimental impacts to surface or other underground
30 improvements. The Contractor must confirm that excessive loss of soil is not occurring or is not adversely impacting any
31 existing facility or improvement.

32 The Contractor must identify locations of frac-outs or uncontrollable loss of mud along the bore path as they are
33 indicated. This information must be entered into the Daily Log and must include location of drill head, depth of drill head, time
34 of day, date, estimated quantity of lost mud, and if a surface loss, methods of containment and cleanup.

35 **2-16.3(16) ENVIRONMENTAL CONTROL**

36 The Contractor must use environmental controls in containing and handling spoils, mud, waste, additives, and other
37 pollutants of any kind that are in compliance with law, code, regulation, and as may be required in the Contract.

38 The Contractor must also have a vector truck on-call and able to respond within very short notice. The vector truck must
39 have a minimum 2 cubic yard storage capacity and adequate ability to extract any drill waste or mud that may appear at any
40 location, at any time, such as a frac out. Other Supplies that absorb and contain mud and other material associated with the
41 drilling must be readily available. Also see Section 1-07.5 for required environmental controls.

42 The Contract may specify additional constraints when proposed drilling is within environmentally critical areas, critical
43 habitat areas, other sensitive areas, and as required by permit.

44 **2-16.3(17) SLOPE DRILLING AND SUBMITTAL REQUIREMENTS**

45 When drilling on slopes, and in particular on landslide prone slopes, the Contractor must have controls in-place to control
46 the flow and release of groundwater and any resulting buildup of hydraulic head, the flow and release of drilling mud and any
47 resulting buildup of hydraulic head, and the influence and control of vibrations resulting from any part of the directional drilling
48 operation and product pipe installation.

49 The Contractor must promptly stop drilling and promptly alert the Engineer of any condition where excessive groundwater
50 is indicated and where the stability of the slope or any part of the slope may become questionable.

51 Unless the Contract specifies otherwise, the Contractor must include a detailed drawing and a description of proposed
52 controls for drilling on the slope in the submittal to the Engineer. This submittal must be delivered before the start of any
53 directional drilling on any slope, and include the following information:

- 54 1. Direction of drilling all pilot holes, any prereaming, and the back reaming – upslope, downslope, or crossing the slope.

- 1 2. Control of drilling mud and groundwater hydraulic head build-up, including preventing the potential for sudden loss of
2 fluid on the slope.
- 3 3. Influence of vibrations generated by any part of the directional drilling operations on the stability of the slope or parts
4 of the slope, including minimizing adverse impacts of vibrations.
- 5 4. Location and type of any temporary subsurface drain installed to assist in the relief of hydraulic build-up.
- 6 5. If drilling uphill, location and type of any controlled outlet installed at the launch location or pit that captures and
7 controls groundwater and drilling mud that may follow the drill string, any required treatment, and discharge methods.
- 8 6. If drilling uphill, drill head lubrication methods.
- 9 7. If drilling downhill, controls for build-up of hydraulic head along the drill string and at the drill head due to drilling mud
10 and any groundwater.
- 11 8. If drilling downhill, methods for removing spoils.
- 12 9. Approach to tracking and verifying drill head location and depth on the proposed bore path alignment and profile, and
13 proposed frequency of locator tracking of the drill head.
- 14 10. Approach to reducing hydraulic head in any and all boring holes where pullback of the drill head has occurred and re-
15 drilling a new bore path is initiated. Also address how the abandoned bore paths is (are) backfilled, how hydraulic
16 head build-up is prevented, and how stability of the slope is maintained, see Section 2-16.3(21).

17 **2-16.3(18) PERSONAL PROTECTIVE EQUIPMENT (PPE)**

18 The Contractor must comply with all applicable safety rules and standards including those recommended by designated
19 and recognized directional drilling and trenchless technology industry organizations. All equipment must be grounded. The
20 operator's station must be electrically isolated and protected. Boots, gloves, and other as necessary clothing must provide
21 protection from potential hazards associated with directional drilling including contact with underground facilities.

22 **2-16.3(19) SAFE WORKING ZONE**

23 The area surrounding the launch location or pit and the receiving location or pit must be secured as a safe working area
24 to protect the public from potential hazards associated with directional drilling.

25 **2-16.3(20) DAILY LOG AND AS-BUILT DRAWING**

26 **2-16.3(20)A GENERAL**

27 The Contractor must keep daily written records of all daily progress and events, and a copy of the proposed bore path
28 updated to reflect the actual bore path in the as-built Drawings.

29 The daily log must be coordinated with and must reference the as-built Drawings, and the as-built Drawings must
30 reference entries in the daily log where appropriate.

31 The daily log and as-built Drawings must be kept at the Project Site and must be made available to the Engineer upon
32 request.

33 See Section 2-16.3(7)C for submittal requirements.

34 **2-16.3(20)B DAILY LOG**

35 Entries to appear in the daily log must be recorded as they occur, or if unable, make a brief entry in the diary stating that
36 additional explanation will be provided at end of Working Day. Typical entries to the daily log must reference entries on the as-
37 built Drawings as applicable and must include, but are not limited to:

- 38 1. Notifications made to utility owners including date notified and a summary of any requirement made by the utility
39 owner beyond a simple notification.
- 40 2. Utility owners' on-site visits including name of individuals, phone and email contact information, date, time of visit, and
41 a summary of any requirement and observation made by the utility owner.
- 42 3. Communications made by utility owners to the Contractor beyond those in items 1 and 2, and a summary of any
43 request made by the utility owner.
- 44 4. Results of any exploratory or other type excavation used to verify location and depth of drill head, for locations shown
45 on the as-built Drawings of locator tracking of the drill head and the indicated depth of drill head at that location, see
46 Sections 2-16.3(9) and 2-16.3(10).
- 47 5. If in an area of active or passive interference: description of the interference, and additional measures used to verify
48 locator indicated drill head location and depth, see Section 2-16.3(5).
- 49 6. For as-built Drawings showing exploratory and other type excavation's location and depth not addressed in preceding
50 item 4: description of the purpose of the excavation and statement of findings. Reference the as-built Drawings where
51 exploratory or other type excavation was used or was required to verify drill head clearance with underground facility,
52 and state results including identifying which underground facility.
- 53 7. Description of mud status, including changes in or adjustments to mud content or quality, and reasons for adjustment.
54 State the distance of the drill head from the launch location or pit where adjustment to mud content was required.

- 1 Also state the location of the drill head when a significant loss of mud is indicated. See Section 2-16.3(15) for daily
2 log entry requirements.
- 3 8. Description of daily progress made. Start with the time of day that drilling starts and list how far drill head advanced at
4 each succeeding hour. Also list time of day of drill head reaching exit location, and state the time of day for items 1, 2,
5 3, 4, 5, and as applicable, 6, 9, and 10 of this Section.
- 6 9. Description of groundwater flowing into any launch or receiving location or pit, and any resulting dewatering, and
7 method of treatment, including discharge or disposal. See Section 2-16.3(11).
- 8 10. If pullback and re-drill was performed: Description of why the condition occurred, reasons for the change bore path,
9 and how the abandoned bore void was filled, including description of void filling material.
- 10 11. Description of prereaming and back-reaming, as applicable, and installation of product pipe. If casing was used,
11 include this in the description, and include a description of annular space filler and how installed, if applicable.
- 12 12. Other information as required by the Engineer (Section 2-16.3(8)), by the Contract, or as may be necessary by the
13 Contractor for documentation purposes.

14 **2-16.3(20)C AS-BUILT DRAWINGS**

15 The as-built Drawing must be the proposed plan and profile bore path alignment and profile and must show existing
16 underground facilities, including their dimension, depth, any appurtenance, and proposed and required clearances.

17 Unless the Contract specifies otherwise, as-built Drawings must be Shop Drawings on 24" x 36" 20 pound bond paper.
18 Horizontal scale must be 1" = 20' and vertical scale must be 1" = 10'. The Contractor may provide a continuous sheet (any
19 length greater than 36 inches) with a 24-inch minimum width and same horizontal and vertical scales.

20 As the bore progresses, the following must be clearly shown on the as-built Drawing, as applicable:

- 21 1. Entrance and exit locations, and details of pits, if used. Identify safe working zones, locations of equipment and
22 Supplies, see Section 2-16.3(11).
- 23 2. Locations of locator tracking of the drill head and the indicated depth of drill head at that location, noting that the
24 surface was marked as specified in Section 2-16.3(9). If exploratory or other excavation was used to verify locator
25 indicated reading, show the location of the exploratory or other type excavation performed in advance of the
26 verification reading. Reference the daily log entry as to status of visual verification.
- 27 3. Locations of active and passive interference, if applicable (Section 2-16.3(5)). Show locations and depth of
28 exploratory or other type excavations verifying locator drill head readings (Sections 2-16.3(9) and 2-16.3(10)).
- 29 4. Locations of underground infrastructure including depth to facility, dimension of facility, special bedding if any , and
30 appurtenances associated with a facility. Clearly identify exploratory or other type excavation locations and depths as
31 required by Section 2-16.3(3).
- 32 5. Exploratory or other type excavation locations and depths that were performed during the drilling. Reference the entry
33 in the daily log, including "pipeline" and "pipeline system."
- 34 6. Proposed bore path alignment and profile (Section 2-16.3(6)C), and actual bore path alignment and profile, if
35 different. Show entry location and exit location angles for product pipe installation including size pipe and invert
36 elevations at entrance and exit locations.

37 If the actual bore path alignment or profile or both differ from as specified in the Contract or as proposed (Section 2-
38 16.3(6)C), the Contractor must show both actual and proposed bore paths and must clearly identify and label each.

39 **2-16.3(21) PULLBACK AND RE-DRILL**

40 Should a condition occur that requires pull back and re-drilling, before attempting any pull back and re-drill, the
41 Contractor must submit to the Engineer: the reasons for pulling back and re-drilling; a procedure for the pull back, describing in
42 detail how the resulting void will be filled with a suitable material; and describe the new bore path alignment and profile.

43 Should the drilling be frozen or a condition arise where progress cannot be made, this is considered defective work or
44 unauthorized work.

45 **2-16.3(22) TESTING**

46 The Contract may specify testing of the installed pipe or conduit, such as a test specified in Section 7-17.3(3).

47 **2-16.4 MEASUREMENT**

48 Measurements for "Casing Pipe, (Material), (Class), (Size), (Directional Drilling)", and for "Pipe, (Material), (Class), (Size),
49 and (Directional Drilling)" is by the linear foot of pipe and casing pipe actually installed and tested. Measurement is from end of
50 pipe to end of pipe whether a pipe end is within a structure or not. No measurement is made for pit whether an entry pit or an
51 exit pit.

52 "Exploratory Or Other Type Excavation, (Directional Drilling)" is per lump sum for all exploratory and other type
53 excavation directly related to directional drilling.

54 **2-16.5 PAYMENT**

- 55 1. "Preparation Required Before Directional Drilling", per lump sum.

1 The Bid Item price for "Preparation Required Before Directional Drilling" includes all costs for the work necessary to
2 perform investigatory requirements including necessary exploratory and other type excavation, and to provide preparations
3 required to complete the information in Section 2-16.3(6)C.

4 2. **"Casing Pipe, (Material), (Class), (Size), (Directional Drilling)"**, per linear foot.

5 The Bid Item price for "Casing Pipe, (Material), (Class), (Size), (Directional Drilling)", per linear foot, includes all costs for
6 the work required to furnish and install casing pipe. All cost for filling the annular space when specified in the Contract are
7 considered incidental to this Bid Item and no separate or additional payment will be made.

8 3. **"Pipe, (Material), (Class), (Size), (Directional Drilling)"**, per linear foot.

9 The Bid Item price for "Pipe, (Material), (Class), (Size), (Directional Drilling)", per linear foot, includes all costs for the
10 work required to directional drill all required by Section 2-16 except for other Bid Items in this Section.

11 4. **"Exploratory or Other Type Excavation, (Directional Drilling)"**, per lump sum.

12 The Bid Item price for "Exploratory or Other Type Excavation, (Directional Drilling)" includes all costs for the work
13 required to perform exploratory or other type excavation to accommodate the requirements of Section 2-16.

14 Payment for exploratory and other type excavation related to preparation required before directional drilling must be
15 included in the Bid Item "Preparation Required Before Directional Drilling" and no separate or additional payment is made.

16 5. **Other payment information**

17 Payment for all cost for the Electrical Safety Observer will be as specified in Section 1-05.2(2).

18 Payment for all cost for backfilling exploratory or other type excavations within paved areas of the Right of Way that are
19 associated with directional drilling are considered incidental to the various Bid Items and no additional or separate payment will
20 be made.

21 Payment for all costs for surface restorations associated with directional drilling will be per the various Bid Items in the
22 Contract.

23 All costs for daily log will be included in the various Bid Items and no separate or additional payment will be made.

24 All cost for submittals are specified in Section 1-05.3

25
26 **END OF DIVISION**
27

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1 **DIVISION 3 PRODUCTION FROM QUARRY AND PIT SITES AND STOCKPILING**

2 **SECTION 3-01 PRODUCTION FROM QUARRY AND PIT SITES**

3 **3-01.1 DESCRIPTION**

4 Section 3-01 describes Work consisting of manufacturing and producing crushed and screened aggregates including pit
5 run aggregates of the kind, quality, and grading specified for use in the construction of Portland cement concrete, asphalt
6 concrete, asphalt treated base, crushed surfacing, maintenance rock, ballast, gravel base, gravel backfill, gravel borrow,
7 riprap, and bituminous surface treatments of all descriptions.

8 These requirements apply whether the source is ledge rock, talus, gravel, sand, or any combination thereof.

9 **3-01.2 MATERIALS**

10 **3-01.2(1) GENERAL SOURCE**

11 **3-01.2(1)A APPROVAL OF SOURCE**

12 Material sources must be approved in advance of use in the Work as specified in the requirements of Section 1-06.

13 **3-01.2(1)B STRIPPING QUARRIES AND PITS**

14 Stripping of quarries and pits consists of the removal, after clearing and grubbing, of the surface material and overburden
15 which is unsuitable for the kind of Material to be borrowed or produced for use. Stripped Materials to be used later, as provided
16 on the Job Site reclamation plan specified in Section 3-03, must be deposited within the quarry or pit site at such a location as
17 not to interfere with future development within the site.

18 **3-01.2(1)C PREPARATION OF SITE**

19 The portion of the quarry or pit site to be used must be cleared and grubbed, and the area from which Materials are to be
20 taken stripped of overburden as specified in Section 3-01.2(1)B. Dispose of all combustible debris resulting from these
21 operations as acceptable to the Engineer.

22 **3-01.2(1)D PRODUCTION REQUIREMENTS**

23 Use all oversize stones, rock fragments, or boulders occurring in the source, up to and including those measuring 18
24 inches in the greatest dimension, in the manufacture of crushed Material.

25 If the grading or quality of raw material in sources used for the manufacture of products covered by this Section is such
26 that the fracture, grading, or quality of the product specified cannot be obtained by using the natural Material, fine portions of
27 the raw material will be rejected to the extent necessary to produce products meeting all requirements of these Specifications.
28 Failure of the Owner to include a scalping requirement in the Contract does not relieve the Contractor of the responsibility for
29 rejecting fine portions of the Material if such becomes necessary to produce products meeting all requirements of these
30 Specifications. Perform scalping after the pit run or quarry run Material has passed through the primary crusher.

31 When scalping over a screen of a specified size is required in the Contract, the scalping screen must be of a size and
32 capacity that it removes enough of the fine material to produce Material as specified.

33 Washing and reclaiming of the reject Material and subsequent addition of this Material to any finished products is not
34 allowed unless specifically authorized in writing by the Engineer.

35 Surplus screenings accumulated during the crushing and screening of specified roadway Materials will be considered
36 separate and distinct from reject Material resulting from scalping operations.

37 Both fine and coarse concrete aggregates must be thoroughly washed to remove clay, loam, alkali, bark, sticks, organic
38 castings, or other deleterious matter. Washing is also required in the production of other Materials if necessary to produce
39 products meeting all quality requirements of these Specifications.

40 When producing screened gravel or sand Materials, remove all oversize Material by screening at the pit site. The
41 Contractor's operations in the pit must be conducted so that the grading of individual loads will be reasonably uniform. In
42 general, use the most suitable Materials available and make as many moves of the loading equipment as may be necessary to
43 fulfill these requirements.

44 Where pit run Materials comply with the requirements of the Specifications, screening or processing is not required.

45 **3-01.2(1)E FINAL CLEANUP**

46 Upon completion of the Contractor's operation, clear the quarry or pit of all rubbish, temporary structures, and equipment,
47 leaving it in a neat and presentable condition. The pit or quarry must be reclaimed per the approved site reclamation plan
48 specified in Section 3-03.

49 **3-01.2(2) CONTRACTOR FURNISHED MATERIAL SOURCE**

50 If the Contractor chooses to provide a source of Materials, or if the Contractor elects to use Materials from other private
51 sources, the Contractor must, at no expense to the Owner, make all necessary arrangements for obtaining the Material and
52 provide evidence that the needed quantity of suitable Material satisfying the requirements of Section 1-06 is available. Use of

1 Materials from such sources is not permitted until representative samples taken by the Engineer have been tested, the source
2 approved, and authority granted for the use. Before the samples are taken by the Engineer, the Contractor must, at no
3 expense to the Owner, have done enough testing of the proposed site to enable the Engineer to obtain a sample that is
4 representative of the Materials in the source.

5 Approval of a Contractor's source is contingent on the Material being of equal quality, and no additional costs will accrue
6 to the Owner as a result of such approval. Equivalency of quality will be based on those test values listed in the Contract as
7 being representative of Material in the Owner pre-approved source. If no such values are listed, the minimum specification
8 requirements will apply.

9 Notify the Washington State Departments of Ecology, Fish and Wildlife and Natural Resources, in writing, of the intent to
10 furnish the source, and at no expense to the Owner, make all necessary arrangements with these agencies for the
11 determinations of regulations which might be imposed on the Contractor during removal of Materials from the source. When
12 the Contractor intends to operate a source under the Owner's blanket surface mining permit, the Contractor must submit a
13 reclamation plan at least 10 Working Days in advance. No work is allowed to start in the pit or quarry before the reclamation
14 plan is approved by the Engineer.

15 The source must be selected so that, after the Materials have been removed, the pit drains to a natural drainage course
16 and no ponding can result. Should the source selected by the Contractor not drain as outlined, the Contractor must obtain
17 written permission from the governing body of the city or county to remove Materials from the pit or quarry, and provide a copy
18 to the Engineer.

19 The Contractor must not operate a pit or a quarry site visible from any State highway unless it can be demonstrated to
20 the complete satisfaction of the Engineer that no unsightly condition will result from or remain as a result of the Contractor's
21 operations. If, in the opinion of the Engineer, unsightly conditions exist after removal of Materials from the site, correct such
22 unsightly conditions as specified.

23 Following removal of Materials from the pit, the entire site must be cleared of all rubbish, temporary structures, and
24 equipment which have resulted from the Contractor's occupancy and operations. Obliterate or screen to the satisfaction of the
25 Engineer any unsightly conditions that remain. Obtain a written release from the permitter upon fulfillment of these
26 requirements. All costs for cleaning up the pit site and for the installation or erection of screening or for other work required to
27 correct unsightly conditions are at the Contractor's sole expense. The requirements of this paragraph do not apply to
28 commercially operated pits.

29 All costs in connection with acquiring the rights to take Materials from the source, for exploring and developing the site,
30 for complying with the regulations of the State agencies, for preparing the Job Site as provided in Section 3-01.2(1)C and
31 Section 3-03, for cleaning up the site, and for correcting unsightly conditions, are included in the Bid Item prices for the various
32 Bid Items of Work involved.

33 The grading and quality of Material must comply with the requirements of Section 9-03 unless the Contract specifies
34 otherwise.

35 **3-01.3 RESERVED**

36 **3-01.4 MEASUREMENT**

37 All crushed, screened, or other quarry Materials will be measured by the tonnage of total weight of Material source minus
38 water which is in excess of naturally occurring amounts.

39 For payment purposes, all crushed, screened, or naturally occurring Materials that are to be paid for by the ton,
40 dependent on their grading, will be limited to the following water contents naturally occurring in the Material source:

| % By Weight Passing U.S. No. 4 | Maximum Water Content % By Weight |
|--------------------------------|-----------------------------------|
| Less than 20% | 4% |
| 20% or more | 8% |

43 **3-01.5 PAYMENT**

44 Unless otherwise specified in the Contract, all costs in connection with the production of Materials meeting the quality
45 requirements of these Specifications are included in the Bid Item prices of the various Bid Items involved and no separate or
46 additional payment will be made.

47 Payment for the particular Materials or aggregates to be produced will be as specified in the appropriate Sections of the
48 Specifications.

1 **SECTION 3-02 RESERVED**2 **SECTION 3-03 SITE RECLAMATION**3 **3-03.1 DESCRIPTION**

4 Section 3-03 describes Work consisting of reclaiming land used for borrowing Material, mining for aggregates, sorting or
5 wasting Materials as specified in the Contract.

6 **3-03.2 GENERAL REQUIREMENTS**7 **3-03.2(1) SITES**8 **3-03.2(1)A CONTRACTOR PROVIDED SITES**

9 All borrow, quarry, and pit sites larger than 3 acres in size of disturbed land, or resulting in pit walls more than thirty feet
10 high and steeper than a 1 horizontal to 1 vertical slope which are owned or furnished by the Contractor, must be reclaimed per
11 the conditions and requirements of an approved operating permit acquired from the Department of Natural Resources. When
12 Material is acquired exclusively for use on this Contract, approval of reclamation plans may be allowed by the Surface Mined
13 Land Reclamation Act of Washington and the rules and regulations adopted by the Department of Natural Resources.

14 When the Contractor obtains an operating permit from the Department of Natural Resources, provide evidence of such
15 approval to the Engineer at least 3 Working Days before any work within the site.

16 Ultimate reclamation plans are not normally required for borrow, quarry, or pit sites not meeting the above criteria or for
17 stockpile waste sites. However, all such sites must be reclaimed to the extent necessary to control erosion and provide
18 satisfactory appearance consistent with anticipated future use.

19 Compliance with the State Environmental Policy Act (SEPA) is required for sites involving more than 100 cubic yards of
20 excavation, or fill, throughout the lifetime of the Job Site unless the local agency in which the project is located establishes a
21 greater amount. Sites involving more than 500 cubic yards of excavation or landfill throughout the lifetime of the Job Site
22 always require compliance with SEPA. Prepare and submit reclamation plans as specified.

23 Under no circumstance will the Contractor be allowed to waste Material within a wetland as defined in Section 1-07.5(8).

24 **3-03.2(1)B OUT OF STATE SITES**

25 All out of State borrow, quarry or pit, stockpile, and waste sites which are furnished by the Contractor exclusively for use
26 on this Contract must be reclaimed per an approved reclamation plan that is in compliance with local area restrictions.

27 **3-03.2(2) RECLAMATION PLANS**28 **3-03.2(2)A PLANS FOR CONTRACTOR PROVIDED SITES**

29 A plan is not required except on specific request for those sources of Material for which the Contractor has obtained a
30 valid surface mining operating permit issued by the Department of Natural Resources and has paid all required fees.

31 If the Contractor elects to apply for an approved reclamation plan, the following requirements apply:

- 32 1. The Contractor must prepare its own plan.
- 33 2. Reclamation plans must be approved in advance of any work within the site.
- 34 3. The Contract will include a list of minimum design requirements which must be considered in preparing reclamation
35 plans. Meet or exceed these minimum requirements for the various types of sites described in the Contract. The
36 Owner may accept or reject reclamation plans.
- 37 4. All Drawings required by the plan must be on reproducible sheets 22" or 24" wide x 36" long in overall dimensions.
- 38 5. The Contractor must submit to the Engineer for approval 6 copies of the reclamation plan, which includes:
 - 39 a. Site boundaries and pertinent topographic features.
 - 40 b. Location of the site. The plan must provide sufficient information to allow the Job Site to be located on quadrangle
41 or county maps.
 - 42 c. Proposed finished ground contours or cross-sections and all final slopes;
 - 43 d. Site drainage; restoration of stream beds.
 - 44 e. Methods by which contaminants are controlled.
 - 45 f. Planned lakes, ponds or other bodies of water which would be beneficial for residential, recreational, game or
46 wildlife purposes.
 - 47 g. Local zoning and planning, if any.
 - 48 h. Type of vegetative cover.
 - 49 i. Proposed stockpiles or buildings.
 - 50 j. Any proposed development of the Job Site which will be affected within 2 years after depletion or abandonment of
51 the site.

- 1 k. A statement of the proposed subsequent use of the land after reclamation and satisfactory evidence that all
- 2 owners of a possessory interest in the land concur with this proposed use.
- 3 l. Any other feature which contributes to the final appearance of the land after restoration measures.
- 4 6. Together with the reclamation plan, submit completed forms SM 2 and SM 6 issued by the Department of Natural
- 5 Resources.
- 6 7. After approval, submit the original tracing of the plan or a reproducible of the plan for all borrow, quarry, and pit sites
- 7 within 10 Working Days of receipt of approval. If the plan is approved as noted, it must be modified by the Contractor
- 8 before submission of the plan to the Engineer.
- 9 8. When the reclamation plan is approved by the Engineer for sites involving more than 3 acres of disturbed land, or
- 10 resulting in pit walls more than 30 feet high and steeper than a 1 horizontal to 1 vertical slope, the Contractor will be
- 11 allowed to operate under an operating permit subject to continuing approval and inspection by the Engineer and the
- 12 Department of Natural Resources.
- 13 9. Complete form SM 3 and forward to the Department of Natural Resources through the Engineer upon completion of
- 14 all seeding and planting.
- 15 Complete form SM 7 and forward to the Department of Natural Resources through the Engineer immediately upon
- 16 completion of mining operations and Job Site reclamation.
- 17 Forms SM 3 and SM 7 are not required on-sites of 3 acres or less of disturbed land and resulting in pit walls 30 feet
- 18 high or less and a 1 horizontal to 1 vertical or flatter slope.
- 19 10. The Engineer will notify the Contractor if environmental requirements must be satisfied. To comply with the
- 20 requirements, the Contractor must furnish a completed environmental checklist in the SEPA guidelines. The SEPA
- 21 checklist will then be reviewed under existing procedures. Any landfill or excavation of 100 cubic yards or less is
- 22 exempt from SEPA requirements.

23 **3-03.3 CONSTRUCTION REQUIREMENTS**

24 **3-03.3(1) EROSION CONTROL**

25 All sites owned or furnished by the Contractor, if specified on a reclamation plan approved by the Engineer, require
26 erosion control as specified in Section 8-01 or landscaping as specified in Section 8-02.

27 **3-03.3(2) DEVIATIONS FROM APPROVED RECLAMATION PLANS**

28 Reclamation of any site which deviates from the approved reclamation plan is not permitted without first revising the
29 approved reclamation plan and obtaining the approval of the Engineer. Allow 5 Working Days review time by the Engineer.

30 **3-03.4 RESERVED**

31 **3-03.5 PAYMENT**

32 For Contractor provided sites, all costs involved in complying with the requirements of an operating permit acquired from
33 the Department of Natural Resources, complying with the requirements of a reclamation plan approved by the Engineer, or
34 with reclaiming sites to the full extent required by the Contract will be included in the costs of other Bid Items of work involved
35 in the Work.

36
37
38

END OF DIVISION

1 **DIVISION 4 BASES**2 **SECTION 4-01 MINERAL AGGREGATES**3 **4-01.1 DESCRIPTION**

4 Section 4-01 addresses Mineral Aggregate. This Work consists of constructing 1 or more layers of Mineral Aggregates
5 on a prepared subgrade per these Specifications and in conformity with the lines, grades, depth, and typical cross-section
6 shown on the Drawings or as established by the Engineer.

7 **4-01.2 MATERIALS**

8 Mineral Aggregate Types must comply with the requirements of Section 9-03. If the Contract allows and if the Contractor
9 proposes to use Mineral Aggregates with recycled aggregates, see Section 4-02.

10 **4-01.3 CONSTRUCTION REQUIREMENTS**

11 Mineral Aggregates must be uniformly spread on the prepared subgrade to the depth, width, and cross-section shown on
12 the Drawings. Unless addressed elsewhere in the Contract, construction methods used must comply with the applicable
13 requirements of Sections 4-04.3

14 **4-01.4 MEASUREMENT**

15 Bid Items of Work completed under the Contract will be measured as provided in Section 1-09.1, Measurement of
16 Quantities, unless otherwise provided for in the Contract or here within.

17 **4-01.5 PAYMENT**

- 18 1. "Mineral Aggregate, (Type)", per ton.
- 19 2. "Mineral Aggregate, (Type)", per cubic yard

20 The Bid Item price for "Mineral Aggregate, (Type)" includes all costs for the work required of furnishing, hauling,
21 stockpiling, placing, grading, and compacting the Mineral Aggregate or accepted crushed substitute.

22 **3. Other payment information**

23 Unless included in other Bid Items for payment, the Bid Item price for backfill for walls includes all costs for the work
24 required by the cubic yard in place as determined by the neat lines shown on the Drawings or Standard Plans less the volume
25 of pipes and Structures greater than 6 inches outside diameter or other minor Structures greater than 1 cubic yard .

26 Unless included in other Bid Items for payment, payment for backfill for foundations, and for drains except behind a wall,
27 includes all costs for the work required by the cubic yard in place as determined by the neat lines shown on the Drawings or
28 the Standard Plans. Payment for minor and local quantities of backfill for drains surrounding weep holes of 1 cubic yard or less
29 will be included in the Bid Item price for concrete in place per Section 6-02.5 and no separate or additional payment will be
30 made.

31 Unless included in other Bid Items for payment, payment for drainage filter layer behind rock facings will be by the Bid
32 Item "Mineral Aggregate, (Type)" by the ton, see Section 2-13.5.

33 Payment for approved changes in the Type of Mineral Aggregate from that specified will be as specified in Section 1-04.3.

34 **SECTION 4-02 MINERAL AGGREGATES WITH RECYCLED MATERIAL**35 **4-02.1 DESCRIPTION**

36 Section 4-02 addresses all Mineral Aggregate with recycled Material and the substitution request for full or partial
37 inclusion of recycled Material. If Mineral Aggregate with recycled Material are not specified per the Contract, the Contractor
38 may submit written request for substitutions per Sections 1-06.1 and 1-05.3. See 4-02.2(2) for substitutions of Mineral
39 Aggregates with recycled Material request requirements.

40 **4-02.2 MATERIALS**

41 Materials must comply with the requirements of the following section:
42

| Material | Section |
|-------------------|--------------|
| Aggregates | Section 9-03 |
| Recycled material | 9-03.16 |

43

44 **4-02.2(1) MATERIALS – WITH RECYCLED AGGREGATES**

45 Mineral Aggregates with recycled Material including recycled Portland cement concrete and recycled asphalt concrete
46 must comply with the submittal requirements of Sections 1-05.3, 1-06.1, and 9-03.16(1).

1 Mineral Aggregates with recycled Material will be referred to or will be specified as Mineral Aggregates (type) R; that is
2 the numerical type followed by the R. If a Mineral Aggregate is specified in the Contract as a type R, it must contain a
3 minimum of 75 percent of the maximum allowable recycled Material as specified in Section 9-03.16 and will be considered a
4 separate Bid Item per the Bid Form. Note that type 1R and type 2R must comply with the requirements of crushed gravel
5 Mineral Aggregates Type 1G and Type 2G (Sections 9-03.9 and 9-03.16).

6 **4-02.2(2) MATERIAL – RECYCLED AGGREGATES SUBSTITUTION REQUEST**

7 The Contractor may submit written request for substitutions per Sections 1-06.1 and 1-05.3. The Contractor may request
8 substitutions of Mineral Aggregates with recycled Material including recycled Portland cement concrete and recycled asphalt
9 concrete meeting the requirements of Section 9-03.16 for Mineral Aggregate (Type) with the exceptions noted for each
10 recycled Material (see Section 4-02.2(1)4-02.2(1)).

11 **4-02.2(2)A SUBMITTAL REQUIREMENTS**

12 See Section 9-03.16(1).

13 **4-02.3 CONSTRUCTION REQUIREMENTS**

14 See Section 4-01.3.

15 **4-02.4 MEASUREMENT**

16 See Section 4-01.4.

17 **4-02.5 PAYMENT**

18 See Section 4-01.5.

19 **SECTION 4-03 RESERVED**

20 **SECTION 4-04 BALLASTING AND CRUSHED SURFACING**

21 **4-04.1 DESCRIPTION**

22 Section 4-04 describes Work consisting of constructing 1 or more courses of crushed aggregate Material on an existing
23 roadway surface, or on a subgrade prepared as specified in the provisions of Section 2-09 in conformity with the lines, grades,
24 depth, and typical cross-sections shown on the Drawings or Standard Plans, as established by the Engineer .

25 This Work also consists of constructing 1 or more layers of gravel base on a prepared subgrade in conformity with the
26 lines, grades, depth, and typical cross-section indicated on the Standard Plans.

27 **4-04.2 MATERIALS**

28 Materials must comply with the requirements in the following Sections:
29

| Material | | Section |
|----------------------|----------------------------------|--------------|
| Dust Palliative | Dust Palliative Oil CMS-2 | Section 9-02 |
| Roadway Ballast | Mineral Aggregate Types 2 and 14 | Section 9-03 |
| Shoulder Ballast | Mineral Aggregate Type 13 | Section 9-03 |
| Base Course | Mineral Aggregate Type 2 | Section 9-03 |
| Crushed Surfacing | Mineral Aggregate Type 1 | Section 9-03 |
| Maintenance Rock | Mineral Aggregate Type 3 | Section 9-03 |
| Sand Filler | Mineral Aggregate Type 11 | Section 9-03 |
| Dust Palliative Sand | Mineral Aggregate Type 6 | Section 9-03 |
| Gravel Base | Mineral Aggregate Type 17 | Section 9-03 |

30
31 The application of dust palliative with or without crushed surfacing is considered an oil mat treatment (Section 4-04). See
32 Section 5-02 for bituminous surface treatment.

33 Crushed gravel may only be used instead of Crushed Rock, Mineral Aggregates Type 1 and Type 2 as a surface ballast
34 course under the following conditions:

- 35 1. Only when specified in the Contract for specific locations or uses; and
- 36 2. Meets the requirements of Section 4-01.

37 Recycled concrete crushed to the requirements of Section 9-03 and proposed for pavement base or subbase where wet
38 conditions do not exist, will be permitted as a substitute for gravel base when approved by the Engineer, and must comply with
39 the requirements of Section 4-01.

1 4-04.3 CONSTRUCTION REQUIREMENTS**2 4-04.3(1) EQUIPMENT**

3 All equipment necessary for acceptable performance of this construction must be on the Project Site and approved by
4 the Engineer before starting Work. If central mix plant methods are used, the central mixing plant must comply with the
5 following requirements:

- 6 1. The cold aggregate feeder must be mechanically operated and adjustable to the extent necessary to provide a
7 uniform and continuous flow of Materials. These Materials must be deposited in an approved mixer with a sufficient
8 amount of water being added to obtain the required density when spread and compacted. The water must be
9 weighed or metered, and dispensed through a device providing uniform dispersion across the mixer.
- 10 2. The mixing plant must be provided with weighing or calibrating devices, feeders, provisions for sampling, and other
11 devices and equipment so designed, coordinated, and operated to produce a uniform mixture, and to allow the
12 sampling of the Materials before and after mixing. The mixer must be kept in good condition, and mixing blades or
13 paddles be of proper size, adjustment, and clearance to provide a positive and uniform mixture at all times.
- 14 3. The capacity of the plant and equipment furnished for the Work must be adequate at all times to provide for efficient
15 and continuous operations as far as practical.

16 The minimum amount and type of heavy equipment considered necessary for the proper execution of this Work must
17 comply with or exceed the following:

- 18 a. One heavy-duty self-propelled grader, of an approved type, equipped with scarifier, broom, and an adjustable blade
19 not less than 8 feet long capable of conforming to the indicated grade.
- 20 b. One 10 ton self-propelled 3-wheel roller, 1 vibratory roller, or 1 pneumatic tired roller. Roller wheels may be weighted
21 if necessary to secure specified weight per linear inch of tire width. Vibratory rollers must comply with the
22 requirements of Section 5-04.3(3)C.

23 Other combinations and types of equipment may be substituted for the above if approved by the Engineer. Additional
24 equipment must be supplied if required by the Engineer. Such equipment includes, but is not limited to, bottom dump hauling
25 equipment with transfer spreading facilities, self-propelled spreading and leveling machines, and spreader boxes equipped
26 with wheels or so constructed as to preclude any damage to the subgrade or underlying courses.

27 The equipment used for the Work is subject to the Engineer's approval.

28 4-04.3(2) SUBGRADE

29 The subgrade must be prepared as specified in Section 2-09 and be approved by the Engineer before placing ballast or
30 surfacing Materials.

31 Gravel base must be uniformly spread on the prepared subgrade to the depth, width, and cross-section shown on the
32 Drawings.

33 4-04.3(3) MIXING

34 Unless otherwise specified in the Contract, the Contractor may use either, or both, of the following described methods:

- 35 1. Central Plant Mix Method: The surfacing Material and water must be mixed in an approved mixing plant as described
36 in Section 4-04.3(1). The completed mixture must be a thoroughly mixed combination of proportioned Materials and
37 water, uniform in distribution of particle sizes and moisture content. A mixture containing water in excess of the
38 proportion established by the Engineer will not be accepted.
- 39 2. Road Mix Method: After Material for each layer of surfacing has been placed, the Material must be mixed until
40 uniform throughout by motor graders or other equipment approved by the Engineer. Add water to facilitate mixing and
41 compacting, in amounts acceptable to the Engineer.

42 4-04.3(4) PLACING AND SPREADING

43 On street areas to be paved with asphalt concrete pavement, place crushed surfacing to a compacted depth of 6 inches.

44 Start spreading of the first course of surfacing or ballasting at points nearest to the point of loading and start successive
45 courses at points farthest from the point of loading. Each course must be constructed continuously from the starting point of
46 the course. The first course of surfacing or ballasting Material must be placed on the entire available subgrade before placing
47 the succeeding course. If the Engineer deems it necessary, a succeeding course must be placed over a section of a previously
48 placed course before the final completion (Physical Completion Date) of that course.

49 Crushed surfacing, base course, and top course must be constructed in layers not to exceed 4 inches in depth. Ballast
50 must be constructed in layers with each layer not to exceed 6 inches in depth.

51 Each layer of surfacing and ballasting Material must be placed and spread by equipment approved for use by the
52 Engineer. The surfacing and ballasting must be spread by any method that results in an even distribution of these Materials on
53 the roadway without perceptible separation in gradation. Spread and screed the Material to a depth and surface uniformity
54 which permits compaction to a reasonably true line, grade, depth, course, and cross-section without further shaping.

1 Should there occur during any stage of the placing and spreading operation a separation of the coarser from the finer
2 Materials, causing, in the opinion of the Engineer, serious lack of uniformity in the grading, the Contractor must immediately
3 change the method of handling the Material to prevent separation.

4 There must be a distance of not less than 1 block nor more than 1/2 mile between the construction of any 2 courses of
5 surfacing or ballast. Use uniform gradations of Mineral Aggregates for surfacing on roadways.

6 Before placing any layer, the preceding layer must be properly bound, and all floating or loose stone removed from the
7 surface.

8 **4-04.3(5) SHAPING AND COMPACTION**

9 Following spreading and shaping of each layer, the layer must be compacted to a minimum 95 percent of the maximum
10 density as specified in Section 2-11 before the next succeeding layer of surfacing or pavement is placed.

11 When necessary, apply a mist or spray of water to replace moisture lost by evaporation should the Engineer determine
12 inadequate moisture is evident. Each completed layer must have a smooth, bound, uniform surface true to the line, grade, and
13 cross-section indicated on the Drawings, or as established by the Engineer.

14 **4-04.3(6) MISCELLANEOUS REQUIREMENTS**

15 The surface of each layer of surfacing Material must be maintained true to line, grade, and cross-section by blading,
16 watering or aerating as required, and rolling until placing the next succeeding course or the final paving surface. The first
17 course of surfacing Material must be placed on all available subgrade before placing the next overlay course. There must be at
18 least 100 feet between the construction of any 2 courses of surfacing or ballast.

19 Should irregularities develop in any layer surface during or after compaction, they must be remedied by loosening the
20 surface and correcting the defects. Then the entire area, including the surrounding surface, must be thoroughly recompactd.
21 The completed surface must be true to line, grade, and crown before proceeding with the surfacing or final paving.

22 **4-04.3(7) WEATHER LIMITATIONS**

23 When, in the opinion of the Engineer, the weather is such that acceptable results cannot be obtained, the Contractor
24 must suspend operations until the weather is favorable. Surfacing materials must not be placed in snow or on a soft, muddy, or
25 frozen subgrade.

26 **4-04.3(8) HAULING**

27 Route hauling equipment over the roadway as to be most effective in the compacting of the surfacing. Hauling over any
28 of the surfacing in the process of construction is not permitted when, in the opinion of the Engineer, hauling adversely impacts
29 the roadway.

30 **4-04.3(9) HOURS OF WORK**

31 See Section 1-08.1(4).

32 **4-04.3(10) SHOULDER BALLAST**

33 The Contractor must not place shoulder ballast until the abutting pavement has been completed. Place shoulder ballast
34 through a spreader box in 1 lift. Processing of the shoulder ballast course on the roadway is not permitted. Compact the
35 aggregate by making a minimum of 3 passes with a vibratory compactor of a type acceptable to the Engineer. The density
36 requirements of Section 4-04.3(5) do not apply.

37 **4-04.3(11) APPLICATION OF DUST PALLIATIVE**

38 Completed crushed rock surfacing courses must be given 2 or more applications of dust palliative oil. Dust palliative oil
39 must be CMS 2 and be uniformly applied by an approved pressure type distributor at the rate of 0.3 gallons of oil per square
40 yard of surface to be treated. Do not apply succeeding applications of dust palliative oil until the preceding application has
41 thoroughly dried.

42 Do not apply dust palliative oil on a wet surface nor when the temperature is below 60 °F.

43 Provide and place Mineral Aggregate Type 6 sand on newly oiled streets to prevent tracking of oil onto adjacent
44 surfaces. Apply additional sand as necessary to areas where oil remains on the surface due to poor surface penetration.

45 **4-04.3(12) RESURFACING OF OIL MAT AND GRAVEL STREETS**

46 The surface of existing oil mat and graveled streets must be scarified and bladed to a minimum width of 21 feet, unless
47 indicated otherwise in the Contract, until it has a uniform grade and cross-section with a 3-inch to 5-inch crown at the center
48 line. Do not attempt to apply oil to the street surface disturbed by construction operations without first scarifying and blading
49 the entire roadway. Preparation work on the street surface must produce a smooth, crowned surface, without residual ripples,
50 ridges, or irregularities as determined by the Engineer. All stones, lumps, broken concrete or asphalt, bricks, or other
51 deleterious material that will not pass a 3-inch standard sieve size must be removed. All wood, peat, organic matter, or other
52 deleterious matter must also be removed before the application of the crushed surfacing. In shaping the existing surfacing, all
53 Material that may have been displaced by traffic, or by other means, must be bladed into the newly formed surfacing section.

1 Apply crushed surfacing, Mineral Aggregate Type 1 only after the newly prepared street surface has been approved by
 2 the Engineer. Spread crushed surfacing to a minimum depth of 2 inches by any method that results in an even distribution of
 3 the Material on the roadway without perceptible separation in gradation. Where separation does occur, it must be corrected as
 4 specified in Section 4-04.3(4). During or after spreading operations, shape the newly spread crushed surfacing by blading to
 5 conform to the depth, line, grade, and cross-section indicated on the Drawings. The Contractor must comply with the
 6 requirements of Section 1-07.5 regarding the control of dust and pollutants.

7 After final grading has been completed and approved by the Engineer, apply dust palliative oil as specified in Section 4-
 8 04.3(11). Before opening the newly oiled streets to traffic, place warning signs at locations on all routes leading to the freshly
 9 oiled roadways, saying "Caution Fresh Oil." Signs must be of a size and Material with adequately sized lettering and bordering
 10 meeting the requirements for Warning Signs in the City of Seattle Traffic Control Manual for In Street Work. Signs must remain
 11 at the locations until the oiled roadway is accepted by the Engineer. No Parking signs, if used, must be removed at the end of
 12 day where areas have been covered with rock, see Section 1-07.23 and Section 1-10.

13 4-04.4 MEASUREMENT

14 Crushed rock surfacing, top course and base course; ballast; and gravel base will be measured by the ton.

15 "Mineral Aggregate, (Type)" for gravel base will be measured by the ton.

16 4-04.5 PAYMENT

17 1. "Dust Palliative", per gallon

18 The Bid Item price for "Dust Palliative" includes all costs for the work required to furnish and place dust palliative.

19 2. Other payment information

20 Payment for Mineral Aggregate of the Type specified is as specified in Section 4-01.5.

21 If the Engineer directs the Contractor to change the Type of Mineral Aggregate from that specified, then any change in
 22 payment resulting from the change will be as specified in Section 1-09.4. Additional payment for Contractor requested
 23 changes in Mineral Aggregate Type which are approved by the Engineer will not be made.

24 SECTION 4-05 FULL DEPTH ASPHALT PAVEMENT RECYCLING

25 4-05.1 DESCRIPTION

26 Section 4-05 describes Work consisting of recycling existing pavement by a technique in which existing full depth asphalt
 27 pavement and a predetermined portion of the underlying Materials are pulverized, blended, mixed, and compacted resulting in
 28 a uniformly mixed base course. Increased stabilization is obtained by mixing with additives. A final wearing surface of asphalt
 29 concrete follows, as specified in Section 5-04.

30 4-05.1(1)A SUBMITTAL

31 At least 10 Working Days before intended use, the Contractor must submit a mix design to the Engineer as specified in
 32 Section 1-05.3. This mix design must indicate the amount of each additive applied per square yard of pulverized surface area
 33 to obtain the desired mix proportion with the pulverized Materials to the depth indicated on the Drawings. Laboratory analyses
 34 and the locations of sample borings in the area to be treated will be provided in the Contract.

35 4-05.2 MATERIALS

36 Materials must comply with the requirements of the following sections:

| Material | Section |
|-------------------|--------------|
| Portland Cement | Section 9-01 |
| Asphalt Emulsion | Section 9-02 |
| Mineral Aggregate | Section 9-03 |
| Water | Section 9-25 |

38 Lime must be a hydrated (not agricultural) lime.

40 4-05.3 CONSTRUCTION REQUIREMENTS

41 4-05.3(1) EQUIPMENT

42 The Contractor has the option to use whatever equipment can effectively pulverize and blend the Materials. The
 43 equipment must be capable of introducing liquid additives uniformly and accurately.

44 The mixing equipment must be equipped with a foot per minute indicator which is integral with the variable speed pump
 45 controller ensuring that asphalt emulsion can be added only when the machine is moving.

1 The metering system must include a totalizer so that the amount of asphalt emulsion used during any given period can
2 be read directly, and must also include a gallons per minute gauge to indicate the instantaneous flow rate during the mixing
3 operation.

4 Equipment acceptable to the Engineer for both pulverizing and mixing is the CMI RS 500 Reclaimer / Stabilizer or
5 approved equal.

6 The compaction equipment must be a vibratory roller compactor weighing a minimum 15 tons.

7 **4-05.3(2) CONSTRUCTION METHOD**

8 **4-05.3(2)A REMOVAL OF OBSTACLES**

9 Before the asphalt pavement reclamation process starts, existing utility castings within the pavement area to be
10 reclaimed must be temporarily removed and the opening securely covered so that the pavement reclamation process does not
11 adversely impact the existing utility and the existing utility does not adversely impact the reclamation equipment. Existing utility
12 castings which cover any Structure connected to the SPU water distribution or water transmission system require the
13 notification specified in Section 1-07.28 item 5. The depth of removal must provide adequate unobstructed clearance between
14 the top of the temporary utility cover and the existing pavement surface to accommodate the pavement reclamation operation.
15 The temporary cover for the utility opening must have sufficient strength and be adequately secured to the exposed utility
16 opening to withstand the stresses of the reclamation process. The location of existing utilities which have had castings
17 removed and then covered must be surveyed so that after reclamation, the covered utility can be located and reinstalled to
18 finished grade.

19 Remove all other obstacles identified on the Drawings as necessary.

20 See Sections 1-07.16(1) and 1-07.28 item 17 regarding the survey monumentation, witness monument,
21 remonumentation, and notifications required.

22 **4-05.3(2)B PULVERIZATION**

23 Pulverize and blend the existing pavement and base Material to the depth shown on the Drawings so the entire mass of
24 Material is uniformly graded. The pulverized Material must have a minimum 95 percent passing the 1-1/2 inch sieve size.
25 Material gradation may vary due to local aggregates and conditions; however, acceptance of the pulverized Material is based
26 on visual inspection by the Engineer. Remove all rock larger than 3 inches and all deleterious material as defined in Section 9-
27 03.1. The pulverizing operation must be completed before the mixing operation. If any pulverized section will be temporarily
28 opened to traffic, first shape and compact it as approved by the Engineer.

29 **4-05.3(2)C ADDITIVES, MIXING AND COMPACTING**

30 If Portland cement or lime is required as an additive to the emulsion treated base, lightly dust it onto the pulverized
31 surface at a uniform rate of application. Apply any Portland cement or lime before the application of asphalt emulsion and the
32 mixing operation.

33 The emulsified asphalt must be uniformly distributed and mixed with the pulverized Material and any imported Material as
34 specified. The mixing operation may be accomplished by using either the same equipment used for the pulverizing operation
35 or a separate machine designed for in place continuous mixing. Regardless of which method is used, use a positive
36 displacement variable speed pump and control system capable of metering the emulsion application rate to 1/10 of a gallon
37 per square yard .

38 The application rate of the emulsified asphalt is expressed in gallons per square yard. This rate must be calculated from
39 the designated percent of emulsion based on the dry unit weight of the unmixed in place Material as determined by the
40 Engineer.

41 Completed the mixing operation in continuous segments. Each segment must be processed and compacted by the end
42 of each Day and be ready to open to traffic.

43 Density of the compacted Material acceptable to the Engineer will be determined as follows:

44 After each pass of the vibratory roller, nuclear densometer readings of the compacted Material will be taken to the depth
45 indicated on the Drawings. These nuclear densometer readings will be taken at several locations so as to determine a
46 relationship indicating "Measured Density" vs. "Number of Passes" of the vibratory roller. When the change in density readings
47 between successive passes of the roller at a given test location increases by less than 2 percent of the previous density
48 reading at that same location then the compaction of the Material at that location is considered acceptable.

49 **4-05.3(2)D FINAL SURFACE PREPARATION**

50 Allow the emulsion treated base to cure for a minimum of 10 Days before the application of the wearing surface. The
51 length of time necessary for proper curing may vary dependent on the weather and environmental conditions.

52 **4-05.4 MEASUREMENT**

53 Measurement for "Reset Casting for Pavement Recycling" will be per each.

54 Measurement for "Full Depth Pavement Recycling" will be by the square yard of existing asphalt pavement pulverized, to
55 the depth and within the limits specified on the Drawings.

1 Measurement for "Portland Cement for Pavement Recycling" will be by the ton of Portland cement applied to the surface
2 of pulverized pavement as specified.

3 Measurement for "Lime for Pavement Recycling" will be by the ton of hydrated lime applied to the surface of the
4 pulverized pavement as specified.

5 Measurement for "Emulsified Asphalt for Pavement Recycling" will be by the ton of emulsified asphalt used during the
6 mixing process as specified.

7 **4-05.5 PAYMENT**

8 1. "Reset Casting for Pavement Recycling", per each

9 The Bid Item price for "Reset Casting for Pavement Recycling" includes all costs for the work required to temporarily
10 remove utility casting and sufficient upper portion of collar and leveling material as necessary; securely place a temporary
11 cover, and replace permanent casting, and collar and leveling material.

12 2. "Full Depth Pavement Recycling", per square yard

13 The Bid Item price for "Full Depth Pavement Recycling" includes all costs for the work required to furnish the equipment
14 and pulverize the existing asphalt pavement to the depth and to the limits indicated on the Drawings, to apply and mix the
15 additives to the depth indicated on the Drawings; to grade, shape and compact; and apply fog seal. The application of water as
16 necessary, will be considered incidental to this Bid Item and no separate payment will be made.

17 3. "Portland Cement for Pavement Recycling", per ton

18 The Bid Item price for "Portland Cement for Pavement Recycling" includes all costs for the work required to furnish and
19 apply the Portland cement to the pulverized surface.

20 4. "Lime for Pavement Recycling", per ton

21 The Bid Item price for "Lime for Pavement Recycling" includes all costs for the work required to furnish and apply the
22 lime to the pulverized surface.

23 5. "Emulsified Asphalt for Pavement Recycling", per ton

24 The Bid Item price for "Emulsified Asphalt for Pavement Recycling" includes all costs for the work required to furnish and
25 apply the emulsified asphalt.

26 **SECTION 4-06 ASPHALT TREATED BASE**

27 **4-06.1 DESCRIPTION**

28 **4-06.1(1) GENERAL**

29 Section 4-06 describes Work consisting of 1 or more courses of asphalt treated base placed on the subgrade per these
30 Specifications and in conformity with the lines, grades, thickness, and typical cross-sections specified in the Contract.

31 **4-06.1(2) DEFINITION**

32 Asphalt Treated Base (ATB): a compacted course of base Material which has been weatherproofed and stabilized by
33 treatment with an asphalt binder.

34 **4-06.2 MATERIALS**

35 Materials must comply with the requirements of the following Sections:
36

| Material | Section |
|-------------------------|--------------|
| Asphalt | Section 9-02 |
| Anti-stripping Additive | Section 9-02 |
| Aggregates | Section 9-03 |

37
38 The grade of paving asphalt must be PG 64-22 meeting the requirements of Section 9-02.1(4).

39 **4-06.3 CONSTRUCTION REQUIREMENTS**

40 **4-06.3(1) ASPHALT MIXING PLANT**

41 Asphalt mixing plants for asphalt treated base must comply with the following requirements:

- 42 1. Heating: The plant must be capable of heating the aggregates to the required temperature.
- 43 2. Proportioning: The mixing plant must be capable of proportioning the aggregates to comply with the specified
44 requirements, and of producing asphalt at the rate specified by the Engineer. If the aggregates are supplied in 2 or
45 more sizes, means must be provided for proportioning or blending the different sizes of aggregates to produce
46 Material meeting the specified gradation and other requirements.

1 3. Mixing: The mixer must be capable of producing a homogeneous mixture of uniformly coated aggregates meeting the
2 specified requirements.

3 **4-06.3(2) PREPARATION OF AGGREGATES**

4 Aggregates for ATB must be heated to a temperature between the limits of 350 °F and 375 °F, unless the Contract
5 specifies otherwise.

6 **4-06.3(2)A MIX DESIGN**

7 The mix design requirements for asphalt treated base must be as specified in the Contract.

8 **4-06.3(3) HEATING OF ASPHALT MATERIAL**

9 Heating of asphalt Material at the mixing plant must comply with Section 5-04.3(2).

10 Heating of asphalt binder must comply with Section 5-04.3(5).

11 **4-06.3(4) MIXING**

12 Mix asphalt treated base as specified in the Contract.

13 **4-06.3(5) HAULING EQUIPMENT**

14 Hauling equipment for asphalt treated base must comply with Section 5-04.3(3)A.

15 **4-06.3(6) SPREADING AND FINISHING**

16 **4-06.3(6)A GENERAL**

17 The machine that spreads the ATB must be equipped with a stationary, vibratory, or oscillating screed or cut off device,
18 subject to the approval of the Engineer. The Engineer's approval of the equipment will be based on a demonstration that the
19 finished product meets all requirements specified. Automatic controls are not required.

20 The temperature of the mixture when compaction is achieved must be at least 185 °F.

21 When the total depth of ATB exceeds 3 inches, the ATB Material must be placed in 2 or more equal courses with each
22 not to exceed 3 inches in thickness.

23 **4-06.3(6)B SUBGRADE PROTECTION COURSE**

24 Place the first course of ATB as a protection for the prepared subgrade as soon as possible after the subgrade has been
25 completed.

26 The surface of the subgrade protection layer when constructed on a grading project must conform to grade and
27 smoothness requirements that apply to the subgrade on which it is placed.

28 **4-06.3(6)C FINISH COURSE**

29 The final surface course of the asphalt treated base, except shoulders, must not deviate at any point more than 3/8 inch
30 from the bottom edge of a 10-foot straight edge laid on the surface in any direction on either side of the roadway crown.
31 Failure to comply with this requirement will require corrective measures acceptable to the Engineer to achieve the required
32 tolerance, at no expense to the Owner.

33 When placing Portland cement concrete pavement on asphalt treated base, ensure a surface tolerance of the asphalt
34 treated base such that no elevation lies above the plan grade minus the specified plan depth of Portland cement concrete
35 pavement. Before placing the Portland cement concrete pavement, bring any such irregularities to the required tolerance by
36 grinding or other means approved by the Engineer.

37 **4-06.3(7) COMPACTION AND DENSITY**

38 The method of compaction must be as specified in Section 5-04.3(9).

39 The density of the asphalt treated base must be at least 80 percent of the maximum theoretical density established for
40 the mix by WSDOT Test Method 705. The frequency of these tests is at the discretion of the Engineer, but will in no case be
41 less than 1 control lot for each normal Day's production. The use of equipment which results in damage to the Materials or
42 produces defective work is not permitted.

43 **4-06.3(8) ANTI STRIPPING ADDITIVE**

44 Add an anti-stripping additive (Section 9-02.4) to the asphalt Material when directed by the Engineer.

45 **4-06.4 MEASUREMENT**

46 Asphalt treated base will be measured by the ton.

47 **4-06.5 PAYMENT**

48 1. "Pavement Base, Asphalt Treated (ATB)", per ton

1 The Bid Item price for "Pavement Base, Asphalt Treated (ATB)" includes all costs for the work required in Section 4-06
 2 and not otherwise provided for separately and necessary to furnish and construct the asphalt treated base on a prepared
 3 subgrade to the lines, grades, and cross-sections required.

4 2. "Anti Stripping Additive", payment will be as specified in Section 1-09.4

5 3. **Other payment information**

6 Payment for roadway excavation and subgrade preparation including excavation and disposal of unsuitable Material is
 7 per applicable Sections.

8 **SECTION 4-07 FULL DEPTH PAVEMENT RECLAMATION**

9 **4-07.1 DESCRIPTION**

10 Section 4-07 describes Work consisting of pulverizing the existing asphalt concrete pavement and a portion of the
 11 underlying base Material to the depth and width indicated on the Drawings; grading the pulverized roadway in reasonably
 12 close conformance with the slopes and the grades indicated on the Drawings; adding Portland cement and water at the
 13 specified rates; in place mixing of the pulverized roadway Materials and additives to the depth specified; regrading per the
 14 slopes and grades indicated on the Drawings; and compacting the mixed stabilized base as specified. Do not mix a portion of
 15 the bottom section of pulverized base Material with Portland cement.

16 **4-07.1(1) SUBMITTAL**

17 At least 10 Working Days before intended use, submit a mix design to the Engineer as specified in Section 1-05.3. This
 18 mix design must indicate the amount of each additive applied per square yard of pulverized surface area to obtain the desired
 19 mix proportion with the pulverized Materials to the depth indicated on the Drawings. Locations of borehole soil samples taken
 20 within the existing area of proposed pavement reclamation, and descriptions of sampled soils will be provided in the Contract.

21 **4-07.2 MATERIALS**

22 Materials must comply with the requirements of the following Sections:

| Material | Section |
|---------------------------------|--------------|
| Portland Cement | Section 9-01 |
| Aggregate | Section 9-03 |
| Joint Filler and Sealants | Section 9-04 |
| Curing Materials and Admixtures | Section 9-23 |
| Water | Section 9-25 |

25 **4-07.3 CONSTRUCTION REQUIREMENTS**

26 **4-07.3(1) EQUIPMENT**

27 Equipment acceptable to the Engineer for both pulverizing and mixing is the CMI RS 500 Reclaimer / Stabilizer or
 28 approved equal. Submit information describing the equipment to be used for this Work at least 5 Working Days in advance.

29 The compaction equipment must be a vibratory roller compactor weighing a minimum 15 tons.

30 **4-07.3(2) CONSTRUCTION METHOD**

31 **4-07.3(2)A PULVERIZING**

32 Pulverize existing pavement and underlying base course Materials to the width and depth indicated on the Drawings.
 33 Make as many passes as necessary to blend all pulverized Materials to the width and depth indicated on the Drawings. The
 34 blended Material must conform to the following gradation:

| Sieve Size | Percent Passing (by weight) |
|---------------------------|-----------------------------|
| 1-1/2 Inch Square Opening | 100 - 96% |

36
 37 Acceptance of the gradation is based on visual inspection of the Engineer. The blended Material must be shaped and
 38 rolled to allow for temporary use of traffic as necessary. Continue shaping until a uniform roadway section is developed. The
 39 surface must be within ± 0.10 feet of the finished grade and the Materials must have a uniform and consistent gradation.
 40 Remove and dispose of all rocks larger than 3 inches and all other deleterious Material.

1 4-07.3(2)B DISTRIBUTING ADDITIVES

2 After the pulverizing and initial shaping and rolling operations are completed, place additives on the roadway surface for
 3 mixing with underlying roadway Materials to the depth indicated on the Drawings. Distribute the Portland cement onto the
 4 prepared roadway surface at a rate to obtain the approved mix design proportions. Blend the roadway surface applying water
 5 at a rate so that the mixed Material does not exceed the optimum moisture content by more than 2 percent.

6 Portland cement and water must not be placed so far ahead of the mixing equipment such that the soil cement pavement
 7 base cannot be mixed, graded, and compacted within 90 minutes after placement of the Portland cement and water. Traffic is
 8 not permitted on the treated surface for a minimum of 3 Days to allow for curing.

9 See Section 2-12 regarding watering except payment for water is as specified in Section 4-07.5.

10 4-07.3(2)C MIXING

11 The mixing operation must consist of thoroughly blending the distributed additives with the pulverized Materials to the
 12 total combined depth indicated on the Drawings. The mixing equipment must be the same equipment used for the pulverizing.
 13 Additional additives or cross mixing or both may be required, as determined by the Engineer, to localized areas to achieve a
 14 property mixed base. Remove all rocks and Material larger than 3 inches that are exposed by the mixing operation. Traffic is
 15 not permitted on the treated surface for a minimum of 3 Days to allow for curing.

16 4-07.3(2)D FINAL GRADING, COMPACTING, AND CURING

17 The mixed and stabilized roadway Material must be final graded and compacted within 90 minutes after the addition of
 18 Portland cement and water. The finished grade is shown on the Drawings.

19 Density of the compacted soil cement acceptable to the Engineer is determined as follows:

20 After each pass of the vibratory roller, a nuclear densometer reading of the compacted Material will be taken to the depth
 21 indicated on the Drawings. These nuclear densometer readings will be taken at several locations so as to determine a
 22 relationship indicating Measured Density vs. Number of Passes of the roller. When the change in density readings between
 23 successive passes of the roller at a given test location increases by less than 2 percent of the previous density reading at that
 24 same location, then the compaction of the Material at that location is considered acceptable.

25 Allow the completed base course to cure for a minimum of 3 Days before allowing traffic access. Do not allow the
 26 compacted soil cement to dry. A water truck or any other method of supplying water may be used to keep the finished surface
 27 moist and prevent loss of moisture from the treated Material. Apply a tack coat as soon as practical after final compaction as
 28 specified in Section 5-04.3(4)B4. Apply the HMA Class asphalt wearing course as soon as practicable after the 3 Day curing
 29 period and before opening the treated pavement to traffic.

30 4-07.3(2)E PATCHING AND CORRECTION OF DEFECTS

31 Any areas in the completed and stabilized base which appear non-uniform in any way including: segregation of
 32 aggregates, insufficient or excessive Portland cement or water, insufficient compaction, or an improper surface tolerance must
 33 be removed and reprocessed, or replaced at the Engineer's direction.

34 4-07.4 MEASUREMENT

35 Measurement for "Full Depth Pavement Reclamation" will be by the square yard.

36 Measurement for "Portland Cement for Pavement Reclamation" will be by the ton.

37 Measurement for "Water" will be by the 1,000 gallons (Mgal).

38 4-07.5 PAYMENT

- 39 1. "Full Depth Pavement Reclamation", per square yard

40 The Bid Item price for "Full Depth Pavement Reclamation" includes all costs for the work required to perform full depth
 41 Pavement reclamation, except for the cost of Portland cement and water as provided in this Section. Payment for the tack coat
 42 is considered incidental to the Bid Item "Full Depth Pavement Reclamation" and no separate or additional payment will be
 43 made.

- 44 2. "Portland Cement for Pavement Reclamation", per ton

45 The Bid Item price for "Portland Cement for Pavement Reclamation" includes all costs for the work required to furnish
 46 and apply Portland cement as specified in Section 4-07.

- 47 3. "Water", per 1,000 gallons (Mgal)

48 The Bid Item price for "Water" includes all costs for the work required to furnish and apply the water as specified in
 49 Section 4-07.

- 50 4. Other payment information

51 All costs associated with obtaining a hydrant use permit are considered incidental to the various Bid Items comprising the
 52 Work and no separate or additional payment will be made, see Section 2-12.5.

53

54

END OF DIVISION

1 **DIVISION 5 SURFACE TREATMENTS AND PAVEMENTS**

2 **SECTION 5-01 SUBSEALING**

3 **5-01.1 DESCRIPTION**

4 Section 5-01 describes filling voids under existing cement concrete pavement and rigid base asphalt pavements by
5 pumping a mixture of Portland cement, pozzolan, or fly ash, and water under the pavement slabs.

6 **5-01.2 MATERIALS**

7 Materials must comply with the requirements of the following Sections:
8

| Material | Section |
|--|-----------------|
| Portland Cement and Blended Hydraulic Cement | Section 9-01 |
| Pozzolans (Fly Ash & Ground Granulated Blast Furnace Slag) | 9-23.6 & 9-23.7 |
| Water | Section 9-25 |

9

10 **5-01.3 CONSTRUCTION REQUIREMENTS**

11 **5-01.3(1) PROPORTIONING MATERIALS**

12 The standard mix design for subsealing is:
13

| Portion | Material |
|------------------------|----------------------------------|
| 1 part (by volume) | Portland cement Type I or II |
| 3 parts (by volume) | Pozzolan (natural or artificial) |
| 2.25 parts (by volume) | Water |

14

15 Any deviation from the above mix design requires Engineer approval. The Contractor may vary the water content as
16 required for local conditions.

17 **5-01.3(2) EQUIPMENT**

18 All equipment used in performance of subsealing is subject to Engineer approval and must be maintained in satisfactory
19 working condition at all times.

20 Air compressors used for operating air hammers and blowing air into the cavities beneath the pavement must be of
21 sufficient size and capacity for acceptable performance.

22 Rotary hammers or rock drills must be equipped with drills capable of cutting 1-1/2-inch diameter holes through the
23 pavement. The equipment must be in good working condition and operated in such a manner that no non-round holes are
24 produced.

25 The grout equipment must consist of a cement injection pump and a high speed colloidal mixing machine. The colloidal
26 mixing machine must operate at a minimum speed of 1,200 rpm and must consist of a rotor operating in close proximity to a
27 stator, creating a high shearing action and subsequent pressure release to make a homogeneous mixture.

28 The dry Material must be accurately measured and the water must be batched through a meter or scale with a totalizer
29 for the day's consumption.

30 Provide wooden cylindrical plugs or other Engineer approved devices to temporarily plug the application holes until the
31 Material has set. Plugs must be slightly tapered on one end for ease in driving.

32 **5-01.3(3) CONSTRUCTION**

33 The Contractor must not start subsealing when the pavement is wet, or when water is present under the pavement. Drill
34 application holes through the cement concrete pavement in the approximate pattern shown on the Drawings.

35 Application holes must be approximately 1-1/2 inches in diameter and must be perpendicular to the pavement surface.
36 Do not drill more holes in a day than can be filled or temporarily plugged during the same day. To prepare the cavity for
37 injection of the subsealing mix Materials, blow compressed air through the application holes for not less than 15 seconds and
38 not more than 60 seconds. After the application holes are blown out and the nozzle is firmly wedged into the hole, pump the
39 subsealing mix into the application hole until all cavities are filled, or until any of the following occurs:

- 40 1. A pavement slab or portion of a slab starts to rise.
- 41 2. Subsealing mix extrudes from adjacent application holes, or along or outside the longitudinal edges of the pavement.
- 42 3. The Engineer orders application of subsealing mix stopped.

1 Immediately upon removal of the nozzle, insert the plug and drive firmly into the application holes.

2 Following the application and after the mix has set, remove the wooden plugs and immediately fill the application holes
3 with subsealing mix, continuing progressively through all pavement that was previously subsealed.

4 Do not allow traffic on any subsealed area until the subseal has hardened.

5 In the event the Engineer determines that continued injection at any specific location is no longer economically feasible,
6 the Contractor must stop operations and move to a new location.

7 **5-01.4 MEASUREMENT**

8 Measurement for "Pavement Subseal" will be by cubic foot of dry Materials used before the addition of water or other
9 additives.

10 Measurement for "Drill Hole for Subsealing" will be by each hole drilled completely through the pavement.

11 **5-01.5 PAYMENT**

12 1. "Drill Hole for Subsealing", per each.

13 The Bid Item price for "Drill Hole for Subsealing" includes all costs for the work required to drill the holes.

14 2. "Pavement Subseal", per cubic foot.

15 The Bid Item price for "Pavement Subseal" includes all costs for the work required to complete the subsealing.

16 **SECTION 5-02 BITUMINOUS SURFACE TREATMENT**

17 **5-02.1 DESCRIPTION**

18 **5-02.1(1) GENERAL**

19 Section 5-02 describes constructing a single or multiple course bituminous surface by treating existing crushed rock,
20 screened gravel, or bituminous roadway surfaces with liquid asphalt and covering with a Mineral Aggregate thoroughly
21 cemented to the roadway to obtain a wearing surface with good riding and nonskid qualities.

22 Roadway surfaces are classified as treated or untreated roadway surfaces as defined in Section 5-04.3(4)A.

23 Bituminous surface treatment method is Class B unless specified otherwise in the Contract.

24 Bituminous surface treatment is not considered "oil mat surface," see Section 4-04.

25 **5-02.1(2) BITUMINOUS SURFACE TREATMENT CLASS A**

26 This method of treatment requires 2 applications of asphalt and 3 applications of aggregate. The second application (tack
27 coat) must be applied after the first application of prime coat has cured and all loose aggregate has been removed.

28 **5-02.1(3) BITUMINOUS SURFACE TREATMENT CLASSES B, C, AND D**

29 These methods require placing 1 application of asphalt and 1 or more sizes of aggregate, as specified, on an existing
30 asphalt roadway to seal and rejuvenate the surface and to produce a uniform roadway surface with good nonskid
31 characteristics.

32 **5-02.2 MATERIALS**

33 Materials comply with the requirements of the following Sections:

34

| Material | Section |
|-------------------------|----------------|
| Asphalt | Section 9-02 |
| Anti-Stripping Additive | Section 9-02.4 |
| Mineral Aggregates | Section 9-03 |

35

36 The grade of asphalt must be Cationic Emulsified Asphalt (CRS 2) meeting the requirements of Section 9-02.1(6).

37 Mineral Aggregate for Bituminous Surface Treatment Class A or Class B must be Mineral Aggregate Type 24, Chip
38 Rock, meeting the requirements of Section 9-03.

39 When cutback asphalts are specified for Bituminous Surface Treatment Class A, construction must not start until the
40 need for anti-stripping additive has been determined. The Contractor must allow a minimum of 7 Working Days after the SPU
41 Materials Laboratory has received samples of the Mineral Aggregate, asphalt, and anti-stripping additive for testing. The
42 Engineer will require additional time to verify acceptable performance and compatibility if the Contractor has requested more
43 than 1 source of asphalt or anti-stripping additive be approved. Take this into consideration in preparing for and meeting
44 Contract Time.

1 5-02.3 CONSTRUCTION REQUIREMENTS**2 5-02.3(1) EQUIPMENT**

3 The Contractor's equipment includes scarifying, mixing, spreading, finishing, and compacting equipment; an asphalt
4 distributor; and equipment for heating asphalt Material, all of which are subject to Engineer approval before use on the Work.

5 The distributor must have a minimum capacity of 1,000 gallons, and must be designed, equipped, maintained, and
6 operated to uniformly apply asphalt Material of an even heat at the required rate. It must be equipped with a 10-foot spray bar
7 with extensions, pressure pump and gauge, a volume gauge located where it can be easily observed from the ground, a
8 tachometer to accurately control the speed and spread of asphalt, and 2 thermometers. 1 of the thermometers must be
9 permanently installed in the tank to indicate asphalt temperatures at all times. Power for operating the pressure pump must be
10 supplied by a unit that will provide a uniform spray from each nozzle across the spray bar and extensions.

11 Rollers must be self-propelled pneumatic tired or smooth wheeled rollers, each weighing at least 10 tons.

12 Spreading equipment must be self-propelled, supported on at least 4 pneumatic tires, and have an approved device for
13 accurately metering and distributing the Mineral Aggregate uniformly over the roadway surface.

14 Brooms must be motorized with a positive means of controlling vertical pressure.

15 Other equipment necessary to acceptably perform the Work specified in this Section is subject to Engineer approval
16 before its use on the Work.

17 Place additional units on the Work when the Engineer considers it necessary, to fulfill the requirements of these
18 Specifications or to complete the Work within the time specified.

19 Both the asphalt distributor and the self-propelled chip spreader must be calibrated before their use, to ensure
20 applications within the specified coverage limits. Adjust the asphalt distributor spray bar height to produce a triple lap of spray
21 fans from bars with a 4-inch nozzle spacing, and a double lap from bars having a 6-inch nozzle spacing.

22 Frequently check and adjust the height of the spray bar during asphalt application as necessary to insure the height
23 above the pavement surface does not vary by more than 1 inch as the truck load lightens.

24 5-02.3(2) PREPARATION OF ROADWAY SURFACE**25 5-02.3(2)A UNTREATED SURFACES**

26 Refer to Section 5-04.3(4)C.

27 No traffic is allowed on the repaired surface until the prime coat of asphalt and Mineral Aggregate is applied.

28 5-02.3(2)B TREATED SURFACES

29 Refer to Section 5-04.3(4)B.

30 5-02.3(2)C SOIL RESIDUAL HERBICIDE

31 The use of soil residual herbicide is not allowed.

32 5-02.3(3) APPLICATION OF ASPHALT

33 The Contractor must apply Cationic Emulsified Asphalt (CRS 2) on the properly prepared roadway surface, at the rate of
34 0.35 to 0.40 gallon per square yard in non-shaded areas, and at 0.38 to 0.45 gallon per square yard in shaded areas. The
35 asphalt spraying application temperature at the distributor must be between 140 °F and 185 °F. The Engineer may vary the
36 rate of asphalt application to provide the best results.

37 To ensure uniform distribution of asphalt before starting the asphalt application the distributor bar must be operated over
38 a pit or vat. To avoid gaps and ridges at transverse junctions of separate applications of asphalt, spread sufficient building
39 paper over the treated surface to ensure that the spray jets function normally when the untreated surface is reached.

40 The pattern, width, and length of application of shots of asphalt Material must provide proper coverage of crushed
41 Material within the times specified, proper widths to provide an acceptable coverage of crushed cover stone, and lapping of
42 subsequent adjacent applications.

43 Apply asphalt to spandrels of intersections and driveways immediately ahead of, or immediately behind, the adjacent
44 longitudinal street application.

45 Omissions (skips) by the distributor must be immediately covered by hand application with the same grade of hot asphalt.

46 Any 1 spread of asphalt must not cover more area than can be covered with Mineral Aggregate within 3 minutes from the
47 time of application on any part of the spread.

48 Spread asphalt toward the source of Mineral Aggregate to avoid injury to the freshly treated surface. Do not spread
49 asphalt until adequate supplies of Mineral Aggregate are on hand at the Project Site.

50 Where earth curbs or no curbs exist, the application of asphalt must extend 4 inches beyond the gutter line. Where
51 concrete curb and gutter exist, the application must lap onto the gutter section, not to exceed 2 inches. Where concrete curb
52 exists, the application must be placed as close as possible to the vertical surface without excessive splash onto the curb.
53 Where concrete curb or curb and gutter exist, the distributor must be equipped with a splash board designed to prevent
54 spraying thereon.

- 1 Protect all castings by securely covering them with heavy building paper weighed down with sand or crushed Material.
2 Use hand sprayers to apply asphalt around castings, and to areas where coverage is insufficient.

3 **5-02.3(4) APPLICATION METHOD OF AGGREGATES**

4 The Contractor must correct any method of handling the Mineral Aggregate that causes segregation of the various sizes
5 of aggregate particles, at the Engineer's request, so that a uniform product is incorporated in the Work.

6 After applying the asphalt uniformly over the roadway surface, uniformly apply Mineral Aggregate of the type specified to
7 the roadway surface at a rate of 25 to 33 pounds per square yard using spreader equipment. Apply a quantity of Mineral
8 Aggregate so that it uniformly covers the asphalt and does not pick up under traffic. Apply the Mineral Aggregate over the
9 freshly spread asphalt by trailer type or self-propelled spreader boxes. Trucks and spreader boxes must not travel on the fresh
10 asphalt, and the Mineral Aggregate layer must be spread in 1 operation for each application of asphalt. Cover spandrels of
11 intersections, driveways, and bare spots by hand spreading from trucks immediately behind the box application. Spread
12 Mineral Aggregate so as to leave an 8-inch strip of asphalt exposed to provide a lap with the next application of asphalt.

13 The Mineral Aggregate must be damp and free of dust and impurities when applied to the roadway. If the Mineral
14 Aggregate is dry, dusty, or both dry and dusty, the Contractor must spray the aggregate with water to obtain a damp and dust
15 free condition. Do not use dusty or dry Mineral Aggregate that compromises adhesion of the Mineral Aggregate to the
16 substrate.

17 As soon as the aggregate has been applied to the surface, roll it with a self-propelled pneumatic tired roller. Places
18 inaccessible to the pneumatic tired roller, such as spandrels of intersections and private driveways, must be rolled with a self-
19 propelled smooth wheel roller.

20 Where excess Mineral Aggregate has been applied, it must either be removed or be drifted uniformly over the adjacent
21 roadway, using a motor patrol grader equipped with a wire broom mold board, subject to Engineer approval. Minimize this type
22 of brooming. Where brooming is necessary, perform it carefully to avoid disturbing the mat in any way. Correct thin or bare
23 spots in the spread of Mineral Aggregate by hand spreading or by use of a grader as described above.

24 Continue rolling and brooming until the roadway is uniformly covered and the Mineral Aggregate is well compacted and
25 set into the asphalt. Continue this operation until the asphalt has cured to the extent that it does not "pick up" under traffic.
26 During the maintenance period following the application of the Bituminous Surface Treatment, the Contractor must perform
27 brooming, spotting, and rolling as necessary to prevent pick up or other damage to the surface.

28 At any time during the progress of the Work, the Engineer may direct the use of a different Mineral Aggregate grading
29 instead of the Mineral Aggregate specified, if they determine it will better achieve the desired results of this Specification.

30 **5-02.3(5) ADDITIONAL ASPHALT AND MINERAL AGGREGATE**

31 If the application of asphalt or Mineral Aggregate, or both, is insufficient or excessive for the required results, the
32 Engineer may require the Contractor to make an additional application of 1 or both Materials per these Specifications.

33 **5-02.3(6) PATCHING AND CORRECTION OF DEFECTS**

34 The Contractor must immediately cover any omissions by the distributor or damage to the treated surface of any coat,
35 using hand application with asphalt in adequate quantities. Patch any holes that develop in the surface in the same manner, as
36 specified in Section 5-04.3(4)C2.

37 Defects such as raveling, lack of uniformity, or other imperfections caused by faulty workmanship must be corrected. The
38 Contractor must repair all defects and correct application means and methods before any new work begins. All improper
39 workmanship and defective Materials resulting from overheating, improper handling or application, must be removed from the
40 roadway and must be replaced with approved Materials and workmanship.

41 If the Engineer determines a fog seal is necessary at any time during the life of the Contract, the Contractor must apply a
42 fog seal of CSS 1 at the rate of 0.07 to 0.18 (0.02 to 0.05 residual) gallons per square yard. Dilute emulsified asphalt with
43 water at a rate of 1 part water to 1 part emulsified asphalt.

44 **5-02.3(7) PROGRESS OF WORK**

45 The Contractor must organize the entire operation to ensure progression in an orderly and expeditious manner.

46 The sequence of operation for placing Bituminous Surface Treatments is:

- 47 1. Apply asphalt emulsion on a properly prepared roadway surface resulting in a uniform application.
- 48 2. Apply Mineral Aggregate by spreader boxes or other means resulting in a uniform application.
- 49 3. Roll with pneumatic tired and/or self-propelled smooth wheeled roller.
- 50 4. Allow a minimum of 48 hours set time.
- 51 5. Sweep with an approved road broom to pick up and remove excess Mineral Aggregate. Conduct this work in the early
52 morning hours before the heat from the sun has warmed the pavement.
- 53 6. Maintain roadway surface for 5 Calendar Days by sweeping and patching as necessary on a daily basis, maintaining
54 traffic signing.

1 10 Calendar Days after the final application, the Contractor must make a final sweep with a mechanical broom, using the pick-
 2 up broom only, to clear off any remaining loose aggregates. Do not use gutter brooms . The Contractor must dispose of the
 3 excess Mineral Aggregates.

4 **5-02.3(8) PROTECTION OF STRUCTURES**

5 Protect all handrails, guardrails, curbs, road signs, and other facilities from splashing and overspray.

6 **5-02.3(9) UNFAVORABLE WEATHER**

7 Do not apply asphalt to excessively wet Material. Do not apply asphalt during rainfall, sand, or dust storms, or before any
 8 imminent storms that might adversely impact construction. The Engineer will determine whether the surface and Materials are
 9 acceptable for construction in inclement weather.

10 The application of any asphalt to the roadway is restricted to the following conditions:

- 11 1. The roadway surface temperature is at least 60 °F and the air temperature at least 60 °F and either holding or rising;
 12 and
- 13 2. The air temperature is at least 70 °F when falling and the wind is less than 10 miles per hour as estimated by the
 14 Engineer.

15 Do not apply any asphalt that cannot be covered 1 hour before darkness. The Engineer may require the Contractor to
 16 delay application of asphalt until the atmospheric and roadway conditions are within the limits listed above.

17 No construction of bituminous surface treatments on any traveled way is allowed before May 15 or after September 1 of
 18 any year except with written approval from the Engineer.

19 **5-02.3(10) ANTI STRIPPING ADDITIVE**

20 When directed by the Engineer, add an anti-stripping additive to the asphalt Material, see Section 9-02.4.

21 **5-02.3(11) UNTREATED ROADWAY SURFACES**

22 Existing crushed rock, gravel, and oil mat streets must be restored with Mineral Aggregate Type 1, to a compacted depth
 23 of 4 inches. Construct final surfacing as specified in Section 5-04.3(4)C2.

24 **5-02.4 MEASUREMENT**

25 Measurement for "Asphalt, (Grade)" will be made by the gallon or ton before dilution.

26 Measurement for "Mineral Aggregate, (Type)" will be by the ton.

27 Measurement for roadway preparation will be as specified in Section 5-04.4

28 **5-02.5 PAYMENT**

- 29 1. "Asphalt, (Grade)", per gallon or ton.

30 The Bid Item price for "Asphalt, (Grade)" includes all costs for the work required to construct a single or multiple course
 31 bituminous surface treatment.

- 32 2. **Other payment information.**

33 Payment for "Mineral Aggregate, (Type)" will be made as specified in Section 4-01.5.

34 Change in Mineral Aggregate type, or in grade of asphalt, or in Engineer directed application of fog seal will be
 35 addressed as specified in Section 1-04.1(2).

36 All costs for the work required to coat omissions or to patch defects must be included in the Bid Item price for the
 37 applicable Bid Item.

38 All costs for splashing and overspray protection must be included in the Bid Item price for the applicable Bid Item.

39 All costs for roadway preparation will be paid as specified in Section 5-04.5.

40 All costs for water will be paid as specified in Section 2-12.5.

41 **SECTION 5-03 RESERVED**

42 **SECTION 5-04 HOT MIX ASPHALT (HMA) AND WARM MIX ASPHALT (WMA) PAVEMENT**

43 **5-04.1 DESCRIPTION**

44 Section 5-04 describes providing and placing 1 or more layers of plant-mixed hot mix asphalt (HMA), warm mix asphalt
 45 (WMA), or both on a prepared foundation or base per these Specifications and the lines, grades, thicknesses, and typical
 46 cross-sections shown on the Drawings.

47 HMA is composed of asphalt binder and Mineral Aggregate as specified, mixed in the proportions specified to provide a
 48 homogeneous, stable, workable, and compactable mixture.

49 WMA is a technology that allows conventional HMA asphalt concrete mixtures to be produced and placed at reduced
 50 temperatures. The reduced temperatures of WMA are achieved using water-based foaming processes.

1 The Contractor may submit other WMA technologies, including organic or chemical additives, for approval.

2 **5-04.2 MATERIALS**

3 Materials must comply with the requirements of the following Sections:

| Material | Section |
|----------------------------|----------------|
| Bituminous Materials | Section 9-02 |
| Mineral Aggregates | Section 9-03 |
| Temporary Pavement Marking | Section 9-29.4 |

5
6 The Contract specifies the grade of asphalt binder required, also see Section 5-04.2(1).

7 **5-04.2(1) USE OF SUBSTITUTE MATERIALS**

8 Any proposed substitutions or Alternate Materials in the production of HMA from those specified in the Contract must be
9 included in the submittal as specified in Section 5-04.3(6), and requires Engineer approval.

10 Unless the Contract specifies otherwise, the Contractor may propose using recycled asphalt pavement, as specified in
11 Section 9-03.6(3)B. Recycled asphalt pavement must not exceed 20 percent of the total weight of aggregate in the HMA mix.
12 Recycled asphalt pavement is not allowed for asphalt binders with grades of PG-70 or higher.

13 Grade of asphalt binder: Unless the Contract specifies otherwise, the Contractor may propose a substitute grade of
14 asphalt binder. The substitute grade of asphalt binder must:

- 15 1. Comply with the requirements of Section 9-02.1(4).
- 16 2. Have a maximum pavement design temperature equal to or greater than the specified binder.
- 17 3. Have a minimum pavement design temperature equal to or lower than the specified binder.

18 The Engineer-approved substituted grade of asphalt binder must be used only in HMA of the same class with the
19 Contract-specified grade of asphalt binder. Blending of asphalt binder, whether different manufacturers and/or Suppliers
20 and/or different grades, is not permitted.

21 **5-04.3 CONSTRUCTION REQUIREMENTS**

22 **5-04.3(1) TERMS RELATED TO HMA**

23 In Section 5-04, Section 9-02, Section 9-03.5, and Section 9-03.6, terms and phrases used, such as “design aggregate
24 structure,” “nominal maximum aggregate size,” “air voids,” “maximum aggregate size,” and “binder content,” and abbreviations
25 such as “JMF” for “job mix formula,” “Va,” “Ndesign,” and “Gsb,” are consistent with and can be found in WSDOT Standard
26 Operating Procedure (SOP) 732 Volumetric Design for Hot-Mix Asphalt (HMA), as well as other documents incorporated by
27 reference within WSDOT SOP 732.

28 These documents are available in the current edition of the Washington State Department of Transportation’s Materials
29 Manual M 46-01.

30 **5-04.3(1)A WMA REQUIREMENTS**

31 When provided for in the Contract, the Contractor must use WMA technologies for paving the wearing course. Submit a
32 WMA mix design conforming to the requirements for HMA mix design, including a description of the WMA technology
33 proposed. The description of the technology must include:

- 34 1. Manufacturer’s recommended mixing and placement temperatures;
- 35 2. Description of all variances from the standard hot mix asphalt (HMA) requirements as defined in Section 5-04; and
- 36 3. Targeted temperature reduction (production and placement).

37 Provide copies of all manufacturers’ literature related to the production, mixing, conveying, and placement of the WMA.
38 Comply with all manufacturers’ recommendations for mixing, conveyance, and placement of WMA.

39 WMA use is subject to Engineer approval of the mix design.

40 **5-04.3(2) MIXING PLANT**

41 In addition to the requirements of Section 1-06, the Contractor must allow the Engineer safe access to stockpiles for
42 sampling and allow an adequate and convenient space for the Engineer to temporarily store and test samples.

43 Plants used for the preparation of HMA must conform to these requirements:

- 44 1. Equipment for Preparation of Asphalt Binder: Tanks for the storage of asphalt binder must be equipped to heat and
45 hold the binder at the required temperatures. The heating must be accomplished by steam coils, electricity, or other
46 approved means so that no flame comes in contact with the storage tank. The circulating system for the asphalt
47 binder must ensure proper and continuous circulation during the operating period. Provide a valve for sampling the

- 1 binder either in the storage tank or in the supply line to the mixer. Also see Section 5-04.3(5) for additional
2 requirements for heating asphalt binder.
- 3 2. Thermometric Equipment: An armored thermometer capable of detecting temperature ranges expected in the HMA
4 mix must be fixed in the asphalt feed line near the charging valve at the mixer unit. The thermometer location must be
5 convenient and safe for observation.
- 6 The plant must be equipped with an approved dial-scale thermometer, a mercury actuated thermometer, an electric
7 pyrometer, or another approved thermometric instrument placed at the discharge chute of the dryer, to automatically
8 register or indicate the temperature of the heated aggregates. This device must be in full view of the facility operator
9 and must be convenient to observation.
- 10 3. Sampling and Testing of Mineral Aggregates: The HMA plant must be equipped with a mechanical sampler for
11 sampling the Mineral Aggregates, see Sections 1-06.1 and 1-06.2.

12 5-04.3(3) PAVING AND RELATED EQUIPMENT

13 5-04.3(3)A HAULING EQUIPMENT

14 Trucks used for hauling HMA must have a tight, clean, smooth metal bed with a retractable cover securely attached to
15 the truck, made of canvas or other suitable material and of sufficient size to completely protect the mixture from adverse
16 weather.

17 Whenever weather conditions during the workshift include, or are forecast to include, precipitation or an air temperature
18 less than 45° F, protect the HMA with the retractable cover.

19 To prevent the HMA mixture from adhering to the hauling equipment, spray truck beds with an environmentally benign
20 release agent. Drain any excess release agent before filling with HMA. For hopper trucks, the conveyer must be in operation
21 during the process of applying the release agent.

22 5-04.3(3)B PAVING EQUIPMENT

23 5-04.3(3)B1 GENERAL

24 As specified in Section 1-05.9, the Contractor must replace equipment producing defective work.

25 When requested by the Engineer, the Contractor must provide HMA and related equipment manufacturer's written
26 operating instructions and maintenance manual.

27 5-04.3(3)B2 HMA PAVERS

28 HMA pavers must be self-contained, power-propelled units, provided with an internally-heated vibratory screed or strike-
29 off assembly, and must be capable of spreading and finishing courses of HMA plant mix material in lane widths specified on
30 the Drawings.

31 The screed or strike-off assembly must effectively produce a finished surface of the required evenness and texture
32 without tearing, shoving, segregating, or gouging the HMA. Extensions are allowed provided they produce the same results,
33 including ride, density, and surface texture, as obtained by the primary screed or strike off assembly. Do not use extensions
34 without augers, vibration, and heated screeds to pave the traveled way.

35 The paver must be equipped with automatic screed controls with sensors for either or both sides of the paver. The
36 controls must be capable of sensing grade from an outside reference line, sensing the transverse slope of the screed, and
37 providing automatic signals that operate the screed to maintain the desired grade and transverse slope. The sensor must be
38 constructed to operate from a reference line or a mat referencing device.

39 The Contractor must furnish and install all pins, brackets, tensioning devices, wire, and accessories necessary for
40 satisfactory operation of the automatic control equipment and must provide samples of the above items before installation
41 when requested by the Engineer.

42 The transverse slope controller must be capable of maintaining the screed at the desired slope within ± 0.1 percent. The
43 paver must be equipped with automatic feeder controls, properly adjusted to maintain a uniform depth of material ahead of the
44 screed.

45 5-04.3(3)B3 MATERIAL TRANSFER VEHICLES (MTV)

46 A material transfer vehicle (MTV) must not be used on any paving operation without the prior written approval of the
47 Engineer.

48 5-04.3(3)C ROLLERS

49 Rollers must be steel wheel, vibratory or pneumatic tire types, in good condition and capable of reversing without
50 backlash. Rollers must be operated per the manufacturer's recommendations. The number and weight of rollers must be
51 sufficient to compact the mixture as specified in Section 5-04.3(9). The use of equipment that results in crushing of the
52 aggregate is not permitted. The Engineer will reject rollers producing pickup, washboard, uneven compaction of the surface,
53 displacement of the mixture, or other defective work, see Section 1-05.7, as specified in Section 1-05.9.

1 **5-04.3(3)D PLANING BITUMINOUS PAVEMENT AND REQUIRED PRE-PLANING METAL DETECTION**

2 **5-04.3(3)D1 GENERAL**

3 Before planing, the Contractor must meet with the Engineer to discuss the planing operations as specified in Section 5-
4 04.3(13).

5 **5-04.3(3)D2 PLANING BITUMINOUS PAVEMENT**

6 Use the cold planing method for planing bituminous pavement. Equipment must have operated successfully on work
7 comparable to that in the Contract, and is subject to Engineer approval before use. Maintain equipment in good working
8 condition while in use.

9 Cold planers must be milling type equipment capable of cutting at least a 5-foot chord to a depth of up to 4 inches in 1
10 pass. For required planing depths in excess of 4 inches, and as the total depth requires, the first pass and all succeeding
11 passes must not exceed 4 inches per pass, until the final depth is reached. Smaller planers may be used for cutting around
12 castings and other metal objects to remain, and for making taper cuts for butt joints.

13 Where metal is not visible on the surface but is detected below the surface, the Contractor must use methods of
14 pavement removal that do not damage the detected metal if it is to remain, and is beyond the 4-inch maximum depth of
15 planing, to avoid damage to Contractor equipment. Where irregularities or unavoidable obstacles make the use of mechanical
16 planing equipment impractical, use other equipment or methods as approved by the Engineer.

17 For mainline cold planing operations, the equipment must have automatic controls with sensor for either or both sides of
18 the equipment capable of sensing the proper grade from an outside reference line. The automatic controls must also be
19 capable of maintaining the desired transverse slope. The sensor must be constructed to operate from a reference line or multi
20 footed ski-like arrangement. The transverse slope controller must be capable of maintaining the desired slope within ± 0.1
21 percent.

22 **5-04.3(3)D3 REQUIRED PRE-PLANING METAL DETECTION**

23 Metal is buried beneath the existing asphalt surface of many Seattle streets. Such metal may be rail track associated
24 with Seattle’s former street car system, or castings buried under asphalt overlay, or other similar metallic items.

25 Before planing, adequately sweep the entire area of asphalt to be planed to detect buried metal.

26 If such metal is detected and is not specified in the Contract, surface mark such detected metal and notify the Engineer
27 before planing, as specified in Section 1-04.6.

28 Where the Drawings indicate the existence of metal not visible on the existing pavement surface, remove such surface
29 pavement material and verify the depth to metal before planing. If the depth to metal is beyond the required depth of planing,
30 note this and avoid planing contact with such metal. If the depth to metal is within the depth range of required planing, then 1
31 of these 2 outcomes is required:

- 32 1. If a metal casting, treat as specified in Section 7-20.
- 33 2. If a metal object except a casting, the Engineer may require removal. If removal is not addressed in the Contract, this
34 portion of work may be addressed as extra work, see Section 1-04.6.

35 Metal detection equipment must have adequate sensitivity to detect metal hidden beneath existing pavement surface to a
36 depth of at least 4 inches. Where planing is indicated to a depth greater than 4 inches, must make multiple planing passes with
37 each pass not exceeding the 4-inch depth. Before each planing pass of 4 inches or less, must resweep the same area of
38 asphalt to detect metal.

39 Where the Engineer directs additional depth planing beyond that required in the Contract, must sweep for metal before
40 such additional depth planing, as described in this Specification.

41 The Contractor is solely responsible for any damage to Contractor planing equipment from metal buried within asphalt.

42 **5-04.3(4) PREPARATION OF STREET SURFACES**

43 **5-04.3(4)A PREPARATION CLASSIFICATION DESCRIPTIONS**

44 In preparing surfaces, the following surface classifications apply:

- 45 1. Treated surfaces: cement concrete, asphalt concrete, brick, seal coat or other bituminous surface treatments
- 46 2. Untreated surfaces: crushed rock, gravel, native subgrade, or oil mat surfaces. Bituminous surface treatments are
47 addressed in Section 5-02, and oil mat surfaces are addressed in Section 4-05.

48 The work of preparing existing surfaces for asphalt concrete or other bituminous Material overlay is classified as follows:
49 “Surface preparation” applies only to treated surfaces, and “roadway preparation” applies only to untreated surfaces.

50 **5-04.3(4)B SURFACE PREPARATION – TREATED SURFACES**

51 **5-04.3(4)B1 GENERAL**

52 When an existing treated surface is used as a base for 1 or more courses of new asphalt concrete, or other surfacing,
53 see Section 4-04 and Section 5-02, the treated surface must first be swept, cleaned, and patched:

- 1 1. Sweep treated surfaces with a power broom until free from dirt and other foreign matter. Use hand brooms to clean
2 omissions of the power broom. Remove fatty asphalt patches, grease drippings, and other objectionable Material
3 from the existing pavement.
- 4 2. Completely remove excess asphalt joint filler and remove premolded joint filler to at least 1/2 inch below the surface
5 of the existing pavement.
- 6 3. Obtain a sound base with a uniform grade and cross-section. Correct irregularities in the existing treated surface
7 before placing a new asphalt wearing course or other bituminous surface treatment. Corrections must be made by
8 planing, preleveling, grinding, patching, or placing new base pavement.

9 **5-04.3(4)B2 PRELEVELING**

10 When a surface of the existing pavement or old base is irregular, the Contractor must bring it to a uniform grade and
11 cross-section by planing, spot grinding or preleveling. Existing surfaces not requiring planing, but requiring other repair or
12 requiring preleveling, will be addressed in the Contract. If existing asphalt overlay is planed and the surface to remain requires
13 preleveling, the Engineer will direct preleveling before HMA wearing course placement as specified in Section 5-04.3(8). As
14 soon as the existing surface has been thoroughly cleaned, repair holes and discontinuities in the surface and edges and edge
15 breaks as specified in the Contract. Patching must be accomplished before preleveling or installation of the first asphalt
16 course, whichever is applicable.

17 Preleveling Materials must be the same HMA class of asphalt concrete as the wearing course or an approved alternate.
18 If the Contract does not require a finish HMA wearing course, prelevel uneven or broken surfaces by placing asphalt concrete
19 of the class specified with a motor patrol grader, by hand-raking, by Miller box, or by another approved method.

20 After placement, thoroughly compact the preleveling Material with a pneumatic tire roller, unless alternate equipment is
21 approved by the Engineer.

22 When planing is not a Bid Item in the Contract, the Contractor must spot grind occasional high areas, such as those
23 caused by rutting, to allow for a uniform application of preleveling.

24 **5-04.3(4)B3 PLANING BITUMINOUS PAVEMENT**

25 **5-04.3(4)B3A PRE-PLANING METAL DETECTION CHECK**

26 Before starting planing of pavements, and before any additional depth planing required by the Engineer, the Contractor
27 must conduct a physical survey of existing pavement to be planed with equipment that can identify hidden metal objects.

28 Should such metal be identified, promptly notify the Engineer.

29 See Section 1-07.16(1) regarding the protection of survey monumentation that may be hidden in pavement.

30 The Contractor is solely responsible for any damage to equipment resulting from the Contractor's failure to conduct a
31 pre-planing metal detection survey, or from the Contractor's failure to notify the Engineer of any hidden metal that is detected.

32 **5-04.3(4)B3B PLANING**

33 See Section 5-04.3(13) regarding a planing plan, and pre-planing briefing before starting planing.

34 Locations of existing surfacing to be planed as shown in the Drawings.

35 Where planing an existing pavement is specified in the Contract, the Contractor must remove existing surfacing material
36 and to reshape the surface to remove irregularities. The finished product must be a prepared surface acceptable for receiving
37 an HMA overlay.

38 Use the cold milling method for planing unless otherwise specified in the Contract. Do not use the planer on the final
39 wearing course of new HMA.

40 Conduct planing operations in a manner that does not tear, break, burn, or otherwise damage the surface which is to
41 remain. The finished planed surface must be slightly grooved or roughened and must be free from gouges, deep grooves,
42 ridges, or other imperfections. The Contractor must repair any damage to the surface by the Contractor's planing equipment,
43 using an Engineer approved method.

44 Repair or replace any metal castings and other surface improvements damaged by planing, as determined by the
45 Engineer.

46 A tapered wedge cut must be planed longitudinally along curb lines sufficient to provide a minimum of 4 inches of curb
47 reveal after placement and compaction of the final wearing course. The dimensions of the wedge must be as shown on the
48 Drawings or as specified by the Engineer.

49 A tapered wedge cut must also be made at transitions to adjoining pavement surfaces (meet lines) where butt joints are
50 shown on the Drawings. Cut butt joints in a straight line with vertical faces 2 inches or more in height, producing a smooth
51 transition to the existing adjoining pavement.

52 After planing is complete, planed surfaces must be swept, cleaned, and if required by the Contract, patched and
53 preleveled.

54 The Engineer may direct additional depth planing. Before performing this additional depth planing, the Contractor must
55 conduct a hidden metal in pavement detection survey as specified in Section 5-04.3(4)B3A.

1 5-04.3(4)B4 TACK COAT AND DISTRIBUTOR EQUIPMENT REQUIREMENTS**2 5-04.3(4)B4A TACK COAT REQUIREMENT**

3 Tack coat must be CSS-1, CSS-1h, or STE-1 emulsified asphalt. The CSS-1 and CSS-1h emulsified asphalt may be
4 diluted with water at a rate not to exceed 1 part water to 1 part emulsified asphalt. The emulsified asphalt must not exceed the
5 maximum temperature recommended by the emulsified asphalt manufacturer.

6 Apply a tack coat of asphalt at the rate of 0.02 to 0.08 gallons per square yard of retained asphalt to all paved surfaces
7 on which any course of HMA will be placed or abutted. The tack coat must cover the existing pavement uniformly with a
8 residual asphalt film, free of streaks and bare spots. Apply the tack coat only to surfaces that are dry and free from moisture.
9 Do not apply the tack coat under the imminent threat of rain, as determined by the Engineer.

10 The Contractor must make arrangements with the Engineer to demonstrate tack coat application at the start of such
11 application. Once the Engineer approves the tack coat application method and rate of application, the Contractor must
12 continue with such application without exception.

13 Where the new asphalt concrete abuts a curb or gutter, cold pavement joint, trimmed meet line, or any metal surface,
14 apply a tack coat of asphalt on the vertical face of the abutting surface. The application on the contact surfaces must be
15 uniform to avoid an accumulation of excess asphalt. Immediately remove any excess tack coat. Do not apply the tack coat on
16 vertical contact surfaces above the finished height of the asphalt concrete being placed.

17 Apply tack coat only to surfaces receiving tack coat treatment. Do not apply tack coat to any other surface. Tack coat
18 applied to surfaces that will not be coated be removed immediately, including thorough cleaning of the surface area as
19 necessary to leave no residue.

20 Do not operate equipment on tacked surfaces until the tack has broken and cured. The Contractor must repair any
21 damages to the tack coat from Contractor operations before placement of the HMA. For surfaces open to traffic, limit the
22 application of tack coat to surfaces that will be paved during the same work shift.

23 5-04.3(4)B4B DISTRIBUTOR EQUIPMENT REQUIREMENT

24 The distributor equipment must be capable of distributing a uniform tack coat in controlled quantities.

25 The distributor must have a capacity of at least 1,000 gallons, and must be designed, equipped, maintained, and
26 operated to uniformly apply asphalt Material of an even heat at the required rate.

27 Power for operating the pressure pump must be supplied by a unit that provides a uniform spray from each of the nozzles
28 across the spray bar and extensions.

29 In addition, the distributor must be equipped with:

- 30 1. A thermometer to indicate the temperature of the tack coat material;
- 31 2. A thermometer installed permanently in the tank to indicate temperatures at all times;
- 32 3. Hand operated spray equipment for use only on inaccessible and irregularly shaped areas;
- 33 4. A 10-foot spray bar with extensions;
- 34 5. Pressure pump and gauge, and volume gauge located where it is easily observed from the ground; and
- 35 6. A tachometer to accurately control the speed and spread of asphalt

36 The Engineer may allow hand operated spray equipment separate from the distributor equipment for inaccessible and
37 irregularly shaped areas if the Contractor can demonstrate acceptable tack coat application.

38 5-04.3(4)C SURFACE PREPARATION OF UNTREATED SURFACES**39 5-04.3(4)C1 GENERAL**

40 The Contractor must shape untreated roadway surfaces, including intersections and side roadway approaches that will
41 receive asphalt concrete pavement, or other surfacing, see Section 4-04 and Section 5-02 must to a uniform grade and cross-
42 section, conforming as nearly as possible to the existing surface, except:

- 43 1. Where new lines and grades are specified in the Contract or established by the Engineer.

44 The basis for establishing final line and grade in such cases is curbs, curbs and gutters, existing pavement, or
45 pavement edges or other existing street improvements. Grade existing driveways as necessary to provide a smooth
46 transition to the final grade of the new pavement surface, including any grading necessary to allow driveway
47 adjustment.

- 48 2. Where no curbs or curbs and gutters exist and where none are required by Contract, extend subgrade preparation 1
49 foot on each side of the roadway beyond the final asphalt paving width shown on the Drawings. The Engineer may
50 require the Contractor to extend this subgrade preparation to greater width to accommodate local conditions such as
51 intersections.

52 Shape the grade so that all frame castings for maintenance holes, monument boxes, gate valve boxes, and catch basins,
53 within the roadway section to be treated, extend above the prepared surface. All such castings must be flush with the final
54 wearing course. Where existing asphalt or Portland cement concrete pavement is being met with new asphalt surfacing,

1 remove sufficient existing untreated surfacing to allow the forming of a butt joint. The completed finish surface, including
2 castings and transitions with existing treated surfaces, must be smooth as specified in Section 5-04.3(11).

3 Those areas and surfaces being prepared for the placement of asphalt concrete pavement or other surfacing are
4 considered subgrade for the new construction. See Section 2-09 for subgrade preparation requirements. Excess native
5 material deemed suitable by the Engineer is considered selected Material per Section 2-10 and must be stockpiled or bladed
6 to the roadway edge and used as needed for fill or shoulder restoration under completion of the paving. Use the selected
7 Material to the fullest extent possible as sub-base Material before placing new crushed rock.

8 Water must be available on the Job Site and must be applied as necessary to comply with compaction requirements and
9 to alleviate dust.

10 Dispose of excess material.

11 **5-04.3(4)C2 PRIME COAT TREATMENT**

12 Where required in the Contract, apply a prime coat treatment of asphalt complying with the requirements of Section 5-
13 02.3(3) for existing gravel, crushed rock, or oil mat streets before paving with asphalt concrete. Apply the prime coat over the
14 entire area of proposed asphalt pavement construction. Following the application of the prime coat, do not place HMA until the
15 prime coat has cured.

16 In the event the surface receiving the prime coat has the gradation and relative density to resist penetration of the prime
17 coat, loosen no more than the upper 1/2 inch of surface and regrade it without compaction, immediately before applying the
18 prime coat.

19 Maintain the completed prime coat by blading or brooming until the asphalt concrete is placed. Patch or repair any holes,
20 breaks, or irregularities that develop in the roadway surface after the prime coat has been applied, as specified in Section 5-
21 04.3(4)C1, immediately in advance of placing the asphalt concrete pavement.

22 Immediately before placing the HMA, sweep the surface of the prime coat clean of all dirt, dust, and other foreign matter.

23 **5-04.3(4)D CRACK SEALING**

24 Where the Contract requires Crack Sealing, clean all cracks and joints with a stiff-bristled broom and compressed air.
25 Remove and dispose of any loose pieces.

26 After cleaning, fill all cracks less than 1/4 inch in width with straight CSS-1 emulsified asphalt and top with sand.

27 After cleaning, fill all cracks and joints 1/4 inch or greater in width with sand slurry.

28 Use rubberized asphalt where specified in the Contract.

29 The Contractor may request substitution of rubberized asphalt for sand slurry; however, such request requires written
30 approval from the Engineer before use. Do not use rubberized asphalt to seal cracks greater than 1-1/2 inches in width.

31 Application of sand slurry or rubberized asphalt:

- 32 1. Sand slurry must consist of 20 percent CSS-1 emulsified asphalt, 2 percent Portland cement, sufficient water for
33 workability, and the remainder clean U.S. No. 4-0 paving sand. Thoroughly mix the components and pour into the
34 cracks and joints until full. The following day, top off any cracks or joints that are not completely filled with additional
35 sand slurry. After the sand slurry is placed, strike the filler off flush with the existing pavement surface and allow to
36 cure. Do not place the HMA overlay until the slurry has fully cured.
- 37 2. Rubberized asphalt sealant Material must comply with the requirements of Section 9-04.9 and must be applied per
38 the sealant manufacturer's recommendations. Submit these recommendations to the Engineer before starting this
39 type of construction, including recommended heating time and temperature, allowable storage time and temperatures
40 after initial heating, allowable reheating criteria, and application temperature range. Cracks must be completely dry
41 before being filled with rubberized asphalt. Control filling to confine the Material within the crack or joint. Where the
42 sealed cracks will be overlaid with asphalt, the sealant must be recessed 3/8 inch below the surface. The method of
43 sealant application must confine the sealant to the crack or joint and must not result in any spillage on the pavement
44 surface.

45 Should spillage occur, the Contractor must have Supplies readily available to quickly and effectively remove all spilled
46 material.

47 **5-04.3(5) HEATING OF ASPHALT BINDER**

48 The temperature of the asphalt binder must not fall below the minimum or exceed the asphalt binder manufacturer's
49 recommended maximum temperatures at any time. The asphalt binder must be heated in a manner that prevents local
50 variations in heating. The heating method must provide a continuous supply of asphalt binder to the mixer at a uniform
51 average temperature with no individual variations exceeding 25 °F. See Section 5-04.3(2) regarding HMA mixing plant
52 requirements.

1 **5-04.3(6) HMA MIX DESIGN AND SUBMITTAL REQUIREMENTS**

2 **5-04.3(6)A PREPARATION OF AGGREGATES**

3 Provide sufficient storage space for each size of aggregate. Remove the aggregates from stockpile in a manner that
4 minimizes segregation when being moved to the HMA plant for processing into the final mixture. Keep different aggregate
5 sizes separated until they have been delivered to the HMA plant.

6 **5-04.3(6)B MIX DESIGN**

7 **5-04.3(6)B1 GENERAL**

8 From the stockpiled aggregates that will be used to produce the HMA, the Contractor must determine a design aggregate
9 structure and asphalt binder content per WSDOT SOP 732, Volumetric Design for Hot-Mix Asphalt (HMA), available in the
10 current edition of the Washington State Department of Transportation's Materials Manual M 46-01. The Contract specifies the
11 grade of asphalt binder, also see Section 5-04.2(1) where binder substitution is allowed. The Contract also specifies the
12 nominal maximum aggregate size and design ESALs. The Engineer will determine the quantity of anti-stripping additive to be
13 added to the mix, based on the Contractor's proposed design and submittal per this Section and Section 9-02.4.

14 Once the Contractor has determined the aggregate structure and binder content, the Contractor's submittal must provide
15 data demonstrating that the proposed HMA design meets the requirements of Sections 9-03.6(2) and 9-03.6(6). The
16 Engineer's determination of anti-stripping agent requirements must be made before HMA paving can start.

17 **5-04.3(6)B2 APPLICATION DEFINITIONS**

18 Unless the Contract specifies otherwise, use the following definitions regarding HMA CI mix designs and HMA submittals:

- 19 1. Structural application – major quantity: A HMA CI mix used for travel way or surfaces for vehicular traffic where the
20 project specifies more than 400 tons of HMA. See Section 5-04.3(6)C for submittal requirements.
- 21 2. Structural application - minor quantity: A HMA CI mix used for vehicular traffic where the project specifies less than
22 400 tons of HMA. See Section 5-04.3(6)D for submittal requirements.
- 23 3. Non-structural application: An HMA CI mix used for sidewalks, ditches, slopes, paths, trails, gores and other non-
24 vehicular traffic application. See Section 5-04.3(6)E for submittal requirements.

25 For any quantity structural application, vehicular traffic includes roadways of any kind, alleys, driveways, and other
26 surfaces as specified in the Contract.

27 **5-04.3(6)C SUBMITTAL – STRUCTURAL APPLICATION – MAJOR QUANTITY**

28 **5-04.3(6)C1 GENERAL**

29 As a convenience to accommodate accelerated submittals for future uses of an approved HMA CI mix design major
30 quantity structural application, an approved HMA CI major quantity structural application mix design remains approved for use
31 on all future projects with a Bid Opening Date within 365 consecutive Calendar Days from the date of approval of that specific
32 HMA CI mix. The SPU Materials Laboratory will specify the approval date on the returned submittal, and will maintain records
33 on such. On future Contracts, the Contractor contact the SPU Materials Laboratory at (206) 386-1236 to find out if and when a
34 specific major quantity structural application mix design was approved.

35 **5-04.3(6)C2 MIX DESIGN AND SAMPLE SUBMITTAL REQUIREMENTS**

36 For HMA CI mix designs not pre-approved as specified in Section 5-04.3(6)C1, the Contractor's HMA CI submittal
37 requires 20 Working Days and requires both the Contractor mix design and samples.

38 Submit the following mix design information for each HMA class:

- 39 1. Project name and Public Works (PW) number
- 40 2. HMA class designation and HMA Supplier
- 41 3. Contractor's mix design number, or other designating identification (designation)
- 42 4. Design equivalent single axle loads (design ESALs)
- 43 5. Aggregate source, see Section 1-06
- 44 6. Aggregate gradations, including blending ratio
- 45 7. Percent (by weight of final mix) of RAP used
- 46 8. Target gradation of final HMA mix
- 47 9. 0.45 power plot of target gradation showing aggregate gradation control points zone
- 48 10. Binder source and performance grade (e.g. PG xx-yy)
- 49 11. Temperature – Viscosity curve of the binder
- 50 12. Recommended binder compaction temperature range
- 51 13. Recommended binder mixing temperature range
- 52 14. Maximum allowable binder temperature

- 1 15. Type and brand of anti-stripping additive
- 2 16. Binder content of RAP (percent by weight of RAP)
- 3 17. Percent (by weight of final mix) of binder in final mix (Pb)
- 4 18. Effective Binder Content (Pbe)
- 5 19. HMA compaction temperature for the gyratory compactor
- 6 20. Relative density of the final mix at Ndesign gyrations
- 7 21. Number of design (Ndesign) gyrations used (Nini; Ndes; Nmax)
- 8 22. Voids in Mineral Aggregate (VMA)
- 9 23. Voids filled with asphalt (VFA)
- 10 24. Air voids in the compacted mixture (Va)
- 11 25. Dust/Asphalt Ratio
- 12 26. Sand Equivalent of the aggregate fraction passing U.S. No. 4 sieve
- 13 27. Percent of flat and elongated particles retained on the U.S. No. 4 sieve
- 14 28. Theoretical maximum density of the mix (Gmm)
- 15 29. Percent of Gmm for extruded specimens at Nini, Ndes and Nmax
- 16 30. Bulk specific gravity of the extruded specimen at Ndesign gyrations (Gmb)
- 17 31. Bulk specific gravity of the combined aggregates in the mix (Gsb)
- 18 32. Effective specific gravity of the combined aggregates in the mix (Gse)
- 19 33. Bulk specific gravity of the aggregate fraction passing the 3/8" sieve
- 20 34. Bulk specific gravity of the aggregate fraction retained on the 3/8" sieve
- 21 35. Specific gravity of the binder (Gb)

22 Samples: The mix design submittal must be accompanied by the following samples and sizes.

23
24 **Mix Design Samples and Sizes**

| Sample | Minimum Sample Size |
|--|---------------------|
| The HMA class mix (if RAP is proposed, the mix must contain the RAP) | 75 pounds |
| Asphalt binders | 1 quart |
| Recycled asphalt pavement component (RAP), if used | 25 pounds |
| Anti-stripping agent | 1 quart |

25
26 Any adjustment to an approved HMA class JMF requires a submittal, see Section 1-05.3(5), and Engineer approval as
27 specified in Section 9-03.6(7).

28 The Engineer may waive submittal of items 2 through 4 above if the Contractor submits a valid and current WSDOT mix
29 design of the same class of HMA using the same constituents from the same sources as the proposed mix design, including
30 anti-stripping agent.

31 The Contractor may propose an asphalt binder from a secondary source in the same submittal as the primary binder
32 source, and include this in the submittal, see items 10., 11., 12., 13., 16., 17., 18., and the Mix Design Samples and Sizes
33 table above.

34 Based on the Contractor's submittal the Engineer will determine the anti-stripping additive requirement, and make this
35 information known on the returned submittal.

36 If the Engineer determines the submitted mix design is defective, the Engineer will provide written notice identifying such
37 defect.

38 The Contractor must not start production of any HMA class until that HMA JMF mix design has been established and
39 approved by the Engineer.

40 Any change in supply source for any of the constituents of an approved HMA class JMF requires submittal of a new mix
41 design, which must be accepted before use as specified in this Section.

42 If the verification testing results of the submitted sample Materials and proposed mix design comply with Sections 9-
43 02.1(4) and 9-03.6, the submittal is considered accepted. The accepted mix design is the initial job mix formula for the
44 specified HMA class of mix and an Engineer approval date will be assigned.

45 To aid the Contractor in preparing the HMA mix design submittal, the Contract will contain an HMA Mix Design Submittal
46 form located in the Appendix of the Project Manual.

1 **5-04.3(6)C3 ACCELERATED SUBMITTAL**

2 When an approved HMA CI mix design for major quantity structural application is specified in the Contract and this HMA
3 mix is within the 365 Calendar Day window before the Bid Opening Date, the Contractor must submit, at least 5 Working Days
4 in advance, a manufacturer’s certificate of compliance stating:

- 5 1. For each HMA class specified in the Contract, the name and location of each Supplier providing the approved HMA
- 6 class mix and component parts.
- 7 2. Supplier’s HMA CI mix design number, or other designating identification (designation) consistent with the approved
- 8 HMA class mix.

9 **5-04.3(6)C4 CERTIFICATION TO ACCOMPANY HMA DELIVERY**

10 For any HMA class major quantity structural application mix, each delivery of HMA CI to the Project Site must be
11 accompanied by a certification stating:

- 12 1. HMA mix being delivered is an approved HMA mix;
- 13 2. Name and location of HMA CI Supplier;
- 14 3. Supplier’s HMA CI mix identification number;
- 15 4. Date and time of load out;
- 16 5. Class of HMA;
- 17 6. Grade of binder;
- 18 7. Percent (by weight of binder) of anti-stripping agent; and
- 19 8. Tonnage of HMA in the hauling vehicle.

20 **5-04.3(6)D STRUCTURAL APPLICATION - MINOR QUANTITY**

21 For HMA CI minor quantity structural application mixes, the Contractor must submit, at least 5 Working Days in advance
22 of first use, a manufacturer’s certificate of compliance showing items 1. through 7. below.

23 At the Engineer’s request, the Contractor must submit the pre-approved mix design data (previously submitted and
24 accepted as specified in Section 5-04.3(6)C2).

25 The Engineer may obtain samples of a previously accepted HMA CI mix and/or its individual constituents for verification
26 of the mix design.

27 In addition, every delivery of the HMA CI mix to the Project Site must be accompanied by a certificate stating:

- 28 1. Name and location of HMA Supplier;
- 29 2. Supplier’s HMA mix identification designation;
- 30 3. Date and time of load out;
- 31 4. Class of HMA;
- 32 5. Binder grade of PG 64-22;
- 33 6. Percent (by weight of binder) of anti-stripping agent including brand name and type;
- 34 7. Minimum design ESALs of 10,000,000; and
- 35 8. Tonnage in vehicle.

36 **5-04.3(6)E NON-STRUCTURAL APPLICATIONS**

37 For HMA CI non-structural application mixes, the Contractor must submit, at least 5 Working Days in advance of first use,
38 a manufacturer’s certificate of compliance showing items 1. through 3. below.

39 At the Engineer’s request, the Contractor must submit the pre-approved mix design data specified in Section 5-
40 04.3(6)C3.

41 The Engineer may obtain samples of a previously accepted HMA CI mix and/or its individual constituents for verification
42 of the mix design.

43 In addition, every delivery of the HMA CI mix to the Project Site must be accompanied by a certificate stating:

- 44 1. HMA Class 1/2 Inch;
- 45 2. Binder grade of PG 64-22 (binder grade may be substituted as specified in Section 5-04.2(1));
- 46 3. Supplier designed at any ESAL level; and
- 47 4. Tonnage in hauling vehicle.

1 5-04.3(7) HMA MIXING PROCESS**2 5-04.3(7)A GENERAL**

3 After the required quantities of Mineral Aggregate and asphalt binder have been placed in the mixer, mix the HMA until a
4 complete and uniform coating of the particles and a thorough distribution of the asphalt binder throughout the Mineral
5 Aggregates is achieved.

6 When discharged, the temperature of the HMA must not exceed the maximum temperature recommended by the asphalt
7 binder manufacturer.

8 A maximum water content of 1 percent is allowed in the HMA at discharge, providing the water causes no problems with
9 compaction, handling, stripping, or flushing. If the water content in the HMA causes any of these problems, the HMA is
10 considered defective Material and the Contractor must stop production of the HMA and discontinue the placing of HMA. As
11 specified in Section 1-05.7, the Contractor must provide an acceptable remedy for addressing the water content of the HMA.
12 Defective Material in place must be removed and replaced with Material that meets the specified requirements.

13 Storing or holding HMA in approved storage facilities is permitted during the daily operation but must not be held for more
14 than 24 hours. HMA held for more than 24 hours after mixing will be rejected. The Contractor must dispose of rejected HMA at
15 no expense to the Owner. The storage facility must have an accessible device at the top of the cone or about the third point
16 from the top, which indicates the quantity of material in storage. No HMA will be accepted from the storage facility when the
17 HMA in storage is below the top of the cone, except as the storage facility is being emptied at the end of the working shift.

18 Where HMA has been held in approved storage and no load out has occurred for 4 continuous hours, the first 4 tons to
19 be loaded out of the storage facility must be wasted and disposed of at the Contractor's expense.

20 5-04.3(7)B ACCEPTANCE SAMPLING AND TESTING – HMA MIXTURE

21 Acceptance of HMA is based on the following:

- 22 1. Aggregates: The acceptance criteria for aggregate properties of sand equivalent, flat and elongated, fine aggregate
23 angularity and fracture is specified in Section 9-03.6(2).
- 24 2. Hot Mix Asphalt Mixture: The acceptance criteria for the HMA mixture is specified in Section 9-03.6(7), HMA
25 Tolerances and Adjustments.
 - 26 a. Sampling:
 - 27 1) HMA samples must not be taken from the first or last 25 tons of HMA produced in each production shift.
 - 28 2) Samples for acceptance testing will be taken on a random basis at the point of delivery per AASHTO T168.
 - 29 b. Definition of Sampling Lot and Sublot: A lot is defined as a discrete quantity of as-constructed pavement to which
30 an acceptance procedure is applied. For the purpose of acceptance sampling and testing, a lot is defined as the
31 total quantity of Material or work produced for each job mix formula placed. A lot is represented by randomly
32 selected samples that will be tested for acceptance. Only 1 lot per JMF is expected. The initial JMF is defined in
33 Section 5-04.3(7)A, Mix Design. The Contractor may request a change in the JMF as specified in Section 9-
34 03.6(7). If the request is approved, all Material produced up to the time of the change will be evaluated on the
35 basis of tests on samples taken from that JMF, and a new lot will start. Sampling evaluation will be performed on
36 a random basis at the frequency of 1 sample per subplot. Sublot size will be determined to the nearest 100 tons to
37 provide not less than 2 uniform size sublots, based on proposal quantities, with a maximum subplot size of 400
38 tons. Sampling and testing will be performed on a random basis as determined by the Engineer. The quantity of
39 material represented by the final subplot may be increased to a maximum of 2 times the subplot quantity calculated.
 - 40 c. Test Results:

41 The Engineer will furnish the Contractor with a copy of the results of the acceptance testing performed in the
42 Laboratory.

43 The Contractor may challenge subplot sample test results.

44 To challenge the Laboratory's test results, the Contractor must comply with the requirements of Section 1-04.4.

45 Resolution of this challenge is determined by a split of the original acceptance sample, retested by the Owner's
46 Laboratory. The split of the sample with challenged results will not be tested by the same tester that conducted
47 the original acceptance test. The challenge sample will be tested for a complete gradation analysis, for asphalt
48 binder content, and for percent air voids (Va). The results of the challenge sample will be compared to the original
49 results of the acceptance sample test and evaluated according to the following criteria:

50

| Deviation from JMF | | |
|---|-----------------------|----------------------------------|
| Property | Allowable Deviation | Standard Specification Reference |
| U.S. No. 4 and larger sieves | ± 4.0% for each sieve | 9-03.6(6) |
| U.S. No. 8 sieve | ± 2.0% | 9-03.6(6) |
| U.S. No. 200 sieve | ± 0.4% | 9-03.6(6) |
| Asphalt binder content | ± 0.3% | 5-04.3(6)C2, item 18 |
| Air Voids in the Compacted Mixture (Va) | ± 0.7% | 5-04.3(6)C2, item 24 |

If the results of the challenge sample testing are outside the allowable deviation established above for any of the above limits, the Contractor agrees the subplot is defective and must be removed and replaced and the cost of retesting be deducted at the rates specified in Section 1-05.7 from any monies due or that may come due the Contractor under the Contract. If the results of the challenge sample testing are within all limits established above, the subplot will be accepted and the cost of retesting will be the Owner's responsibility.

d. Test Methods

1) Testing of HMA for compliance of volumetric properties (VMA, VFA Va and Dust/Asphalt Ratio) will be per WSDOT SOP 731, Method for Determining Volumetric Properties of Asphalt Concrete Pavement Class Superpave, WSDOT FOP for AASHTO T 166, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens, and WSDOT FOP for AASHTO T 209 FOP for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures Rice Density. Testing for compliance of asphalt binder content will be per WSDOT FOP for AASHTO T 308 Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method, or WAQTC FOP TM 6, Moisture Content of Bituminous Mixtures by Oven. Testing for compliance of gradation will be per WAQTC FOP for AASHTO T 27/T 11.

e. Reject Mixture

- 1) Rejection by Contractor: The Contractor may elect to remove any defective Material before sampling and replace it with new Material. Any such new Material may be sampled, tested, and evaluated for acceptance.
- 2) Rejection by Engineer: Sublots found to be defective during acceptance sampling and testing must be removed and replaced. In addition, the Engineer may also isolate and reject within a subplot any Material that is determined to be defective.

If, during paving, the Engineer determines Material being placed does not comply with the Specifications, the Contractor must shut down operations and must not resume HMA placement until the Engineer is satisfied that specified Material is being supplied.

The Engineer may, without sampling, reject any batch, load, or section of HMA that appears defective in gradation, temperature or asphalt binder content. Material rejected before placement must not be incorporated into the pavement. Any rejected HMA section of roadway must be removed. The Contractor may request that the rejected Material be tested. If the Contractor elects to have the rejected Material tested, a minimum of 3 representative samples will be obtained and tested. Acceptance of rejected Material will be based on conformance with the Specifications. No payment will be made for Material that fails to comply with Specification. In addition, the cost of sampling and testing must be borne by the Contractor. If the Material meets Specification, the cost of sampling and testing is borne by the Owner and payment for the HMA will be made at the Bid Item price.

5-04.3(8) SPREADING AND FINISHING

The mixture must be laid on an approved surface, spread, and struck off to the grade and elevation established.

Unless otherwise directed by the Engineer, the nominal compacted depth of any layer of any course must conform to these limits:

| Material | Maximum |
|----------------|-----------|
| HMA Class 1" | 0.35 feet |
| HMA Class 3/4" | 0.30 feet |
| HMA Class 1/2" | 0.25 feet |

When more than 1 course is necessary to meet the final paving grade, the first course must include any widening of the existing roadway and preleveling of the existing pavement surface. Construct the preleveling course or courses so that the final wearing course has a uniform compacted depth and conforms to the finished grade and cross-section elevations specified. Construction of a course on another must not proceed until the underlying course has cooled and set.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the paving may be done with other approved equipment or by hand.

1 When more than 1 JMF is being used to produce HMA, the Material produced for each JMF must be placed by separate
2 spreading and compacting equipment. The intermingling of HMA produced from more than 1 JMF is prohibited. Each strip of
3 HMA placed during a working shift must conform to a single JMF established for the class of HMA specified unless there is a
4 need to make an adjustment in the JMF. No adjustment to the JMF is allowed without approval of the Engineer.

5 When laying HMA, operate the paver at a uniform forward speed consistent with the trucking delivery rate and roller train
6 capacity to result in a continuous operation. The auger speed and flight gate opening must be adjusted to coordinate with the
7 operation.

8 During mainline paving, the wings on the receiving hopper must not be folded, and the mix level in the hopper must be
9 maintained so that the conveyors are not exposed, unless the Engineer approves otherwise.

10 Manual operation of the screed will be permitted in the construction of irregularly shaped and minor areas. These areas
11 include, but are not limited to, gore areas, road approaches, tapers, and left-turn channelizations.

12 When specified in the Contract, reference lines for vertical control are required. Place lines on both outer edges of the
13 traveled way of each roadway. Horizontal control using the reference lines is permitted. The grade and slope for intermediate
14 lanes must be controlled automatically from reference lines, or using a mat referencing device and a slope control device.
15 When the finish of the grade prepared for paving is superior to the established tolerances and when, in the opinion of the
16 Engineer, further improvement to the line, grade, cross-section, and smoothness can best be achieved without the use of the
17 reference line, a mat referencing device may be substituted for the reference line. Substitution of the mat referencing device is
18 subject to the continued approval of the Engineer. The reference line may be removed after the completion of placing the first
19 course of HMA when approved by the Engineer. Whenever the Engineer determines that any of these methods fail to provide
20 the necessary vertical control, the reference lines must be promptly reinstalled by the Contractor before further placement of
21 HMA.

22 **5-04.3(8)A UTILITY ADJUSTMENTS**

23 Utility castings must be adjusted to finished grade before construction of the final wearing course as specified in Section
24 7-20.

25 **5-04.3(9) COMPACTION**

26 **5-04.3(9)A GENERAL**

27 Immediately after the HMA has been spread and struck off, and after surface irregularities have been adjusted, the mix
28 must be thoroughly and uniformly compacted. The completed course must be free from ridges, ruts, humps, depressions,
29 objectionable marks, and irregularities and must conform to the line, grade, and cross-section shown on the Drawings if
30 necessary, the JMF may be altered as specified in Section 9-03.6(7) to achieve desired results.

31 Compaction must take place when the mixture is in the proper condition so that no undue displacement, cracking, or
32 shoving occurs. All compaction equipment must be capable of producing the required compaction. Areas inaccessible to large
33 compaction equipment must be compacted by mechanical or hand tampers. Any HMA that becomes loose, broken,
34 contaminated, shows an excess or deficiency of asphalt, or is in any way defective, must be removed and replaced at no
35 additional cost with fresh Material which must be immediately compacted to conform to the surrounding area.

36 The type of rollers used and their relative position in the compaction sequence must be generally the Contractor's
37 option, provided Specification densities are attained. However, pneumatic tired rollers must be used between October 1st of
38 any year and April 1st of the following year unless the Engineer directs otherwise. Coverages with a vibratory or steel wheel
39 roller may precede pneumatic tired rolling.

40 Vibratory rollers must not be operated in the vibratory mode when the internal temperature of the mix is less than 175 °F.
41 Regardless of mix temperature, a vibratory roller must not be operated in a vibratory mode when checking or cracking of the
42 mat occurs. Vibratory rollers in the vibratory mode are prohibited on bridge decks, brick bases, and cobblestone bases.

43 HMA for preleveling must be thoroughly compacted to the satisfaction of the Engineer.

44 **5-04.3(9)B CONTROL**

45 **5-04.3(9)B1 COMPACTION REQUIREMENT**

46 For an HMA CI having a specified compacted course thickness greater than 0.10 foot, the acceptable level of relative
47 density is a minimum 92.0 percent of the reference maximum density. The reference maximum density is determined by the
48 Engineer as the moving average of the most recent 3 determinations for the JMF being placed to accommodate start-up for a
49 large placement. Where less than 3 determinations have been made, the reference maximum density will be the average of all
50 determinations made to that time to accommodate start-up for a large placement. The actual density attained for a subplot of an
51 HMA CI are determined as the average of 5 nuclear density gauge tests, after completion of the finish rolling, at randomly
52 selected locations within each density subplot. In addition to the randomly selected locations, the Engineer may select any
53 additional locations for testing that appears deficient or in any way defective. Such additional tests are included in the
54 calculation of the average density for that subplot. The quantity represented by each subplot for density testing will be no greater
55 than a single day's production or 400 tons, whichever is less. For density testing of very large daily placements of HMA, the
56 Engineer may increase the size of the final subplot to a maximum of 600 tons. A lot is defined in Section 5-04.3(7)B.

5-04.3(9)B2 TEST RESULTS

Density sublots not meeting the prescribed minimum relative density are considered defective work, and must be removed and replaced. No payment will be made for defective Material that fails to comply with the minimum relative density.

For compaction lots subject to rejection, cores may be used as an alternate to the nuclear density gauge tests. When cores are taken by the Engineer at the request of the Contractor, they must be requested before midnight of the next Working Day after receiving the test results. The cores will be taken at locations selected by the Engineer. Cores must not be located in wheel paths. On sublots that fail to attain the minimum relative density, the cost for the coring will be deducted from any monies due or that may become due the Contractor under the Contract at the rates specified in Section 1-05.7.

In addition to the randomly selected locations for relative density tests for a subplot, the Engineer may also isolate any area that is suspected of being defective in relative density. The isolated area will be evaluated as a separate representative area. Such isolated area determinations are at the sole discretion of the Engineer.

5-04.3(10) JOINTS**5-04.3(10)A LONGITUDINAL AND TRANSVERSE JOINTS**

The placing of the top or wearing course must be nearly continuous, and the roller must pass over the unprotected end of the freshly laid mixture only when the laying of the course is discontinued to allow the mixture to cool. When this work is resumed, the previously compacted mixture must be sawcut back to produce a slightly beveled edge for the full thickness of the course.

Where a transverse joint is being made and pavement will be open to traffic, construct a temporary wedge of HMA at a slope of 5 horizontal to 1 vertical. The HMA in the temporary wedge must be separated from the permanent HMA by strips of heavy wrapping paper. When paving operations are renewed, remove the wrapping paper and trim the joint to a slightly beveled edge for the full thickness of the new HMA course. Dispose of the Material that is cut away and lay new mix against the fresh cut. Use rollers or tamping irons to seal the joint.

All joints must be flush and provide a smooth transition across the meet line.

The longitudinal joint in any 1 layer must be offset from the layer immediately below by no more than 6 inches or less than 2 inches. All longitudinal joints constructed in the top layer must be at a lane line or edge line of the traveled way. Where traffic conditions, project geometry or other conditions exist that make the construction of longitudinal joints at the lane line or edge of the traveled way impractical or impossible, a longitudinal joint may be constructed at the center of the traffic lane with the Engineer's written approval.

Hot lap joints may be allowed by the Engineer provided planned grades are maintained, no surface irregularities exist and compaction requirements are met. Use 2 paving machines to construct longitudinal hot lap joints. Achieve a minimum average compacted density throughout the traffic lane as specified in 5-04.3(10). Do not operate construction equipment except rollers on any uncompacted mix.

Immediately following the compaction of the top wearing course, seal meet line joints where the new asphalt concrete abuts existing asphalt concrete pavements, Portland cement concrete pavements, oil mats, or concrete curbs and gutter as specified in Section 5-04.3(10)B.

5-04.3(10)B NEW PAVEMENT CONNECTIONS WITH EXISTING PAVEMENTS

Where construction of new asphalt concrete pavement connects with an existing roadway surface, driveway, bridge, railway crossing, gutter, or other similar facility, the Contractor must provide a smooth riding transition between the new surface and existing surface. Such work may require modification of the existing roadway profile by burning, planing or milling to achieve the desired smooth riding transition or may require other adjustment of the new connecting surface.

Butt joints are required at the meet lines of new construction and existing surfaces. Trim the existing abutting pavement by chipping, planing, milling, or such other acceptable method to insure a minimum depth of 2 inches of compacted asphalt concrete at the point of connection. Meet lines must be trimmed straight and the edges vertical. Dispose of all waste material resulting from such trimming or chipping.

Transitions made by shimming or feathering must be accomplished when the final course is being constructed, by raking out the oversize aggregate from the HMA class being used. Do not leave the asphalt open graded when feathering and shimming down to an existing surface. If approved by the Engineer, shimming and feathering may be accomplished at a later date. In such cases, use structural HMA Class 3/8 Inch.

Tack all surfaces that will contact the new asphalt as specified in Section 5-04.3(4)C2.

Meet lines between new and existing surfaces must be sealed while the new asphalt concrete is still warm by painting with tack coat and then immediately covering the asphalt paint strip with clean, dry paving sand (Mineral Aggregate Type 6) as specified in Section 9-03.14.

5-04.3(11) SURFACE SMOOTHNESS**5-04.3(11)A GENERAL**

The completed surface of all courses must be of uniform texture, be smooth, and have a continuous plane grade except across the crown. All surfaces must be free from defects of all kinds. The completed surface of the wearing course must not vary more than 1/8 inch from the lower edge of a 10-foot straight edge placed on the surface parallel to the centerline. The

1 transverse slope of the completed surface of the wearing course must not vary more than 1/4 inch in 10 feet from the rate of
2 transverse slope shown on the Drawings.

3 When deviations in excess of, but not more than twice, the above tolerances are found, the pavement surface must be
4 corrected to low places, or Material removed from high places by grinding with an acceptable grinding machine. The corrected
5 deviation must be sealed as specified in Section 5-04.3(14). Where the Engineer determines grinding or filling does not allow
6 for an acceptable repair, removal and replacement of the wearing course of asphalt concrete is required. Correction of defects
7 must be carried out until there are no deviations greater than the allowable tolerances.

8 All areas in which the surface of the completed pavement deviates more than twice the allowable tolerances described
9 above must be removed and replaced to the extent determined by the Engineer.

10 If deviations are found that exceed the allowable tolerances but are not in excess of twice the allowable tolerances
11 described above and, in the opinion of the Engineer, correction using any of the methods specified above do not produce
12 acceptable smoothness and serviceability, the Engineer may accept the completed pavement. Under these described
13 circumstances, the decision whether to accept the completed pavement or to require corrections as described above is vested
14 entirely in the Engineer.

15 **5-04.3(11)B CONCRETE OVERLAYING ASPHALT**

16 When Portland cement concrete pavement is placed on asphalt concrete pavement, the surface tolerance of the asphalt
17 concrete pavement must be such that no elevation lies above the proposed finished grade minus the specified depth of
18 Portland cement concrete pavement. Before placing the Portland cement concrete pavement, any such irregularities must be
19 brought to the required tolerance by grinding or other acceptable means.

20 **5-04.3(12) WEATHER LIMITATIONS**

21 Asphalt for prime coat must not be applied when the ground temperature is lower than 50 °F, without written approval of
22 the Engineer.

23 Do not place HMA on any wet surface, or when the average surface temperatures are less than those specified in the
24 following table, or when weather conditions otherwise prevent the proper handling or finishing of the bituminous mixtures.

| Surface Temperature Limitations | | |
|--|-----------------------|----------------------|
| Compacted Thickness (Feet) | Wearing Course | Other Courses |
| Less than 0.10 | 55 °F | 45 °F |
| 0.10-0.20 | 45 °F | 35 °F |
| 0.21-0.35 | 35 °F | 35 °F |

26 **5-04.3(13) PAVING AND PLANING UNDER TRAFFIC**

27 **5-04.3(13)A GENERAL**

28 In addition the requirements of Section 1-07.23 and the traffic controls required in Section 1-10, and unless the Contract
29 specifies otherwise or the Engineer approves, the Contractor must comply with the following:

30 1. Intersections:

- 31 a. Keep intersections open to traffic at all times, except when paving or planing operations through an intersection
32 requires closure. Such closure must be kept to the minimum time required to place and compact the HMA
33 mixture, or plane as appropriate. For paving, schedule such closure to individual lanes or portions thereof that
34 allows the traffic volumes and schedule of traffic volumes required in the approved traffic control plan. Schedule
35 work so that adjacent intersections are not impacted at the same time and comply with the traffic control
36 restrictions required by the Traffic Engineer. Each individual intersection closure or partial closure, must be
37 addressed in the traffic control plan, which must be submitted to and accepted by the Engineer, see Section 1-
38 10.2(5).
- 39 b. When planing or paving and related construction must occur in an intersection, consider scheduling and
40 sequencing such work into quarters of the intersection, or half or more of an intersection with side street detours.
41 Be prepared to sequence the work to individual lanes or portions thereof.
- 42 c. Should closure of the intersection in its entirety be necessary, and no trolley service is impacted, keep such
43 closure to the minimum time required to place and compact the HMA mixture, plane, remove asphalt, tack coat,
44 and as needed.
- 45 d. Any work in an intersection requires advance warning in both signage and a number of Working Days advance
46 notice as determined by the Engineer, to alert traffic and emergency services of the intersection closure or partial
47 closure.
- 48 e. Allow new compacted HMA asphalt to cool to ambient temperature before any traffic is allowed on it. Traffic is not
49 allowed on newly placed asphalt until approval has been obtained from the Engineer.
50

2. Centerline marking, post-paving temporary marking, temporary stop bars, and maintaining temporary pavement marking must comply with Section 1-10.3(3)L.
3. Permanent pavement marking must comply with Section 8-22.3(1).

5-04.3(13)B SUBMITTALS - PLANING PLAN AND HMA PAVING PLAN

The Contractor must submit a separate planing plan and a separate paving plan to the Engineer at least 5 Working Days in advance of each operation's activity start date. These plans must show how the moving operation and traffic control are coordinated, as they will be discussed at the pre-planing briefing and pre-paving briefing. When requested by the Engineer, the Contractor must provide each operation's traffic control plan on 24 x 36 inch or larger size Shop Drawings with a scale showing both the area of operation and sufficient detail of traffic beyond the area of operation where detour traffic may be required. The scale on the Shop Drawings is 1 inch = 20 feet, which may be changed if the Engineer agrees sufficient detail is shown.

The planing operation and the paving operation include, but are not limited to, metal detection, removal of asphalt and temporary asphalt of any kind, tack coat and drying, staging of supply trucks, paving trains, rolling, scheduling, and as may be discussed at the briefing.

When intersections will be partially or totally blocked, provide adequately sized and noticeable signage alerting traffic of closures to come, a minimum 2 Working Days in advance. The traffic control plan must show where peace officers will be stationed when signalization is or may be, countermanded, and show areas where flaggers are proposed.

At a minimum, the planing and the paving plan must include:

1. A copy of the accepted traffic control plan, see Section 1-10.2(5), detailing each day's traffic control as it relates to the specific requirements of that day's planing and paving. Briefly describe the sequencing of traffic control consistent with the proposed planing and paving sequence, and scheduling of placement of temporary pavement markings and channelizing devices after each day's planing, and paving.
2. A copy of each intersection's traffic control plan (see item 2 in Section 5-04.3(13)A).
3. Haul routes from Supplier facilities, and locations of temporary parking and staging areas, including return routes. Describe the complete round trip as it relates to the sequencing of paving operations.
4. Names and locations of HMA Supplier facilities to be used.
5. List of all equipment to be used for paving.
6. List of personnel and associated job classification assigned to each piece of paving equipment.
7. Description (geometric or narrative) of the scheduled sequence of planing and of paving, and intended area of planing and of paving for each day's work, must include the directions of proposed planing and of proposed paving, sequence of adjacent lane paving, sequence of skipped lane paving, intersection planing and paving scheduling and sequencing, and proposed notifications and coordinations to be timely made. The plan must show HMA joints relative to the final pavement marking lane lines.
8. Names, job titles, and contact information for field, office, and plant supervisory personnel.
9. A copy of the approved Mix Designs.
10. Tonnage of HMA to be placed each day.
11. Approximate times and days for starting and ending daily operations.

5-04.3(13)C PRE-PAVING AND PRE-PLANING BRIEFING

At least 2 Working Days before the first paving operation and the first planing operation, or as scheduled by the Engineer for future paving and planing operations to ensure the Contractor has adequately prepared for notifying and coordinating as required in the Contract, the Contractor must be prepared to discuss that day's operations as they relate to other entities and to public safety and convenience, including driveway and business access, garbage truck operations, Metro transit operations and working around energized overhead wires, school and nursing home and hospital and other accesses, other contractors who may be operating in the area, pedestrian and bicycle traffic, and emergency services. The Contractor, and Subcontractors that may be part of that day's operations, must meet with the Engineer and discuss the proposed operation as it relates to the submitted planing plan and paving plan, approved traffic control plan, and public convenience and safety. Such discussion includes, but is not limited to:

1. General for both Paving Plan and for Planing Plan:
 - a. The actual times of starting and ending daily operations.
 - b. In intersections, how break up the intersection, and address traffic control and signalization for that operation including use of peace officers.
 - c. The sequencing and scheduling of paving operations and of planing operations, as applicable, as it relates to traffic control, to public convenience and safety, and to other contractors who may operate in the Project Site.
 - d. Notifications required of Contractor activities, and coordinating with other entities and the public as necessary.
 - e. Description of the sequencing of installation and types of temporary pavement markings as it relates to planing and to paving.

- f. Description of the sequencing of installation of, and the removal of, temporary pavement patch material around exposed castings and as may be needed.
 - g. Description of procedures and equipment to identify hidden metal in the pavement, such as survey monumentation, monitoring wells, street car rail, and castings, before planning, see Section 5-04.3(4)B3A.
 - h. Description of how flaggers will be coordinated with the planing, paving, and related operations.
 - i. Description of sequencing of traffic controls for the process of rigid pavement base repairs.
 - j. Other items the Engineer deems necessary to address.
2. Paving – additional topics:
- a. When to start applying tack and coordinating with paving.
 - b. Types of equipment and numbers of each type equipment to be used. If more pieces of equipment than personnel are proposed, describe the sequencing of the personnel operating the types of equipment. Discuss the continuance of operator personnel for each type equipment as it relates to meeting Specification requirements.
 - c. Number of JMFs to be placed, and if more than 1 JMF how the Contractor will ensure different JMFs are distinguished, how pavers and MTVs are distinguished if more than 1 JMF is being placed at the time, and how pavers and MTVs are cleaned so that 1 JMF does not adversely influence the other JMF.
 - d. Description of contingency plans for that day's operations such as equipment breakdown, rain out, and Supplier shutdown of operations.
 - e. Number of sublots to be placed, sequencing of density testing, and other sampling and testing.

5-04.3(14) SEALING OF PAVEMENT SURFACES

Any wearing course or other pavement course used for the driving surface will be evaluated by the Engineer to determine whether a fog seal is required. Determination is made when the results of nuclear or core density testing show that a seal is needed. The fog seal must be CSS 1 or CSS 1h emulsified asphalt uniformly applied to the pavement. The finished application must be free of streaks and bare spots. Dilute the emulsified asphalt at a rate of 1 part water to 1 part emulsified asphalt. Apply the diluted emulsified asphalt at the rate of 0.10 to 0.18 (0.03 to 0.05 residual) gallons per square yard. Apply the emulsified asphalt within the temperature range specified for these asphalt emulsions in Section 5-02.3(3). Unless otherwise approved by the Engineer, the fog seal must be applied before opening to traffic.

5-04.3(15) ANTI-STRIPPING ADDITIVE

Add anti-stripping additive to the HMA per the Engineer determined anti-stripping additive requirement as made known on the returned submittal, see Section 5-04.3(6)C2.

5-04.3(16) SHOULDER PAVING

Shoulders, if required, must be constructed to the lines, grades, and cross-sections specified. Material for building up shoulders must be Mineral Aggregate Type 1.

5-04.3(17) NON-STRUCTURAL HMA APPLICATIONS

5-04.3(17)A HMA SIDEWALKS

Construct asphalt walkways at the locations and to the width specified on the Drawings. Unless the Contract specifies otherwise, asphalt walkways must be constructed with a 4-inch section of compacted crushed rock Mineral Aggregate Type 2 and covered with 3 inches of compacted HMA Class 1/2 Inch.

5-04.3(17)B HMA DRIVEWAYS

Asphalt driveways must be constructed as shown on the Drawings. Unless the Contract specifies otherwise, the Contractor must provide 3 inches of compacted HMA of the class specified in the Contract over 4 inches of compacted Mineral Aggregate Type 2.

5-04.3(18) TEMPORARY PAVEMENT PATCHING

Unless the Contract specifies an HMA CL asphalt concrete as a temporary patch Material, the temporary asphalt patch Material must comply with Section 9-02.5.

The Contractor must furnish, place and maintain a 4-inch minimum compacted thickness of temporary pavement patch Material over open cuts. Such temporary asphalt patching is required where vehicular or pedestrian traffic must be accommodated and permanent pavement patching cannot be placed immediately. Trench backfill must be compacted as specified in Section 2-10. Temporary pavement patch Material must be compacted and leveled to coincide with adjacent surfaces.

If the temporary surface subsides after the initial placement, place additional temporary pavement patch Material over the subsided Material as necessary to maintain a surface level with existing pavement. The Contractor must timely maintain such temporary patching.

Before final restoration of the pavement, must remove the temporary pavement patch Material and such underlying material as may exist, clean the exposed face of the existing pavement to remain, and restore the pavement.

1 5-04.4 MEASUREMENT

2 Measurement for HMA of the class specified will be by the ton whether the HMA is used for structural or non- structural
3 applications, and whether a major quantity or a minor quantity. The net weight of HMA being delivered to the Project Site must
4 be weighed in the transporting equipment on a certified platform scale, and with accuracy, as specified in Section 1-09.2.

5 Measurement of HMA of the class specified will be based on the actual quantity incorporated into the Work as
6 determined by the Material load tickets received and accepted by the Engineer on the day the Material was delivered and
7 incorporated into the Work. Deductions will be made for any asphaltic Material included in the measurement that is not
8 incorporated into the Work on the day delivered.

9 Measurement for "Roadway Preparation" will be made by a single linear foot measurement along the centerline of the
10 main roadway being prepared. All related intersections, side street approaches, and irregular shaped areas thereto will be
11 incidental to this one measurement. Measurement will be to the nearest whole linear foot.

12 Measurement for "Surface Preparation, Plane Bituminous Pavement" will be by the square yard and will be based on the
13 average depth shown on the Drawings plus any additional depth up to 4 inches maximum to cover removal of high spots, to
14 cover extra thickness in existing pavement, and to cover the extra depth required to provide a 4-inch reveal along the curb line
15 as specified in Section 5-04.3(4)B3B. Should the Drawings indicate or the Engineer direct an area be planed in excess of 4
16 inches, that area planed in excess of 4 inches total depth will be measured in additional square yards of surface planed for up
17 to an additional 4 inches depth. In general, any area planed in excess of 4 inches will be measured by the square yard for
18 each incremental depth of 4 inches. The final planed depth beyond the first 4 inches thickness will include multiples of 4 inches
19 with the last planing pass up to 4 inches maximum. (Example: an area of pavement planed to 9.5 inches total depth will be
20 measured as 3 times the square yardage for that area, or 4 inches + 4 inches + 1.5 inches or up to 4 inches.). Measurement
21 also includes sweeping to detect metal hidden below the surface for each 4-inch or less depth increment of pavement to be
22 planed.

23 Measurement for "Surface Preparation, Prelevel" will be by the ton of HMA class placed for preleveling surfaces based
24 on the actual quantity incorporated into the Work as determined by the Material load tickets received and accepted by the
25 Engineer on the day the Material was delivered and placed.

26 Measurement of permanent pavement patching will be by the ton for the HMA class specified.

27 Measurement of temporary pavement patch will be made by the ton for the initial placement only. Additional temporary
28 pavement patch required to maintain the surface of the temporary patch level with adjacent roadway surfaces will not be
29 measured. An exception for measuring pavement patch for electrical conduit construction as specified in Section 8-33 will be
30 based on actual measured dimensions with the width of restoration no greater than 24 inches.

31 Measurement of "Material Transfer Vehicle (MTV)" will be made by the ton of HMA transferred through the MTV and
32 placed. Measurement will not be made for "Material Transfer Vehicle (MTV)" for placed HMA not transferred through the MTV.

33 Measurement for "Pavement, WMA (Class)" will be by the ton in the same manner as measurement for HMA.

34 5-04.5 PAYMENT

35 1. "Pavement, HMA (Class)", per ton.

36 The Bid Item price for "Pavement, HMA (Class)" includes all costs for the work required to furnish, haul, place and
37 compact the HMA mix, including tack coat, fog seal and sealing joints and meet lines, sand for joints and meet lines, cleaning,
38 and such other work as may be necessary and not otherwise set forth as a separate Bid Item in the Bid Form.

39 2. "Roadway Preparation", per linear foot.

40 The Bid Item price for "Roadway Preparation" includes all costs for the work required to prepare the untreated roadway,
41 including scarifying, blading, shaping, and compacting to remove irregularities and obtain a uniform surface except prime coat
42 treatment which will be paid as specified in Section 5-02.

43 3. "Surface Preparation, Prelevel", per ton.

44 The Bid Item price for "Surface Preparation, Prelevel" includes all costs for the work required to prelevel uneven or
45 broken treated surfaces by placing and compacting asphalt as specified in Section 5-04.3(4)B2.

46 4. "Surface Preparation, Plane Bituminous Pavement", per square yard.

47 The Bid Item price for "Surface Preparation, Plane Bituminous Pavement" includes all costs for the work required to
48 prepare the treated surface including sweeping for hidden metal, exposing metal below the pavement surface where indicated
49 on the Drawings before planing, milling and planing and other type pavement removal as may be necessary, removing and
50 disposing of cuttings, extra planing for butt joints, and feathering meet areas in preparation for an asphalt overlay.

51 5. "Crack Sealing", per linear foot.

52 The Bid Item price for "Crack Sealing" includes all costs for the work required to clean and fill the cracks and joints.

53 6. "Pavement Patch, Temporary", per ton.

54 The Bid Item price for "Pavement Patch, Temporary" includes all costs for the work required to install and remove the
55 temporary patch. The costs for additional Material required to maintain temporary pavement patches after the initial installation
56 must be at the sole expense of the Contractor.

57 7. "Material Transfer Vehicle (MTV)", per ton.

1 The Bid Item price for "Material Transfer Vehicle (MTV)" includes all costs for the work required to place HMA through the
 2 MTV. All cost for the MTV not included in "Material Transfer Vehicle (MTV)" are included in other Bid Items and no separate or
 3 additional payment will be made.

4 8. "Pavement, WMA (Class)", per ton.

5 The Bid Item price for "Pavement, WMA (Class)" includes all costs for the work required to furnish, haul, place and
 6 compact the WMA mix, including tack coat, fog seal and sealing joints and meet lines, sand for joints and meet lines, cleaning,
 7 and such other work as may be necessary and not otherwise set forth as a separate Bid Item in the Bid Form.

8 9. Other payment information

9 Payment for Mineral Aggregate (Type) will be made as specified in Section 4-01.5.

10 Payment for removal will be made as specified in Section 2-02.5.

11 All costs for the rejection and disposal of Materials held for more than 24 hours after mixing, as specified in Section 5-
 12 04.3(8), are at the Contractor's sole expense and at no additional or separate cost to the Owner.

13 When cores are taken by the Engineer at the request of the Contractor, the Owner must be reimbursed for the coring
 14 expenses as specified in Section 1-05.7.

15 Where samples have been taken by the Engineer from the uncompressed asphalt concrete, new Material must be placed
 16 and compacted at no additional expense to the Owner.

17 Where the Engineer accepts area of pavement that does not comply with the smoothness requirement as specified in
 18 Section 5-04.3(11)A, the total payment for yardage of that pavement will be reduced by \$500.00 for each and every increment
 19 of section of a single traffic lane of 100 feet in length. Where more than 100 feet of such pavement exists, whether in 1 or more
 20 lanes, payment will be reduced as described. Payment for the last incremental section of said pavement will be reduced by
 21 \$500.00 if such last incremental section is less than 100 feet.

22 Where the placement of asphalt for Portland cement concrete overlay requires grinding to provide for the full thickness of
 23 concrete pavement overlay, all expense for grinding is at the Contractor's sole expense and no separate or additional payment
 24 will be made.

25 Payment for backfill and compaction of the subgrade is included in the Bid Item price for the particular Bid Items of Work
 26 necessitating such work.

27 Payment for subgrade preparation as required by Section 5-04.3(4)C1 will be as specified in Section 2-09.5.

28 Payment for Material used for fog seal as specified in Section 5-04.3(14) will be paid as asphalt for tack coat, except no
 29 payment will be made for sealing pavement that has been repaired as specified in Section 5-04.3(11).

30 All costs for anti-stripping additive as specified in Sections 5-04.3(6) and 5-04.3(15) are incidental to and included in the
 31 applicable Bid Item prices and no separate or additional payment will be made.

32 All costs for temporary pavement marking and removal are incidental to and included in the applicable Bid Item prices
 33 and no separate or additional payment will be made.

34 All costs to repair pavement damaged by the removal of temporary marking tape specified in Section 5-04.3(13) is at the
 35 Contractor's sole expense and no additional or separate payment will be made.

36 All cost to repair existing pavement to remain, that is damaged by the Contractor's planing as specified in Sections 5-
 37 04.3(4)B2 and 5-04.3(4)B3, is at the sole expense of the Contractor and no separate or additional payment will be made.

38 If the Contractor requests and the Engineer approves a change in grade of asphalt binder as specified in Section 5-
 39 04.2(1), the Contractor accepts no change in the Bid Item price, and no separate or additional payment will be made.

40 All cost associated with Contractor proposed and Engineer approved use of recycled asphalt pavement, and use of
 41 substitute asphalt binder grade as specified in Section 5-04.2(1) will be at no cost to the Owner and no separate or additional
 42 payment will be made.

43 All cost to remove and replace newly placed pavement that is defective is at the Contractor's sole expense and no
 44 separate or additional payment will be made.

45 All cost related to planing equipment that is damaged by contacting metal hidden in pavement is at the Contractor's sole
 46 expense and no separate or additional payment will be made. See Sections 5-04.3(3)D and 5-04.3(4)B3.

47 All cost for adjusting metal castings below the existing pavement surface shown on the Drawings, and not visible on the
 48 surface, is specified in Section 7-20.5.

49 All cost related to addressing hidden metal found in pavement as required before starting planing, and which are not
 50 shown on the Drawings, is specified in Section 1-04.6.

51 **SECTION 5-05 CEMENT CONCRETE FOR ROADWAY AND RELATED WORK**

52 **5-05.1 DESCRIPTION**

53 Section 5-05 describes constructing a pavement composed of Portland cement concrete or blended hydraulic cement
 54 concrete on a prepared subgrade or base as specified in this Section and in conformity with the lines, grades, thicknesses,
 55 and typical cross-sections shown on the Drawings, Standard Plans, or established by the Engineer. Cement concrete
 56 pavement construction consists of:

- 1 1. Roadway Paving. May be full reconstruction, but typically selective reconstruction, of cement concrete roadway or
- 2 cement concrete roadway base with asphalt overlay.
- 3 2. Non-Roadway. Requirements for cement concrete alleys, driveways, sidewalks, curb ramps, curbs, curb and gutters,
- 4 and other cement concrete construction on prepared subgrade or base.
- 5 Extra Work for using colored or imprinted concrete including color matching joint material, when specified, is also
- 6 addressed.

5-05.2 MATERIALS

Materials must comply with the requirements of the following Sections:

| Material | Section |
|--|----------------|
| Portland Cement and Blended Hydraulic Cement | Section 9-01 |
| Fine Aggregate | Section 9-03 |
| Coarse Aggregate | Section 9-03 |
| Combined Aggregate | Section 9-03 |
| Premolded Joint Filler | Section 9-04.1 |
| Joint Sealants | Section 9-04.2 |
| Deformed Steel Bars (Rebar) | Section 9-07.2 |
| Dowel Bars | Section 9-07.5 |
| Tie Bars | Section 9-07.6 |
| Wire Mesh | Section 9-07.7 |
| Concrete Patching Material | Section 9-20 |
| Curing Materials and Admixtures | Section 9-23 |
| Water | Section 9-25 |
| Epoxy Resins | Section 9-26 |

5-05.3 CONSTRUCTION REQUIREMENTS

5-05.3(1) CONCRETE MIX DESIGN

The Contractor must provide a concrete mix design for each cement concrete class specified in the Bid Form.

Use ACI 211.1 as a guide to determine proportions. The Contractor is responsible for concrete strength, placement, and workability. The maximum slumps determined per AASHTO T 119 (ASTM C 143) are 4 inches, unless otherwise accepted by the Engineer.

The specified cement concrete mix designs must comply with this Section and the parameters specified by the following cement concrete classes and table:

1. Roadway Cement Concrete, Variable Mixes: Variable mixes indicates that design parameters are broad and more than 1 mix design for this class is allowed, to provide the Contractor with more control of work. Mix designs meeting the requirements of any of the following 3 roadway cement concrete class may be provided for this class. Only 1 pay item exists; the Contractor determines the means and method of mix usage and associated costs of mixes within Contract requirements.
2. Roadway Cement Concrete, HES: HES indicates a high-early-strength cement concrete. HES and roadway cement concrete are included in the Bid Item description, as well as a time from batching to opening to traffic (3000 psi).
3. Roadway Cement Concrete: Traditional 28 day cement concrete without pozzolans. Roadway cement concrete is included in the Bid Item description.
4. Roadway Cement Concrete, W/25 percent pozzolans: W/25 percent pozzolans indicates that minimal cement content is desired and the use of pozzolans is required. W/25 percent pozzolans and Roadway are included in the Bid Item description.
5. Non-Roadway Cement Concrete, HES, High Strength: HES indicates a high-early-strength cement concrete. HES, High Strength, and non-roadway cement concrete are included in the Bid Item description, as well as a time from batching to opening to traffic (3000 psi for commercial driveways, 2500 psi for non-commercial driveways, and 2500 psi for other applications).
6. Non-Roadway Cement Concrete, High Strength: High Strength indicates a high strength non-roadway cement concrete. High Strength and non-roadway cement concrete are included in the reference.

- 1 7. Non-Roadway Cement Concrete, High Strength W/25 percent pozzolans: High Strength indicates a high strength
 2 non-roadway cement concrete. W/25 percent pozzolans indicates that minimal cement content is desired and the use
 3 of pozzolans is required. High Strength, Non-Roadway, and W/25 percent pozzolans are included in the reference.
 4 8. Non-Roadway Cement Concrete: Traditional non-roadway cement concrete. Only non-roadway cement concrete is
 5 included in the reference.
 6 9. Non-Roadway Cement Concrete, W/25 percent pozzolans: W/25 percent pozzolans indicates that minimal cement
 7 content is desired and the use of pozzolans is required. Non-roadway cement concrete and W/25 percent pozzolans
 8 are included in the reference.

9 Mix designs for the preceding classes of cement concrete must comply with the design strengths by arithmetic mean and
 10 be proportioned within the limits specified in the following table.

Cement Concrete Mix Design Strengths

| Cement concrete mix class | Design Strength Parameters | | Cementitious Material | | Pozzolans | |
|---|---|------------------------------------|-----------------------|------------------|------------------------------------|--|
| | Minimum flexural strength (psi) | Minimum compressive strength (psi) | Minimum (lbs/CY) | Maximum (lbs/CY) | Maximum % of Cementitious Material | Maximum % of Cementitious Material |
| Roadway Cement Concrete, Variable Mixes | 570 at 28Days ¹ and 650 at 42 Days | 3600 at 28 Days ² | 505 | 675 ³ | None | 10% Microsilica 30% Fly Ash 30% GGBFS 30% Combined ⁴ |
| Roadway Cement Concrete, HES | 650 at 14Days | 3600 at 28 Days ² | 564 | 675 ³ | None | 10% Microsilica 30% Fly Ash 30% GGBFS 30% Combined ⁴ |
| Roadway Cement Concrete | 570 at 28Days ¹ and 650 at 42 Days | 3600 at 28 Days | 505 | 587 | None | 10% Microsilica 30% Fly Ash 30% GGBFS 30% Combined ⁴ |
| Roadway Cement Concrete, W/25% pozzolans | 570 at 28Days ¹ and 650 at 42Days | 3600 at 28 Days | 505 | 587 | 25% Combined ⁴ | 10% Microsilica 30% Fly Ash 30% GGBFS 30% Combined ⁴ |
| Non-Roadway features are alleys, driveways, sidewalks, curb ramps, curbs, curb and gutters. Mix requirements below are referenced from Specification Sections addressing those features. | | | | | | |
| Non-Roadway Cement Concrete, HES, High Strength | N/A | 3000 at 28 days ² | 564 | 675 ³ | None | 10% Microsilica 30% Fly Ash 30% GGBFS 30% Combined ⁴ |
| Non-Roadway Cement Concrete, High Strength | N/A | 3000 at 28 Days | 463 ⁵ | 564 | None | 10% Microsilica 30% Fly Ash 30% GGBFS 30% Combined ⁴ |
| Non-Roadway Cement Concrete, W/25% pozzolans, High Strength | N/A | 3000 at 28 Days | 463 ⁵ | 564 | 25% Combined ⁴ | 10% Microsilica 30% Fly Ash 30% GGBFS 30% Combined ⁴ |
| Non-Roadway Cement Concrete | N/A | 2500 at 28 Days | 463 ⁵ | 505 | None | 10% Microsilica 30% Fly Ash 30% GGBFS 30% Combined ⁴ |
| Non-Roadway Cement Concrete, W/25% pozzolans | N/A | 2500 at 28 Days | 463 ⁵ | 505 | 25% Combined ⁴ | 10% Microsilica 30% Fly Ash 30% GGBFS 30% Combined ⁴ |

NOTES:

- 13
 14 1. Mix design can be accepted based on 28 day requirement provided no single beam test is under 550 psi and quality
 15 level is not less than 80 percent per the Quality Level Calculation in this Section.

- 1 2. Mix design for high-early-strength requires 5 sets of cylinder tests at the specified time from batching for a lower
- 2 compressive strength for opening to traffic as specified here (3000 psi roadway, commercial driveways, and alleys,
- 3 2500 psi for residential driveways). The quality level must not be less than 80 percent per the Quality Level
- 4 Calculation in this Section.
- 5 3. Maximum for HES 24 hour or less mix is 752 pounds; a higher limit requires approval of the Engineer.
- 6 4. Combined use of Fly Ash and GGBFS; Microsilica not included.
- 7 5. 548 if 3/8" or 1/2" course aggregate used

9 **5-05.3(1)A MATERIALS**

10 Materials must conform to Section 5-05.2 and must comply with Section 5-05.

11 **5-05.3(1)B ROADWAY CEMENT CONCRETE**

12 Fine aggregate must conform to Section 9-03.1(2), Class 1. Coarse aggregate must conform to Section 9-03.1(3),
13 AASHTO grading No. 467. An alternate combined gradation conforming to Section 9-03.1(4) may be proposed, that has a
14 nominal maximum aggregate size equal to or greater than a 1-1/2 inch sieve.

15 **5-05.3(1)C NON-ROADWAY CEMENT CONCRETE**

16 Fine aggregate must conform to Section 9-03.1(2), Class 2. Coarse aggregate must conform to Section 9-03.1(3).
17 Coarse aggregate used must be 3/4 inch to 1-1/2 inch, at the option of the Contractor, except as provided for below.

- 18 1. An alternate combined gradation conforming to Section 9-03.1(4) may be proposed, that has a nominal maximum
- 19 aggregate size equal to or greater than a 1-1/2 inch sieve.
- 20 2. The maximum size of aggregate used for extruded or slip formed curb construction or pattered cement concrete is at
- 21 the option of the Contractor, but must not be larger than 1 inch or smaller than 3/8 inch.

22 **5-05.3(1)D POZZOLANS**

23 Fly ash, if used, must be as specified in Section 9-23.6 and must be limited to Class F with a maximum CaO content of
24 15 percent by weight.

25 Ground granulated blast furnace slag, if used, must conform to Section 9-23.7.

26 Blended Hydraulic Cement, if used, must comply with Section 9-01.2(3).

27 The water-cement ratio is calculated on the total weight of cementitious material. The following are considered
28 cementitious materials: Portland cement, fly ash, ground granulated blast furnace slag, and microsilica.

29 **5-05.3(1)E SUBMITTALS**

30 The Contractor's submittal for all materials in this Section must include the mix proportions per cubic yard; test results
31 from flexural strength of beams and roadway concrete and compressive strength of cylinders and all cement concrete: the
32 proposed material sources: and applicable certifications for all ingredients. For roadway concrete, the mix must be capable of
33 providing a minimum flexural strength of 650 psi. For non-roadway concrete, the mix must be capable of providing the
34 minimum time based compressive strength.

- 35 1. Roadway Concrete: Evaluation of roadway concrete strength must be based on statistically analyzed results of 5
- 36 beam specimens made per AASHTO T 126 and tested per AASHTO T 177, which demonstrate a quality level of not
- 37 less than 80 percent analyzed per the Quality Level Calculation in this Section.
- 38 2. In addition the Contractor must fabricate, cure, and test 5 sets of cylinders, for evaluation of 28 Day strengths, per
- 39 AASHTO T 22 and AASHTO T 23, using the same mix design as used in fabrication of the beams.
- 40 3. Non-Roadway Concrete: Evaluation of non-roadway concrete strength must be based on statistically analyzed results
- 41 of 5 sets (10 total) cylinders specimens made per AASHTO T 22 and tested per AASHTO T 23, which demonstrate a
- 42 quality level of not less than 80 percent analyzed per the Quality Level Calculation in this Section.
- 43 4. High-Early-Strength (HES) Concrete: In addition to the above, evaluation of high-early-strength concrete at specified
- 44 time, for road opening strengths must be based on statistically analyzed results of 5 sets (10 total) cylinders
- 45 specimens made per AASHTO T 22 and tested per AASHTO T 23, which demonstrate a quality level of not less than
- 46 80 percent analyzed per the Quality Level Calculation in this Section.

47 Mix designs submitted by the Contractor must provide a unique identification for each proposal and must include test
48 data confirming that concrete made per the proposed design will comply with the requirements of this Section. Test data must
49 be from an independent testing lab or from a commercial concrete producer's lab. If the test data is developed at a producer's
50 lab, the Engineer or a representative may witness all testing.

51 Following acceptance of the Contractor's mix design as specified in Section 1-05.3, the following conformance
52 requirements apply.

53 Conformance to Mix Design: Cement and coarse and fine aggregate weights must be within the following tolerances of
54 the mix design.

| Portland Cement Concrete Batch Weights, per cubic yard of Concrete | | |
|--|--------------|--------------|
| Cement | +5% | -1% |
| Coarse Aggregate | + 200 Pounds | - 200 Pounds |
| Fine Aggregate | + 200 Pounds | - 200 Pounds |

If the total cementitious material weight is made up of different components, these component weights must be within the following tolerances:

- Portland cement weight plus 5 percent or minus 1 percent of that specified in the mix design.
 - Fly ash and ground granulated blast furnace slag weight \pm 5 percent of that specified in the mix design.
 - Microsilica weight \pm 10 percent of that specified in the mix design.
- Water must not exceed the maximum water specified in the mix design.

The Contractor may initiate minor adjustments to the accepted mix proportions within the tolerances noted above without resubmitting the mix design.

Using admixtures to accelerate the set or to increase workability is permitted only when approved by the Engineer. Only non-chloride accelerating admixtures that comply with Section 9-23.4 are allowed. The Contractor must notify the Engineer in writing of any proposed modification. A new mix design will designate a new lot.

5-05.3(1)F QUALITY LEVEL CALCULATION

The procedures for determining the quality level are as follows:

- Determine the arithmetic mean, \bar{X}
- Compute the sample standard deviation, S_n
- Compute the lower quality index (QI), where L is mix design requirement.

For $n = 5$ sets, a $QI \geq 0.88$ is required for a quality level not less than 80 percent

$$QI = (\bar{X} - L) / S_n$$

5-05.3(2) CONSISTENCY

The Materials must be mixed with sufficient water to produce a stiff concrete which will hold its shape when deposited on the subgrade. Concrete placed during wet weather must be mixed with sufficient water to produce a very stiff mixture. The consistency must be such that mortar does not separate from the coarse aggregate during handling.

For Roadway Concrete: The water-cementitious material ratio, by weight, must not exceed 0.44. When slip form paving equipment is used, the Contractor must further control concrete consistency to ensure that edge slump conforms to the requirements of Section 5-05.3(11).

For Non-Roadway Concrete:

| Cement | | Max. W/C |
|--------|--------|----------|
| Sacks | Pounds | |
| 4.5 | 423 | 0.65 |
| 5 | 470 | 0.58 |
| 5.5 | 517 | 0.53 |
| 6 | 564 | 0.49 |
| 6.5 | 611 | 0.45 |
| 7+ | 658+ | 0.44 |

Interpolate between values for cement contents not listed.

5-05.3(3) EQUIPMENT

Equipment necessary for handling Materials and performing all parts of the Work must conform to the following requirements.

5-05.3(3)A BATCH PLANT AND EQUIPMENT

All concrete must be batched in a prequalified manual, semi-automatic, or automatic plant as specified in Section 6-02.3(4)A. The Engineer is not responsible for any delays to the Contractor due to problems in getting the plant certified.

1 **5-05.3(3)B MIXING EQUIPMENT**

2 Concrete may be mixed at a batching plant or wholly or in part in truck mixers. Each mixer must have a manufacturer's
3 plate attached in a prominent place showing the capacity of the drum in terms of volume of mixed concrete and the speed of
4 rotation of the mixing drum or blades.

5 Truck mixers used for mixing and hauling concrete, and truck agitators used for hauling plant-mixed concrete, must
6 conform to the requirements of Section 6-02.3(4)A.

7 Bodies of non-agitating hauling equipment for concrete must be smooth, mortar-tight, metal containers must be capable
8 of discharging the concrete at a satisfactory controlled rate without segregation. Covers must be provided when needed for
9 protection. Plant-mixed concrete may be transported in non-agitated vehicles provided that the concrete is delivered to the Job
10 Site and discharge is completed within 45 minutes after the introduction of mixing water to the cement and aggregates, and
11 provided the concrete is in a workable condition when placed.

12 **5-05.3(3)C FINISHING EQUIPMENT – ROADWAY**

13 When and where specified in the Contract, or as desired by the Contractor and approved by the Engineer, the method of
14 constructing concrete pavement for continuous roadway paving must be with approved slip form paving equipment designed
15 to spread, consolidate, screed, and float-finish the freshly placed concrete in 1 complete pass of the machine, so a dense and
16 homogeneous pavement is achieved with a minimum of hand finishing. When and where indicated, use this method for both
17 cement concrete and cement concrete base paving.

18 Place cement concrete pavement with approved placement and finishing equipment using stationary side forms except
19 where slip forms are used.

20 Hand screeding and float finishing of cement concrete pavement may only be used on small irregular areas as allowed
21 by the Engineer.

22 **5-05.3(3)D JOINT SAWING EQUIPMENT - ROADWAY**

23 The Contractor must provide approved power driven concrete saws for sawing joints, adequate in number of units and
24 power to complete the sawing at the required rate. Provide at least 1 standby saw in good working order. Maintain an ample
25 supply of saw blades at the Project Site at all times during sawing operations. Provide adequate artificial lighting facilities for
26 night sawing. All of this equipment must be on the Job Site both before and continuously during concrete placement. Sawing
27 equipment must be available immediately and continuously upon call by the Engineer on a 24-hour basis, including Saturdays,
28 Sundays and Holidays.

29 **5-05.3(3)E SMOOTHNESS TESTING EQUIPMENT – ROADWAY**

30 The Contractor must provide a long-handle 10-foot straight edge for checking the surface smoothness, as specified in
31 Section 5-05.3(12), on the Job Site before starting to place concrete. The straight edge must be lightweight, straight and true,
32 and equipped with a long handle to allow for checking the smoothness of the surface in the direction of traffic and across traffic
33 lanes.

34 **5-05.3(4) CEMENT CONCRETE BATCHING AND ACCEPTANCE**

35 **5-05.3(4)A MEASURING, AND BATCHING MATERIALS**

36 The batch plant site, layout, equipment, and transport of material must ensure a continuous supply of Material to the
37 Work.

38 Measuring Materials:

- 39 1. The fine aggregate and each size of coarse aggregate must be measured by weighing, with the weight for the
40 particular aggregates used being proportional to their respective bulk specific gravities. The weighing of each size of
41 material must be a separate and distinct operation.

42 Corrections must be made for variations in weight of materials due to the moisture content.

43 The equipment for weighing aggregates must conform to the requirements of Section 1-09.2

- 44 2. Cement must be weighed on scales meeting the requirements of Section 1-09.2. Adequate provision must be made
45 to prevent loss of cement between the batch box and the mixer.

- 46 3. Water may be measured either by volume or by weight. The accuracy of measuring the water must be within a range
47 of error of 1 percent.

48 Batching Materials: On all projects requiring more than 2500 cubic yards of Portland cement or blended hydraulic cement
49 concrete for paving, the batching plant must be equipped to proportion aggregates and cement by weight using automatic and
50 interlocked proportioning devices of approved type.

51 **5-05.3(4)B ACCEPTANCE OF PORTLAND CEMENT OR BLENDED HYDRAULIC CEMENT CONCRETE**

52 Acceptance of cement concrete pavement per class is specified in Section 5-05.3(4)B3.

53 The point of acceptance is per WAQTC FOP for TM 2 or at the point of discharge when a pump is used. The concrete
54 producer must provide a certificate of compliance for each truckload of concrete as specified in Section 6-02.3(5)B.

1 Acceptance testing for compliance of air content and 28Day compressive strength must be conducted from samples
2 prepared per WAQTC FOP TM 2. Air content must be determined per WAQTC FOP for AASHTO T 152. Compressive
3 strength must be determined per AASHTO T 23 and AASHTO T 22.

4 The Contractor must provide cure boxes as specified in Section 6-02.3(5)H, and protect concrete cylinders in cure boxes
5 from excessive vibration and shock waves during the curing period as specified in Section 6-02.3(6)D.

6 **5-05.3(4)B1 ACCEPTANCE PARAMETERS FOR ROADWAY CEMENT CONCRETE**

7 Representative area method, see Section 5-05.3(4)B3, for acceptance applies to all other projects and cement concrete
8 work specified in Section 5-05.

9 The lower limit for air content (LLAC) is 4.0 percent, and the upper limit for air content (ULAC) is 7.0 percent. The lower
10 limit for compressive strength (LLCS) is 1200 psi less than that established in the mix design as the arithmetic mean of the 5
11 sets of 28Day compressive strength cylinders, or 3600 psi, whichever is higher. These compressive strength cylinders must be
12 cast at the same time as the flexural beams used to prequalify the mix design under Section 5-05.3(1). There is no upper limit
13 for 28 Day compressive strength.

14 Parameters for pavement thickness are shown on the Contract Documents. See Section 5-05.5(2).

15 **5-05.3(4)B2 ACCEPTANCE PARAMETERS - NON-ROADWAY CEMENT CONCRETE**

16 For non-roadway cement concrete, the LLCS is 2500 psi for standard non-roadway mix and 3000 psi for High Strength
17 non-roadway mix. The LLAC is 4.0 percent, and the ULAC is 7.0 percent.

18 **5-05.3(4)B3 REPRESENTATIVE AREA METHOD**

19 Non-roadway cement concrete, and roadway cement concrete areas as determined by the Engineer, will be sampled at
20 the discretion of the Engineer and accepted based on the representative area method.

21 Each representative area, including individual subplot when not included in a lot, will meet the specified acceptance
22 requirements for compressive strength and air content when the compressive strength is equal to or greater than the LLCS,
23 and the air content is equal to or falls between the LLAC and ULAC.

24 Each representative area as determined by the Engineer will be rejected if any of the following conditions occur:

- 25 1. Individual strength tests representing a representative area falls below the LLCS by more than 12 percent, or 500 psi
26 for roadway cement concrete, 300 psi for non-roadway cement concrete, whichever is least.
- 27 2. Individual strength tests at a representative area falls below the LLAC of 4 percent by more than 1 percent.
- 28 3. Individual strength tests at a representative area falls above the ULAC of 7 percent by more than 1 percent.

29 Sublots not meeting the full requirements and not rejected may remain in place but are subject to a lot based Pay
30 Adjustment disincentive as described in the following table:

| | Pay Factor = 1.00 | 0.90 | 0.75 | 0.50 |
|--|--|---------------------------------------|---------------------------------------|--------------------------------------|
| Cement Concrete Mix | LLCS (28 Day Compressive Strength, psi) | 96% of LLCS | 92% of LLCS | 88% of LLCS |
| Non-Roadway Cement Concrete | >= 2500 | >= 2400 | >= 2300 | >= 2200 |
| Non-Roadway Cement Concrete, High Strength | >=3000 | >= 2820 | >= 2760 | >= 2640 |
| Roadway Cement Concrete | 1200 psi less than mix design arithmetic mean, or 3600 psi | Calc | Calc | Calc |
| LLAC & ULAC % Air Content | | | | |
| Non-Roadway Cement Concrete | >= 4 and <= 7 | < 4.0 and >= 3.6, or > 7.0 and <= 7.4 | < 3.6 and >= 3.3, or > 7.4 and <= 7.7 | < 3.3 and >= 3.0, or >7.7 and <= 8.0 |
| Non-Roadway Cement Concrete, High Strength | | | | |
| Roadway Cement Concrete | | | | |

32
33 The price adjustment factor is 60 percent for compressive strength and 40 percent for air content. Thus, the composite
34 pay factor for strength and air is the pay factor for Strength by 60 percent plus the lower pay factor for air content by 40
35 percent. However, if either pay factor is 0, than the composite pay factor is 0 and the complete lot is rejected and no payment
36 will be made.

37 **5-05.3(4)B4 RE-TESTING BY CORING**

38 When compressive strengths fail to satisfy the acceptance requirements above, the Contractor may request acceptance
39 of in-place concrete strength based on core results. This method will not be used if the Engineer determines coring would be

1 harmful to the integrity of the Structure. If allowed, cores must be obtained by the Contractor per AASHTO T 24 and delivered
2 to the Owner for testing per AASHTO T 22. Do not take cores within 18 inches of joints

3 If the concrete in the Structure will be dry under service conditions, the core must be air-dried at a temperature between
4 60 °F and 80 °F and at a relative humidity less than 60 percent for 7 days before testing, and will be tested air dry.

5 Acceptance for each subplot or failed area by the core method requires that 3 cores be at least 85 percent of the specified
6 LLCS with no 1 core less than 75 percent. The failing area may be subdivided to form smaller areas with each requiring 3
7 cores. When the Contractor requests strength analysis by coring, the results obtained will be accepted by both parties as
8 conclusive and supersede all other strength data for the area represented. Failing subplot compressive strengths within a lot will
9 be replaced by the new data and, if applicable, sub-sublots and sub-sublot sizes.

10 If the Contractor elects to core, cores must be obtained no later than 50 Days after initial concrete placement. The
11 Engineer will concur in the locations to be cored. The Contractor is responsible for repair of cored areas. The cost incurred in
12 coring and testing these cores, including repair of core locations, is borne by the Contractor.

13 **5-05.3(4)C REJECTION OF CONCRETE**

14 The Contractor may, before sampling, elect to remove any defective material and replace it with new material at no
15 expense to the Owner. Any such new material will be sampled, tested, and evaluated for acceptance.

16 The Engineer may reject any load that appears defective before placement. Material rejected before placement must not
17 be incorporated into the pavement. No payment will be made for the rejected materials unless the Contractor requests that the
18 rejected material be tested. If the Contractor elects to have the rejected materials tested, a sample will be taken and both the
19 air content and strength must be tested by the Engineer. Payment for rejected material will be based on the results of 1
20 sample, which was taken and tested. If the rejected material fails either test, no payment will be made for the rejected material.
21 In addition, the cost of sampling and testing at the rate of \$300.00 per sample is borne by the Contractor. If the rejected
22 material passes both tests, the mix will be compensated for at a composite pay factor of lot or representative area and the cost
23 of the sampling and testing is borne by the Owner.

24 The Engineer may reject any load that exceeds a maximum slump of 4 inches or as otherwise described in the accepted
25 mix design. Slump is determined per AASHTO T 119 (ASTM C 143).

26 The Engineer may reject any concrete visually showing segregation or lack of consolidation. Acceptance based on visual
27 bases where aesthetics are a critical feature, such as sidewalks, patterned, colored, or exposed aggregate concrete, will be at
28 the sole discretion of the Engineer. No payment will be made for the rejected materials and the Contractor must remove and
29 replace the material at no cost to the Owner.

30 The Engineer will reject any lot, sub-lot, or representative area that fails to comply with Section 5-05.3(4)B3. No payment
31 will be made for the rejected materials and the Contractor must remove and replace the material at no cost to the Owner.

32 The Engineer will reject any primary unit or secondary unit that fails to comply with Sections 5-05.5(2). No payment will
33 be made for the rejected materials and the Contractor must remove and replace the material at no cost to the Owner.

34 **5-05.3(5) MIXING CONCRETE**

35 The concrete may be mixed in a batching plant or in truck mixers. The mixer must be of an approved type and capacity.
36 Mixing time is measured from the time all materials are in the drum. Ready-mixed concrete must be mixed and delivered as
37 specified in Section 6-02.3(4)A and 6-02.3(4)B and other requirements of Section 6-02.3(4) not address within Section 5-
38 05.3(5).

39 When mixed in a batching plant, the mixing time must not be less than 50 seconds nor more than 90 seconds.

40 Operate the mixer at a drum speed as shown on the manufacturer's nameplate on the mixer. Any concrete mixed less
41 than the specified time must be discarded and disposed of by the Contractor at no expense to the Owner. The volume of
42 concrete mixed per batch must not exceed the mixer's rated capacity, as shown on the manufacturer's standard rating plate on
43 the mixer.

44 Each concrete mixing machine must be equipped with a device for counting automatically the number of batches mixed
45 during the day's operation.

46 Retempering concrete by adding water or by other means is not permitted.

47 **5-05.3(5)A LIMITATIONS OF MIXING**

48 Do not mix, place, or finish concrete when the natural light is inadequate, as determined by the Engineer, unless an
49 adequate and approved artificial lighting system is operated.

50 Discontinue mixing and placing concrete when a descending air temperature in the shade away from artificial heat
51 reaches 40 °F and do not resume until an ascending air temperature in the shade and away from artificial heat reaches 35 °F,
52 unless authorized in writing by the Engineer.

53 When mixing and placing is authorized during cold weather, the aggregates may be heated by either steam or dry heat
54 before being placed in the mixer. The apparatus used must heat the mass uniformly and must be arranged to preclude the
55 possible occurrence of overheated areas which might injure the materials. Unless otherwise authorized, the temperature of the
56 mixed concrete must not be less than 50 °F or more than 90 °F during discharge into or from the hauling conveyance. Do not
57 mix concrete with aggregates less than 32 °F.

1 5-05.3(6) SUBGRADE

2 The subgrade must be constructed as specified in Section 2-06.

3 Do not place concrete on a frozen subgrade nor during heavy rainfall.

4 The subgrade must be moist before the concrete is placed.

5 When the subgrade is an asphalt treated base the surface must be clean and free of any deleterious materials. When
6 placing concrete on a treated base, the surface temperature must not exceed 90 °F. If water is used for cooling, remove any
7 excess water standing in pools or flowing on the surface before placing concrete.

8 When applicable, the subgrade must be prepared and compacted to a minimum of 3 feet beyond each edge of the area
9 receiving concrete pavement, to accommodate the slip form equipment.

10 Where thickened edges for pavements are required, excavate the subgrade and shape to provide for the section shown.

11 5-05.3(7) PLACING, SPREADING, AND COMPACTING CONCRETE

12 All the requirements apply regardless of the methods used to place concrete pavement.

13 The Specifications relating to the frequency and amplitude of internal vibration are considered the minimum requirements
14 and are intended to ensure adequate density in the hardened concrete.

15 5-05.3(7)A SLIP FORM CONSTRUCTION FOR CONTINUOUS PAVING

16 When and where specified in the Contract, or as desired by the Contractor and approved by the Engineer, the method of
17 constructing concrete pavement may use slip form paving equipment.

18 Distribute the concrete uniformly into final position by a self-propelled slip form paver without delay. The alignment and
19 elevation of the paver must be regulated from outside reference lines established for this purpose. The paver must vibrate the
20 concrete for the full width and depth of the strip of pavement being placed with vibration adequate to provide a consistency of
21 concrete that will stand normal to the surface with sharp well-defined edges. The sliding forms must be rigidly held together
22 laterally to prevent spreading of the forms.

23 The plastic concrete must be effectively consolidated by internal vibration with transverse vibrating units for the full width
24 of pavement and/or a series of equally spaced longitudinal vibrating units. The space from the outer edge of the pavement to
25 the outer longitudinal unit must not exceed 9 inches. The spacing of internal units must be uniform and not exceed 18 inches.

26 The term internal vibration refers to vibrating units located within the specified thickness of pavement section.

27 The rate of vibration of each vibrating unit must not be less than 7,500 cycles per minute, with an amplitude of vibration
28 sufficient to be perceptible on the surface of the concrete along the entire length of the vibrating unit and for a distance of at
29 least 1 foot. The frequency of vibration or amplitude must be varied proportionately with the rate of travel to result in a uniform
30 density and air content. The paving machine must be equipped with a tachometer or other suitable device for measuring and
31 indicating the actual frequency of vibrations.

32 The concrete must be held at a uniform consistency. Operate the slip form paver with as nearly a continuous forward
33 movement as possible. Coordinate all operations of mixing, delivering, and spreading concrete to provide uniform progress
34 with stopping and starting of the paver held to a minimum. If, for any reason, it is necessary to stop the forward movement of
35 the paver, the vibratory and tamping elements must also be stopped immediately. Do not apply tractive force to the machine in
36 addition to that which is controlled from the machine.

37 When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the
38 existing pavement must be equipped with protective pads on crawler tracks or rubber-tired wheels on which the bearing
39 surface is offset to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge.

40 5-05.3(7)B STATIONARY SIDE FORM CONSTRUCTION

41 Side form sections must be straight, free from warps, bends, indentations, or other defects. Remove defective forms from
42 the Work. Use metal side forms unless other forms are approved by the Engineer.

43 Side forms may be built up by rigidly attaching a section to either top or bottom of forms. If such buildup is attached to the
44 top of metal forms, the buildup must be of metal.

45 Side forms must be sufficiently rigid, both in the form and in the interlocking connection with adjoining forms, such that
46 springing will not occur under the weight of grading and paving equipment or from the pressure of concrete. Provide sufficient
47 forms so that there will be no delay in placing the concrete due to lack of forms.

48 Before placing side forms, the underlying material must be at the proper grade. Place side forms to the required grade
49 and alignment of the edge of the finished pavement. Wood wedges may be used to adjust the form elevation provided they do
50 not extend into the concrete. The forms must be firmly supported during the entire operation of placing, compacting, and
51 finishing the pavement.

52 Drill forms in advance of being placed to line and grade to accommodate tie bars where specified.

53 Immediately in advance of placing concrete and after all subgrade operations are completed, side forms must be trued
54 and maintained to the required line and grade for a distance sufficient to prevent delay in placing concrete. Do not place
55 concrete until the forms are approved by the Engineer.

1 Side forms must remain in place at least 12 hours after the concrete has been placed, and in all cases until the edge of
2 the pavement no longer requires the protection of the forms. Apply curing compound to the concrete immediately after the
3 forms are removed.

4 Side forms must be thoroughly cleaned and oiled each time they are used and before concrete is placed against them.

5 Unless otherwise approved by the Engineer, concrete must be spread, screeded, shaped, and consolidated by 1 or more
6 self-propelled machines. These machines must uniformly distribute and consolidate concrete without segregation so that
7 completed pavement will conform to required cross-section with a minimum of handwork.

8 The number and capacity of machines furnished must be adequate to perform the Work required at a rate equal to that of
9 concrete delivery.

10 Concrete for the full paving width must be effectively consolidated using surface vibrators, in combination with internal
11 vibrators, or by some other method of consolidation that produces equivalent results without segregation.

12 When vibrators are used to consolidate concrete, the rate of vibration must not be less than 3,500 cycles per minute for
13 surface vibrators or less than 7,000 cycles per minute for internal vibrators. Amplitude of vibration must be sufficient to be
14 perceptible on the surface of the concrete more than 1 foot from the vibrating element. Furnish a tachometer or other suitable
15 device for measuring and indicating frequency of vibration.

16 Connect power to vibrators so that vibration stops when forward or backward motion of the machine is stopped.

17 **5-05.3(8) JOINTS - ROADWAY**

18 Joints in cement concrete pavement will be designated as longitudinal and transverse contraction joints, longitudinal and
19 transverse construction joints, through joints, or isolation joints, and must be constructed as shown on the Drawings or
20 Standard Plans per the following Specifications:

21 Construct the faces of all joints perpendicular to the surface of the cement concrete pavement.

22 All joints in intersections where traffic lanes cross are considered transverse joints; use dowel bars on all joints per the
23 following or as shown on the Drawings.

24 If bar details are not shown on joint details on Drawings, then Standard Plans reinforcement steel details must apply for
25 steel placement.

26 When cement concrete pavement is placed adjacent to existing cement concrete pavement, the vertical face of all
27 existing working joints must be covered with a bond-breaking Material such as polyethylene film, roofing paper, or other
28 Material as approved by the Engineer.

29 **5-05.3(8)A CONTRACTION JOINTS**

30 All contraction joints must be constructed at the locations, intervals, and depths specified in the Contract. Sawed joints
31 are typically used with continuous or full reconstruction paving. Unless otherwise specified, the use of sawed or formed
32 contraction joints is at the option of the Contractor, however, sawing into adjacent cement concrete paving or curbs is not
33 allowed.

34 **5-05.3(8)A1 SAWED CONTRACTION JOINTS**

35 The depth of sawcuts must be as shown on the Drawings or Standard Plans and must not cut underlying pavement tie
36 bars or dowels.

37 Transverse and longitudinal contraction joints must be sawed with suitable power-driven concrete saws. Provide
38 sufficient sawing equipment capable of completing the sawing to the required dimensions and at the required rate to control
39 cracking. To ensure continuity of sawing, standby equipment must be on the Job Site and all sawing equipment must be
40 available immediately and continuously on a 24 hour basis.

41 Provide adequate artificial lighting facilities for night sawing. Joints must not vary from the specified or indicated line by
42 more than 3/4 inch.

43 Sawing transverse contraction joints depends on the setting time of the concrete, and must be done at the earliest
44 possible time following placement of the concrete without tearing or raveling the adjacent concrete excessively.

45 Longitudinal contraction joints must be sawed as required to control cracking and as soon as practical after the initial
46 control transverse contraction joints are completed. For HES concrete this should be within 6 hours of placement. Any sawing
47 of joints that result in premature or uncontrolled cracking must be changed immediately by adjusting the time interval between
48 placing of concrete and the sawing of joints.

49 Any damage to the curing Material during the sawing operations must be repaired immediately after the sawing is
50 completed. If curing compound is used, the area disturbed by sawing of joints must be reapplied immediately upon completion
51 of the sawing operation and care taken to prevent the curing compound from getting into the groove.

52 Install formed transverse contraction joints where designated by the Engineer, if necessary to prevent uncontrolled
53 transverse cracks from occurring before the pavement can be sawed.

54 **5-05.3(8)A2 SEALING SAWED CONTRACTION JOINTS (NON-BASE ONLY)**

55 Sawed contraction joints must be filled with joint sealant filler conforming to the requirements of Section 9-04.2. Joints
56 must be thoroughly clean when sealing and dry if the hot-poured type is used. Take care to avoid air pockets. The hot-poured

1 compound may be applied in 2 or more layers, if necessary. The hot-poured compound and the cold-poured compound must
2 be applied under sufficient pressure to fill the groove from bottom to top, with the cured joint sealant between 1/4 inch and 5/8
3 inch below the top surface of the concrete.

4 **5-05.3(8)A3 FORMED CONTRACTION JOINTS (NON-BASE ONLY)**

5 Construct formed contraction joints by embedding a 3/8 inch thick premolded joint filler as specified in Section 9-04.1 and
6 as shown on the Drawings or Standard Plans. The depth of the formed joints must be as shown on the Drawings or Standard
7 Plans. Cut the premolded joint filler to the exact section of the joint. The length of the premolded joint filler must extend to
8 within 1/4 inch of any panel edge.

9 Place formed contraction joints after compaction and finishing of concrete are completed and before initial set. Cut a
10 vertical groove into the surface at the location of the joint, using a tool provided with stops (tee iron) to prevent cutting the
11 groove deeper than the planned depth. Then embed the preformed joint filler into the groove until the top is flush with the
12 pavement surface, with a deviation of not more than 1/8 inch below the surface. The premolded joint filler must be
13 perpendicular to the surface and always in a straight line.

14 The surface of the pavement must be finished against the filler strip with hand floats to restore the surface finish.
15 Maintain the premolded joint filler in a perpendicular position, true to alignment without irregularities.

16 **5-05.3(8)A4 WEAKENED PLANE CONTRACTION JOINTS (BASE ONLY)**

17 A weakened plane must be made in the plastic concrete to match existing cracks as designated by the Engineer, or as
18 shown on the Drawings. Typically, maximum joints spacing must not exceed 15 feet for a base slab thickness greater than 7
19 inches; and must not exceed 12-1/2 feet for a base slab thickness less than 7 inches.

20 The plane must be weakened with a joint cutter to a minimum depth of 2 inches. Bulging caused by the joint cutter must
21 be corrected by floating lightly.

22 Unless otherwise specified, if new curb is also being placed, place preformed joint filler completely through the curb at
23 the point where the weakened plane intersects the curb.

24 **5-05.3(8)B CONSTRUCTION JOINTS**

25 When placing of standard or slow curing (non-high-early-strength) concrete is discontinued for more than 45 minutes, a
26 transverse construction joint must be installed. Construction joints must be as shown on the Standard Plans. Place traffic
27 cement concrete construction joints at the direction of the Engineer.

28 Construct transverse construction joints between cement concrete pavement and reinforced concrete bridge approach
29 slabs.

30 All transverse and longitudinal construction joints, including the joint between new and existing pavement when widened
31 must be either:

- 32 1. Sawed and sealed with joint filler as specified in Sections 5-05.3(8)A1 and 9-04.2; or
- 33 2. Formed and sealed with a 3/8-inch thick premolded joint filler as specified in Section 9-04.1(1) or as shown on the
34 Drawings or Standard Plans.

35 Unless otherwise specified, construct all longitudinal construction joints with tie bars and all transverse construction joints
36 with dowel bars as shown on the Drawings or Standard Plans. See Section 5-05.3(10)A for exceptions to tie-bars and dowels
37 placement requirements for new to existing joints.

38 Unless otherwise specified, optional keyways are allowed only as detailed in the Standard Plans.

39 **5-05.3(8)C THROUGH JOINTS**

40 Place through joints only where shown on the Drawings. Unless otherwise shown, joint alignment must be at right angles
41 to the pavement Structure centerline.

42 Construct through joints with 3/4 inch premolded joint filler as specified in Section 9-04.1(2). The premolded joint filler
43 must extend from 1 inch below the subgrade to 1 inch below the top of the pavement. Through joints must extend the full width
44 of the pavement Structure. Use dowels unless otherwise directed or otherwise shown on the Drawing.

45 The premolded joint filler must be held accurately in place during the placing and finishing of the concrete by a bulkhead,
46 a holder, a metal cap, or any other approved method. The joint must be perpendicular to the paved surface and the holder
47 must be in place long enough to prevent sagging of the Material, especially on streets having steep grades.

48 Place a wood filler strip or metal cap on the top of the premolded joint filler to form the groove 1 inch deep.

49 After concrete is significantly set and before opening to traffic, remove the wood filler strip or the metal cap above the top
50 of the premolded joint filler and thoroughly cleaned of all loose material. It must then be filled level with the pavement surface
51 with joint sealant meeting the requirements of Sections 9-04.2(2).

52 Heat and place the joint sealant Material per the manufacturer's instructions. Burned Material will be rejected. The
53 through joint groove must be dry when pouring the sealing compound.

1 5-05.3(8)D ISOLATION JOINTS

2 When drainage features are placed within the concrete pavement, place premolded joint filler (as specified in Section 9-
3 04.1(2)) as detailed in the Drawings through the full depth of concrete pavement.

4 5-05.3(8)E JOINT LOCATION

5 Unless otherwise shown on the Drawings or directed by the Engineer, the following applies:

6 5-05.3(8)E1 TRANSVERSE JOINTS

7 Standard spacing of transverse contraction joints along straight sections of pavement Structures, between through joints
8 or between intersections or other irregular areas, must be at intervals as shown on the Standard Plans. Where the spacing
9 between intersections, transverse through joints, or other irregular areas are not in even multiples, the last several spaces
10 approaching the through joint or header must be varied by shortening the spaces. The Contractor must provide advance notice
11 to the Engineer and coordinate the spacing. On horizontal curves, the joint spacing must be measured along the outer edge of
12 the outside lane and at right angles to the center line.

13 When paving adjacent to existing pavement or a previously paved lane, the new transverse joints must be placed to
14 match joint locations in the adjacent pavement. Where the existing joint spacing is greater than intervals as shown on the
15 Standard Plans, intermediate transverse joints must be constructed. The Contractor must provide advance notice to the
16 Engineer and coordinate the spacing.

17 For intersections and other irregular areas, the arrangement of contraction joints must be per standard intersection
18 patterns as shown on the Drawings and Standard Plans. The area of any one irregular panel formed by doweled contraction
19 joints in intersections must not exceed:

- 20 1. 225 square feet, or dimensions of 15 feet, for a slab thickness greater than 7 inches; or
- 21 2. 156 1/4 square feet, or dimensions of 12-1/2 feet for a slab thickness less than 7 inches.

22 The Contractor must provide advance notice to the Engineer and coordinate the spacing.

23 Unless otherwise directed by the Engineer, where uncontrolled cracks have appeared or exist in the adjacent lane not to
24 be replaced, they must be matched as nearly as possible by uniform transverse joints in the second lane. In the event
25 uncontrolled cracks in the existing paved lane are too frequent or in random locations and impossible to match with a uniform
26 spacing, the 2 lanes must be completely separated by a longitudinal through joint when directed by the Engineer.

27 Where integral curb or doweled curb is placed along the concrete pavement, place premolded joint filler transversely
28 across the full section of the curb in true alignment with the pavement joint, perpendicular to the pavement grade.

29 All joints in an intersection are considered transverse joints except those joints that end normal to the curb radius.

30 5-05.3(8)E2 LONGITUDINAL JOINTS

31 Standard locations for longitudinal joints for the following pavement widths, whether contraction or construction, must be
32 as shown on the Standard Plans unless otherwise shown on the Drawings. Typically, longitudinal joints are placed at lane
33 lines; bike lane must be combined with parking and treated as a single lane. Longitudinal or skewed joints must not be placed
34 within bike lanes.

35 Typically, maximum longitudinal joints spacing should not exceed:

- 36 1. 15 feet for a slab thickness greater than 7 inches; and,
- 37 2. 12 1/2 feet for a slab thickness less than 7 inches.

38 A 3/8" x 2" minimum preformed joint filler must be placed between the 2 lanes when the second lane is constructed. See
39 Standard Plans.

40 5-05.3(9) CASTINGS AND STEEL REINFORCING IN CONCRETE PAVEMENT

41 Unless otherwise specified in the Drawings or directed by the Engineer, use reinforcing steel to reinforce cement
42 concrete in rigid pavement around all maintenance hole castings and monument casings in the roadway, except when the
43 casting crosses or is less than 18 inches from any pavement joint. Use one of the following methods of reinforcement:

- 44 1. Steel Reinforcement (Wire Mesh): Castings must have 6-1/2 feet to 7 feet by 6-1/2 feet to 7 feet square or rectangle
45 of steel reinforcement placed around the casting at mid depth of the concrete pavement slab as shown on Standard
46 Plan 406. The centered hole cut for the casting must be cut a minimum of 3 inches to a maximum of 4 inches from
47 the casting at mid depth of the concrete pavement. The dimensions of the mesh must be reduced where pavement
48 joints are encountered such that no reinforcing steel is within 2-1/2 inches of any cement concrete pavement joints or
49 surfaces.

50 Wire mesh must be W2.9 with spacing of 4 inches on-center in both the lateral and transverse directions. Wire mesh
51 for concrete reinforcement must conform to the requirements of Section 9-07.7.

- 52 2. Steel Reinforcement (Rebar): Castings must have 2 squares of steel reinforcing bars (rebar) placed around the
53 casting at mid depth of the concrete pavement slab as shown on Standard Plan 406. Rebar must be size #5 and
54 must be tied at rebar intersection points as shown. Reinforcing steel must not be within 2-1/2 inches of any cement
55 concrete pavement joints or surfaces. Rebar must be as specified in Section 9-07.2.

1 When any portion of castings is within 18 inches of a pavement joint, see Standard Plans, Drawings, or contact the
2 Engineer for addition installation details.

3 See Section 7-20.3(1)C for temporary transition tapers around exposed castings.

4 If reinforcement details are shown on the Drawings, those details must be followed as described. Unless otherwise
5 indicated, any wire mesh and rebar shown on these details must comply with the applicable requirements in methods 1 and 2,
6 respectively.

7 **5-05.3(10) TIE BARS AND DOWEL BARS**

8 Unless otherwise indicated or directed by the Engineer, tie bars must be placed at all longitudinal contraction and
9 construction joints, per the requirements shown on the Standard Plan. In addition, tie bars must be installed when concrete
10 shoulders are placed as a separate operation or when widening existing pavement. See 5-05.3(10)A for new to existing joints
11 tie bars and dowel use requirements.

12 Tie bars must be placed at longitudinal construction joints between lanes so that the individual bars are at the required
13 elevation and spaced as shown on the Standard Plan. Place so that the vertical edge of the concrete is not deformed or
14 otherwise damaged during placement of the bars.

15 Placement tolerances for tie bars must be within 1 inch of the middle of the concrete slab, within 1 inch of being centered
16 over the joint and placed parallel or perpendicular to centerline within 1 inch of the vertical and horizontal plane.

17 Unless otherwise indicated or directed by the Engineer, dowel bars are required for the construction joint at the end of
18 paving operations each day and must be placed per the Standard Plan. Unless otherwise indicated or directed by the
19 Engineer, dowel bars must be placed at all transverse contraction joints as specified in the Contract or per the Standard Plans.
20 See 5-05.3(10)A for New to Existing joints tie bars and dowel use requirements. All dowel bars must have a parting
21 compound, such as curing compound, grease or other Engineer approved equal applied to them before placement. Wire
22 baskets that remain in the pavement to hold the dowels must be approved by the Engineer. Any dowel bar delivered to the
23 project that displays rust/oxidation, pinholes, questionable blemishes, or deviates from the round will be rejected.

24 The Contractor must furnish a manufacturer's certificate of compliance as specified in Section 1-06.3, including mill test
25 report verifying conformance to the requirements of Section 9-07.5 as well as written certification identifying the patching
26 material, when applicable, used at cut dowel bar ends.

27 Only 1 type of dowel bars is allowed per contract; intermixing of different dowel bar types is not allowed.

28 Placement tolerances for dowel bars must be within 1 inch of the middle of the concrete slab, within 1 inch of being
29 centered over the transverse joint and parallel to centerline within 1/2 inch of the vertical and the horizontal plane.

30 Cutting of stiffeners within the dowel bar cage is not allowed.

31 **5-05.3(10)A "NEW TO EXISTING" JOINTS – TIE-BARS AND DOWELS**

32 Unless otherwise directed by the Engineer, when new concrete pavement is to be placed against existing cement
33 concrete pavement, tie bars, and dowel bars must be drilled and grouted into the existing pavement with either Type I or IV
34 epoxy resin as specified in Section 9-26.

35 Tie bars and dowels are not required:

- 36 1. When indicated on the drawing;
- 37 2. When existing pavement is less than 8 inches thick; or
- 38 3. When the Engineer determines the existing concrete to be incompetent.

39 The epoxy-bonding agent must be either Type I or IV epoxy resin as specified in Section 9-26. The Contractor may use
40 any method for drilling the holes, provided the method selected does not damage the existing concrete. Any damage caused
41 by the Contractor's operations must be repaired by the Contractor at no cost to the Owner as specified in Section 1-07.13.

42 The tie bar holes must be blown clean with compressed air before grouting. The bar must be centered in the hole for the
43 full length of embedment before grouting. The grout must then be pumped into the hole around the bar in a manner that the
44 back of the hole will be filled first. Blocking or shimming must not impede the flow of the grout into the hole. Dams, if needed,
45 must be placed at the front of the holes to confine the grout. The dams must allow the escape of air without leaking grout and
46 must not be removed until grout has cured in the hole.

47 **5-05.3(11) ROADWAY FINISHING**

48 After the concrete has been given a preliminary finish using finishing devices, the surface of the fresh concrete must be
49 checked by the Contractor with a straight edge device not less than 10 feet in length. High areas indicated by the straight edge
50 device must be removed by the hand-float method. Each successive check with the straight edge device must lap the previous
51 check path by at least of the length of the straight edge.

52 Any edge slump of the pavement, exclusive of specified edging, in excess of 1/4 inch must be corrected before the
53 concrete has hardened. If edge slump on any 1 foot or greater length of hardened concrete exceeds 1 inch, the concrete must
54 be repaired as specified in Section 5-05.3(19).

1 **5-05.3(11)A EDGING (NON-BASE ONLY)**

2 Before the final finishing is completed and before the concrete has taken the final set, the pavement must be edged as
3 described in the following table:
4

| Location | Radius |
|--------------------------------|----------|
| Edge of Pavement | 1/2 inch |
| Contraction Joints (non-sawed) | 1/4 inch |
| Through or Construction Joints | 1/2 inch |

5
6 Particular attention must be given to edge at the appropriate time. The concrete must attain a partial set and all free
7 water must have disappeared so that the edged joints are clearly defined with no tearing or slump of the edges.

8 **5-05.3(11)B ROADWAY SURFACE FINISHING (NON-BASE ONLY)**

9 Rough Finish: The pavement must be given a final finish surface by texturing with a comb perpendicular to the centerline
10 of the pavement. The comb must produce striations approximately 1/8 inch to 3/16 inch in depth. Randomly space the
11 striations from 1/2 inch to 1-1/4 inch. The comb must be operated mechanically either singly or in gangs with several placed
12 end to end. Finishing must take place with the elements of the comb as nearly perpendicular to the concrete surface as
13 possible, to eliminate dragging the mortar. If the striation equipment has not been previously approved, a test section must be
14 constructed before approval of the equipment. If the pavement has a raised curb without a formed concrete gutter, the
15 texturing must end 2 feet from the curb line. This 2-foot un-textured strip must be hand finished.

16 **5-05.3(11)C ROADWAY BASE FINISHING (BASE ONLY)**

17 Roadway cement concrete base is pavement that is intended as a base for an asphalt wearing course, the concrete must
18 be placed and screed to the finished grade and floated to a uniform surface. It must be brushed transversely with a fiber or
19 wire brush of a type approved by the Engineer. The brush finish should provide a texture finish throughout the pavement base
20 surface. The surface tolerance is 3/8 inch in 10 feet.

21 **5-05.3(11)D UTILITY ADJUSTMENTS**

22 Utility castings must be adjusted to roadway finished grade before the construction of the final wearing course. See
23 Section 7-20.3(1) for adjustment tolerances of maintenance holes, catch basins, and similar Structures; and corrective action
24 for non-compliance.

25 **5-05.3(12) ROADWAY SURFACE SMOOTHNESS**

26 Surface smoothness will be measured with a 10-foot straight edge before 5:00 p.m. of the Day following the placing of
27 the concrete. A 10-foot straight edge will be placed to bridge any depressions and touch all high spots. Surface variances (SV)
28 are as follows:
29

| Location | SV |
|----------------------|----------|
| Roadway | 1/4 inch |
| Alleys | 3/8 inch |
| Cement Concrete Base | 3/8 inch |

30
31 Should the surface vary more than the specified surface variance (SV) from the lower edge of the straight edge, the high
32 portion must be reduced by the Contractor to the specified SV tolerance by abrasive means at no expense to the Owner. If
33 reduction of high portions of the surface involves breaking, dislodging, or other disturbance of the aggregates, such cutting is
34 not permitted until the pavement has achieved its design strength. If in the opinion of the Engineer irregularities cannot be
35 satisfactorily removed by such methods, the Contractor must remove and replace the pavement at no expense to the Owner.

36 Smoothness perpendicular to the centerline will be measured with a 10-foot straight edge across all lanes with the same
37 cross slope, including shoulders when composed of cement concrete pavement. The overlapping 10-foot straight edge
38 measurement must be discontinued at the point 6 inches from the most extreme outside edge of the finished cement concrete
39 pavement. The transverse slope of the finished pavement must be uniform so that no variations greater than specified SV are
40 present when tested with a 10-foot long straight edge laid in a direction perpendicular to the centerline. Any areas that are in
41 excess of this specified tolerance must be corrected by abrasive means.

42 Smoothness parallel to the centerline will be measured with a 10-foot straight edge across all lanes, including shoulders
43 when composed of cement concrete pavement. The overlapping 10-foot straight edge measurement must be discontinued at
44 the point 6 inches from the starting or ending of the finished cement concrete pavement, or any point of vertical grade change,
45 referred to as vertical point of intersection. The longitudinal slope of the finished pavement must be uniform so that no
46 variations greater than specified SV are present when tested with a 10-foot long straight edge laid in a direction parallel to the

1 centerline after adjusting for any horizontal curvature between vertical point of curvature and vertical point of tangent. Any
2 areas that are in excess of this specified tolerance must be corrected by abrasive means.

3 **5-05.3(13) CURING**

4 Immediately after the finishing operations have been completed and as soon as marring of the concrete will not occur,
5 the entire surface of the newly placed concrete must be cured using one of the following methods.

6 **5-05.3(13)A CURING COMPOUND**

7 Liquid membrane-forming concrete curing compound Type 2 meeting the requirements of Section 9-23.2 must be applied
8 to the entire area of the exposed surface of the concrete with an approved mechanical spray machine. The spray fog must be
9 protected from the wind with an adequate shield. It must be applied uniformly at the rate of 1 gallon to not more than 150
10 square feet.

11 The compound must be applied with equipment of the pressure tank or pump type equipped with a feed tank agitator
12 which ensures continuous agitation of the compound during spraying operations. The nozzle must be of the 2-line type with
13 sufficient air to properly atomize the compound.

14 Do not apply the curing compound during or immediately after rainfall. If it becomes necessary to leave the pavement
15 uncoated overnight, it must be covered with polyethylene sheeting, which must remain in place until weather conditions are
16 favorable for the application of the curing compound.

17 If rain falls on the newly coated pavement before the film has dried sufficiently to resist damage, or in the event of
18 damage to the film from any cause, the Contractor must apply a new coat of curing compound in 1 or 2 applications to the
19 affected area at the rate which, in the opinion of the Engineer, will result in a film of curing value equal to that specified in the
20 original coat.

21 Before placing the curing compound in the spray tank, it must be thoroughly agitated as recommended by the
22 Manufacturer. Do not dilute the compound by adding solvents, or alter it in any manner. If the compound has become chilled to
23 the extent that it is too viscous for proper stirring or application or if portions of the vehicle have been precipitated from
24 solution, it must be heated to restore proper fluidity but not above 100 °F or manufacturer's recommendations. All curing
25 compound must have been accepted in accordance to Section 1-05.3 before placing in the spray tanks.

26 The curing compound must be applied immediately after the concrete has been finished and after any bleed water that
27 has collected on the surface has disappeared, or at a time designated by the Engineer. If hairline cracking develops in the
28 pavement before finishing is completed, the Engineer may direct the application of the curing compound at an earlier stage, in
29 which event any concrete cut from the surface in finishing operations must be removed entirely from the pavement. If
30 additional mortar is then needed to fill torn areas, it must be obtained ahead of the spraying operations. All areas cut by
31 finishing tools after the application of the curing compound must immediately be given new applications at the rate specified
32 above.

33 The curing compound, after application, must be protected from injury until the pavement has reached a minimum
34 compressive strength of 3000 psi. All traffic, either by foot or otherwise, is considered injurious to the film of the applied
35 compound.

36 The Contractor must provide on the Job Site a sufficient quantity of white polyethylene sheeting to cover all pavement
37 laid in 3 hours of maximum operation. This sheeting must be reserved exclusively for the protection of the pavement in case of
38 rain or breakdown of the spray equipment used for applying the curing compound. The protective sheeting must be placed
39 over the pavement when directed, and in the manner specified by the Engineer.

40 All liquid membrane-forming curing compounds must be removed from the Portland cement concrete pavement to which
41 traffic delineators will be bonded. Curing compound removal must not start until roadway pavement and driveways have
42 attained a minimum compressive strength for traffic to be allowed on it, or for 3 Days for non-roadway cement concrete except
43 driveways. The Contractor must submit a proposed removal method to the Engineer and must not start the removal process
44 until the Engineer has approved the removal method.

45 The Contractor must assume all liabilities for and must protect the Owner from any damages or claims arising from the
46 use of materials or processes described here.

47 Alternate curing for cement concrete base:

48 On cement concrete base, emulsified asphalt CSS 1 or CRS 1 meeting the requirements of Section 9-02.1(6) may be
49 applied at a rate between 0.15 gallon and 0.25 gallon per square yard of surface. Do not apply the emulsified asphalt during or
50 immediately after rainfall. If it becomes necessary to leave the pavement uncoated overnight, it must be covered with
51 polyethylene sheeting, which must remain in place until weather conditions are favorable for the application of the emulsified
52 asphalt.

53 If rain falls on the newly coated pavement before the emulsified asphalt has dried sufficiently to resist damage, or in the
54 event of damage to the emulsified asphalt from any cause, the Contractor must apply a new coat of emulsified asphalt to the
55 affected area at the rate which, in the opinion of the Engineer, will result in a film of curing value equal to that specified in the
56 original coat.

1 5-05.3(13)B WHITE POLYETHYLENE SHEETING

2 The sheeting must be placed over the pavement immediately after finishing operations are completed, or at a time
3 designated by the Engineer.

4 The sheeting must be laid so that individual sheets overlap at least 2 feet, and the lapped areas held in close contact with
5 the pavement by weighting with sand bags or boards to prevent movement by the wind. The sheeting must extend downward
6 to cover the edges of the pavement and must be secured to the subgrade with sand bags or boards or a continuous bank of
7 base material. Any holes occurring in the sheeting must be patched immediately to the satisfaction of the Engineer. The
8 sheeting must be maintained against injury and remain in place until the roadway pavement and driveways have attained a
9 minimum compressive strength for traffic to be allowed on it, or for 3 Days for non-roadway cement concrete except
10 driveways.

11 5-05.3(13)C WET CURING

12 Wet curing must be accomplished by applying a continuous fog or mist spray to the entire pavement surface until the
13 roadway pavement and driveways have attained minimum compressive strength, or for 3 Days for non-roadway cement
14 concrete except driveways. If minimum compressive strength for traffic to be allowed is reached prior, a curing compound
15 must be applied in accordance Section 5-05.3(13)A before opening to traffic.

16 If water runoff is not a concern, continuous sprinkling is acceptable. Do not start sprinkling until the concrete has
17 achieved initial set as determined by AASHTO T 197 or other approved method.

18 5-05.3(14) COLD WEATHER WORK

19 When concrete is being placed and the ambient air temperature is expected to drop below 35 °F (2 °C) during the day or
20 night, the Contractor must protect the concrete from freezing. The Contractor must provide a Cold Weather Plan before
21 placing concrete when ambient air temperature below 35 °F may occur or when requested by the Engineer.

22 Under the Cold Weather Plan, the Contractor must, at no expense to the Owner, provide a sufficient supply of straw, hay,
23 blankets, or other suitable blanketing material and spread it over the pavement to a sufficient depth to prevent the concrete
24 from freezing. Straw, hay, blankets, or other suitable blanketing material must be spread over the pavement to a sufficient
25 depth to keep the concrete from freezing. The blanket material must be covered with a layer of burlap or plastic sheeting,
26 weighted, or anchored to prevent the wind from displacing the insulation. The Engineer may require recording thermometers if
27 daytime temperature is below 35 °F.

28 The protection must be maintained for 10 Days or until opening strength is obtained, whichever occurs first. The
29 Contractor must replace any concrete damaged by freezing at no additional cost to the Owner.

30 The Contractor is responsible for the quality and strength of the concrete thus cured. Any concrete injured by frost action
31 or freezing must be removed and replaced at the Contractor's expense as specified in this Section.

32 5-05.3(15) CONCRETE PAVEMENT CONSTRUCTION IN ADJACENT ROADWAY LANES

33 Unless otherwise shown on the Drawings or in the Contract, the pavement may be constructed in multiple lanes (2 or
34 more adjacent lanes paved in a single operation). Use longitudinal contraction joints between adjacent lanes that are paved
35 concurrently and construction joints when lanes are paved separately. Tie bars must be installed during initial lane
36 construction.

37 The Contractor must replace, at no expense to the Owner, any panels on the new pavement that are cracked or broken
38 as a result of the Contractor's operations.

39 5-05.3(16) PROTECTION OF ROADWAY CEMENT CONCRETE.

40 The Contractor must protect the pavement and its appurtenances from any damage. Protection includes personnel to
41 direct traffic and the erection and maintenance of warning signs, lights, barricades, temporary take-down bridges across the
42 pavement with adequate approaches, and any other means necessary to accommodate local traffic and to protect the
43 pavement during the curing period or until opened to traffic as determined by the Engineer.

44 The operation of construction equipment on the new roadway pavement is not allowed until the pavement has developed
45 a compressive strength of 3000 psi as determined from cylinders, made during placement, cured under comparable
46 conditions, and tested per AASHTO T 22, or by maturity meter for HES cement concrete. An exception is 1 track from a slip
47 form-paving machine when paving adjacent lanes or light vehicles required for sawing operations or taking cores.

48 Placement of shoulder material may start when the pavement has developed a compressive strength of 1800 psi as
49 determined from cylinders made at the time of placement, cured under comparable conditions, and tested per AASHTO T 22
50 as long as construction equipment is not operated on the new pavement.

51 If shown on the Drawings, a continuous barrier must be constructed and maintained along the edge of the pavement
52 being constructed and adjacent to the portion of the roadway used for traffic. The barriers must be left in place until the new
53 pavement is ready to be opened to traffic and must then be removed by the Contractor. If not shown on the Drawings, use
54 requirements of Section 1-10 for traffic control.

55 Any damage to the pavement occurring before final acceptance must be replaced or repaired as specified in Section 5-
56 05.3(19).

1 5-05.3(17) OPENING TO VEHICLE TRAFFIC

2 The pavement may be opened to traffic when the concrete has developed a compressive strength of 3000 psi (2500 psi
3 for residential driveways) as determined from cylinders, made at the time of placement, cured under comparable conditions,
4 and tested per AASHTO T 22, or by maturity meter. Maturity meters testing is at the option of the Engineer and requires the
5 Contractor to develop the maturity-strength relationship and provide maturity curves along with supporting data for approval by
6 the Engineer. The submittal of maturity curves is required for all HES cement concrete and at the option of the Contractor for
7 other mixes. The Contractor must provide and maintain approved maturity meter sensors.

8 The Contractor is responsible for Fabrication, curing, and testing of cylinders to measure early strength. Obtain the
9 services of an approved independent Laboratory to perform these activities. However, at the Engineer's option, fabrication,
10 curing, and testing of cylinders may be performed by the Engineer. If the Engineer agrees to perform testing, the requirements
11 for the Contractor to do so are waived.

12 At the Contractor's request, or when desired by the Engineer, time for opening pavement may be determined by the
13 Engineer through the use of the maturity test per ASTM C 1074. The pavement must not be opened to traffic until the maturity-
14 strength relationship shows the roadway pavement has a compressive strength of 3000 psi (2500 psi for residential driveways)
15 as determined by the Engineer.

16 If the Contractor's test results conflict with the Owner's, use the Owner's testing results.

17 Clean the pavement before opening to traffic.

18 All costs associated with Work specified above are borne by the Contractor.

19 5-05.3(18) PRE-PAVING MEETING

20 The Contractor must coordinate with the Engineer to have a pre-paving meeting at least 5 Working Days before the first
21 paving operation. Be prepared to discuss operations as they relate to other entities and the public's safety and convenience,
22 including: driveway and business access; garbage truck operations; Metro transit operations and working around energized
23 overhead wires; school, nursing home, hospital, and other access; other contractors who may be operating in the area;
24 pedestrian and bicycle traffic; emergency services; and other applicable public interests. Be prepared to discuss the placement
25 and finishing methods, reinforcement placement, joint placement, and the curing methods for all classes and subclasses
26 (variable mixes) of cement concrete to be used.

27 5-05.3(19) REPAIR OF DEFECTIVE ROADWAY PAVEMENT SLABS

28 Broken slabs, slabs with random cracks, nonworking contraction joints near cracks, edge slumping and spalls along
29 joints and cracks must be replaced or repaired as specified at no expense to the Owner; this must be accomplished before
30 completion of joint sealing.

31 New pavement slabs containing more than 1 crack must be entirely removed and replaced. Pavement slabs containing a
32 single crack must be removed and replaced such that the minimum dimension of the removed slab is 6 feet long and full panel
33 width. The portion of the panel to remain in place must have a minimum dimension of 6 feet in length and full panel width,
34 otherwise entire removal and replacement of the slab is required. There must be no new joints closer than 6 feet to an existing
35 transverse joint. Saw cutting full pavement depth is required along all longitudinal joints and at transverse locations. Use tie
36 bars and dowel bars as specified in Section 5-05.3(10). Existing pavement slabs containing 1 or more cracks must also be
37 entirely removed and replaced.

38 Spalls and edge slumping must be repaired by making vertical saw cuts at least 3 inches outside the affected area and to
39 a minimum depth of 2 inches. Spall repairs that encounter dowel bars or are within 6 inches of a dowel bar are not permitted.
40 These spall areas must be repaired by replacing a half or full panel as permitted by the Engineer. Removal of the existing
41 pavement must not damage any pavement to be left in place. If jackhammers are used for removing pavement, they must not
42 weigh more than 30 pounds, and chipping hammers must not weigh more than 15 pounds. All power-driven hand tools used
43 for the removal of pavement must be operated at angles less than 45 degrees as measured from the surface of the pavement
44 to the tool. The patch limits must extend beyond the spalled area a minimum of 3 inches. Repair areas must be kept square or
45 rectangular. Combine repair areas that are within 12 inches of each other.

46 The Contractor must remove material within the perimeter of the saw cut to the greater of a depth of 2 inches, or sound
47 concrete as determined by the Engineer. The surface patch area must be sandblasted and all loose material removed. All
48 sandblasting residue must be removed using dry oil-free air.

49 When a partial depth repair is placed directly against an adjacent longitudinal joint, a bond-breaking Material such as
50 polyethylene film, roofing paper, or other Material as approved by the Engineer must be placed between the existing concrete
51 and the area to be patched.

52 Patches that abut working transverse joints require placement of a compressible insert. The new joint or crack must be
53 formed to the same width as the existing joint or crack. The compressible joint material must be placed into the existing joint 1
54 inch below the depth of repair. The compressible insert must extend at least 3 inches beyond each end of the patch
55 boundaries.

56 Patches that abut the lane/shoulder joint require placement of a formed edge, along the slab edge, even with the surface.

57 The patching material must be mixed, placed, consolidated, finished, and cured according to manufacturer's
58 recommendations. Slab/patch interfaces that will not receive pavement grinding must be sealed with a 1:1 cement-water grout
59 along the patch perimeter.

1 The Contractor must reseal all joints as specified in Section 5-05.3(8)B.

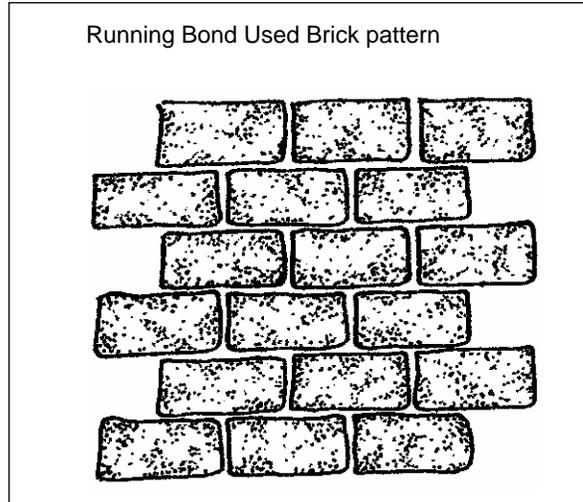
2 Opening to traffic must comply with Section 5-05.3(17).

3 Low areas where grinding cannot remedy the defect must be sandblasted, filled with epoxy bonded mortar, and textured
4 by grinding. The epoxy bonding agent must comply with the requirements of Section 9-26.1(1)B for Type II epoxy.

5 **5-05.3(20) PATTERNED AND COLORED CEMENT CONCRETE TREATMENT**

6 Use colored and/or imprinted concrete, including color matching joint material, when specified.

7 Patterned Cement Concrete Treatment: Patterned cement concrete is defined as additional work necessary to imprint
8 cement concrete with a pattern, and is referenced by "Patterned" and "Running Bond Used Brick" or other pattern in the Bid
9 Item description and call-outs for locations on the Drawings. Other patterns may be shown on the Drawings or on Drawing
10 Details in the Appendix of the Contract. Refer to the sketch below for Running Bond Used Brick pattern details. Nominal size
11 for a typical brick is 8" long x 4" wide. The long edge of each brick must be laid perpendicular to the crosswalk.



12

13

14 The Contractor must use the Running Bond Used Brick pattern for crosswalks or at other locations when shown on the
15 Drawings.

16 Other cement concrete surface treatment patterns must be applied at locations and alignments, and as shown in the
17 Drawings or Drawing Details.

18 The Contractor must submit technical data and manufacturer's specifications for patterned concrete components and a
19 proposed plan for mixing, delivery, placement, finishing, and curing of the patterned concrete. This plan must be submitted to
20 the Engineer for approval at least 10 Working Days before constructing the test panel.

21 Monitor the water content, weight of cementitious materials, and size, weight, and color of aggregate to maintain
22 consistency and accuracy of the mixed concrete. Schedule delivery of concrete to provide consistent mix times from batching
23 until discharge. Do not add water after a portion of the batch has been discharged.

24 Use imprinting tools capable of imprinting the surface of the concrete with a uniform and aligned pattern and/or texture.
25 Use a clear release agent as specified by the imprinting tool manufacturer. These materials must be approved before use.

26 Unless approved manufacturer's recommendations differ:

- 27 1. Screed concrete to the finished grade and apply release agent. Using methods as recommended by the
28 manufacturer, apply pre-approved imprinting tools to the surface while the concrete is still plastic. Do not lightly
29 broom surface.
- 30 2. For sidewalks, unless otherwise specified, score or saw cut the surface to a minimum depth of 1/4 the thickness of
31 the slab at intervals of 5 feet. Tool the edges, joints and scored areas as consistent with the imprinting pattern. If the
32 saw cut option is used, the Contractor is responsible for performing the saw cut operation at such time as to minimize
33 the possibility of spalling and/or cracking.
- 34 3. Within 24 hours, remove release agent with pressure wash and apply a pre-approved sealer, recommended by the
35 coloring manufacturer, at a rate consistent with manufacturer's recommendations.

36 Colored Cement Concrete Treatment:

37 Colored cement concrete is defined as additional work necessary to color cement concrete with a color, and is
38 referenced by "Colored" and a Federal Standard 595B "F (color code)" in the Bid Item description and call-outs for locations on
39 the Drawings.

40 All coloring agents must produce a color conforming to the Federal Standard 595B. The color must be as specified in the
41 Contract. Color pigments must be high quality iron oxides conforming to ASTM C 979. The dosage must not exceed 10
42 percent by weight of cementitious material in the concrete mix design. Color admixtures for integrally colored concrete must be

1 certified by the manufacturer as meeting the requirements of ASTM C 979 - Pigments for Integrally Colored Concrete must be
2 packaged such that 1 dose is the proper dosage for 1 cubic yard of concrete.

3 Submit technical data and manufacturer's Specifications for colored concrete components and a proposed plan for
4 mixing, delivery, placement, finishing, and curing of the colored concrete. This plan must be submitted to the Engineer for
5 approval at least 10 Working Days before constructing the test panel.

6 Monitor the water content, weight of cementitious materials, and size, weight, and color of aggregate to maintain
7 consistency and accuracy of the mixed colored concrete. Schedule delivery of concrete to provide consistent mix times from
8 batching until discharge. Do not add water after a portion of the batch has been discharged.

9 When more than 1 concrete pump is used to place concrete, the Contractor must assign the pumps to receive colored
10 concrete. The assigned pumps must receive only colored concrete throughout the concrete placement operation.

11 Use consistent finishing practices to ensure uniformity of texture and color.

12 The curing compound used for curing colored concrete surfaces must be clear or match the color of the colored concrete
13 must be manufactured specifically for colored concrete. Do not use curing compounds containing calcium chloride. The time
14 between completing surface finishing and applying curing compound must be the same for each colored concrete component.

15 Unless approved manufacturer's recommendations differ:

- 16 a. Apply color admixtures and dry shake additives at the manufacturers recommended dosage rate. This rate is to
17 remain constant for all batches of concrete produced. Before placing concrete, protect adjacent surfaces and
18 Structures from spatters. Once a portion of the batch has been placed, no additional water must be added to the
19 remaining batch.
- 20 b. To integrally color the concrete, introduce the color additive into the mixer drum as recommended by the
21 manufacturer. The quantity of concrete being delivered must be less than 1/3 the capacity of the mixer drum. Batch
22 the concrete in full cubic yard increments.
- 23 c. After the concrete is placed, apply a color matching hardener evenly to the plastic surface by the dry shake method
24 as recommended by the manufacturer.

25 Color Matching Joint Material:

26 When specified for any location, use a color matched caulking compound designed for joint sealing.

27 Install premolded resilient joint filler where the sidewalk line intersects a building, walk, permanent Structure or other
28 location designated by the Engineer, to within 1 inch of the top of the slab. Caulk the top 1 inch of the joint with color matching
29 caulking compound.

30 Test Panels:

31 Before the start of work, must show evidence of successful completion of similar installations. Construct a Job Site test
32 panel for each individual color and pattern or combination of color and pattern specified in the Contract at least 10 Working
33 Days before placing patterned and/or colored concrete. The test panels must be 5' x 5' minimum, and constructed at a location
34 selected by the Engineer.

35 Construct as many test panels as necessary to produce sample panels that meet the approval of the Engineer. The
36 permanent work must be consistent with the appearance of the approved test panels. The test panels must not be
37 incorporated into the Work and must be disposed of under the Contract when directed by the Engineer.

38 The approved test panel must be used as the standard of comparison in determining acceptability of concrete surfaces.

39 **5-05.3(21) EXPOSED AGGREGATE CEMENT CONCRETE TREATMENT**

40 Use exposed aggregate concrete when specified. Exposed aggregate finish on concrete surfaces must be as shown on
41 the Drawings, the cement concrete Specifications of the Contract, and either Section 5-05 for flat work or Section 6-02 for
42 Structures.

43 Exposed aggregate cement concrete is defined as additional work necessary to expose aggregate on the surface of
44 cement concrete.

45 Exposed aggregate is an architectural finish on concrete surfaces, it must not be used on new sidewalks, walkways, or
46 any pedestrian access unless otherwise approved by SDOT. It may be used to repair existing exposed aggregate concrete
47 sidewalks only. It may be used for vertical or sloped features and within architectural landscaping such as within traffic inlands.

48 Exposed Aggregate Finish:

49 Exposed aggregate architectural finish on concrete surfaces must conform to the details shown on the Drawings and
50 these provisions:

- 51 1. If provided, the exposed aggregate finish must match the texture, color, and pattern of the referee panel or existing
52 exposed aggregate surface. If provided, location of referee panel will be provided in the Contract documents.
- 53 2. The facing aggregate must match the variegated colors and color distribution found in the natural aggregates at the
54 location provided in the Contract documents.
- 55 3. If cement concrete for exposed aggregate is to be colored, see Section 5-05.3(20).

56 Cast-in-place Concrete Surfaces; unless otherwise specified in the Contract:

1 Coarse aggregate for exposed aggregate finish for cast-in-place concrete surfaces must be river gravel, exclusive of
 2 crushed gravel and rock, conforming to the applicable course aggregate requirements of the cement concrete specified. The
 3 matrix of cement and fine aggregate must be removed from the surface of the concrete by water jetting, coarse brooming,
 4 abrasive blasting, or a combination of these procedures to expose coarse aggregates to a depth of approximately 1/4 inch to
 5 1/2 inch from the formed or floated surface. Removal methods must not dislodge or loosen the coarse aggregate from
 6 embedment in the concrete matrix. At the option of the Contractor, a commercial quality, water-resistant set retarder
 7 manufactured for the intended use may be used. Exposed aggregate finish must have cement film, discoloring agents, dirt,
 8 dust, grease, loose concrete, and other foreign material removed and must be uniform in appearance.

9 Precast Concrete Surfaces; unless otherwise specified in the Contract:

10 Facing aggregate for exposed aggregate finish for precast concrete surfaces must be river gravel, exclusive of crushed
 11 gravel and rock, with maximum dimension of each rock between 2.5 inches and 5 inches. Precast panels may be cast with
 12 facing aggregate up or down on the casting bed, at the option of the Contractor. The aggregate facing mix must be separately
 13 prepared, applied to the form or fresh concrete, and its integrity maintained during the casting process, so that the facing is
 14 cast integrally with the concrete wall panel, and the entire panel is homogeneous and structurally monolithic. The facing rock
 15 must be placed finger width apart in a pattern of randomly distributed colors and sizes. Matrix must be removed from the front
 16 face of the panel to expose the facing aggregate to a depth of 1 inch to 1-1/2 inches. Exposed aggregate finish must have
 17 cement film, discoloring agents, dirt, dust, grease, loose concrete, and other foreign material removed and must be uniform in
 18 appearance.

19 Cast-in-place concrete surfaces with finish must be cured by the water method. Do not use seals and curing compounds.

20 Test Panels:

21 Before the start of work, the Contractor must show evidence of successful completion of similar installations. Construct a
 22 Job Site test panel for each individual exposed aggregate surface specified in the Contract at least 10 Working Days before
 23 placing exposed aggregate, and colored if applicable, concrete. The test panels must be 5 feet x 5 feet, minimum, and
 24 constructed at a location selected by the Engineer.

25 Construct as many test panels as necessary to produce sample panels that meet the approval of the Engineer. The
 26 permanent work must be consistent with the appearance of the approved test panels. The test panels must not be
 27 incorporated into the Work and must be disposed of as specified in the Contract when directed by the Engineer.

28 The approved test panel must be used as the standard of comparison in determining acceptability of concrete surfaces.

29 **5-05.4 MEASUREMENT**

30 Surfaces and base roadway cement concrete will be measured by the square yard for the completed pavement. The
 31 area is determined from measurements taken as listed below.

- 32 1. The width measurement is the width of the pavement shown on the typical cross-section in the Standard Plans or
 33 Drawings, additional widening where called for, or as otherwise specified in writing by the Engineer.
- 34 2. The length is measured along the center of each roadway or ramp.

35 If Bid Item is included in the Bid Form, dowel bar will be measured per each for the actual number of bars used in the
 36 completed Work, else no measurement will be made.

37 If Bid Item is included in the Bid Form, Tie bar with drill hole will be measured per each for the actual number of bars
 38 used in the completed Work, else no measurement will be made.

39 The calculation for Portland or hydraulic cement concrete compliance adjustment is the area of concrete represented by
 40 the composite pay factor for compressive strength and air content. A Deficiency Adjustment is applied independently for
 41 thickness deficiency adjustment.

42 Measurement for "Portland Cement Reduction Incentive/Disincentive Adjustment - Roadway" will be calculated based the
 43 in-place quantity of all sidewalk, curb, driveway, alley, and roadway concrete. Depth is determined by the specified thickness
 44 and must exclude thickened edges. Measurements will only be made when this Bid Item is included in the Bid Form.

45 Measurement for "Patterned Cement Concrete, (pattern)" will be by the square yard of area where imprinting tools are
 46 applied.

47 **5-05.5 PAYMENT**

- 48 1. "Roadway Cement Concrete, Variable Mixes, (thickness)", per square yard
- 49 2. "Roadway Cement Concrete, HES (time), (thickness)", per square yard
- 50 3. "Roadway Cement Concrete, (thickness)", per square yard
- 51 4. "Roadway Cement Concrete, W/25% pozzolans, (thickness)", per square yard
- 52 5. "Roadway Cement Concrete Base, Variable Mixes, (thickness)", per square yard
- 53 6. "Roadway Cement Concrete Base, HES (time), (thickness)", per square yard
- 54 7. "Roadway Cement Concrete Base, (thickness)", per square yard
- 55 8. "Roadway Cement Concrete Base, W/25% pozzolans, (thickness)", per square yard

1 The unit Contract price per square yard for "Roadway Cement Concrete" is full payment for all costs incurred to carry out
 2 the requirements of Section 5-05, except for those costs included in other items, which are included in this Section and are
 3 included in the Proposal. If no Bid Items for "Dowel Bar" and "Tie Bar with Drill Hole" are included in the Bid Item price this
 4 work is included in the unit Contract price per square yard for "Roadway Cement Concrete"

5 9. "Dowel Bar", per each,

6 The unit Contract price per each for "Dowel Bar" is full payment for furnishing, and installing dowel bars and any costs for
 7 drilling holes, placing dowel bars with baskets, furnishing and installing parting compound and all other costs associated with
 8 completing the installation of dowel bars.

9 10. "Tie Bar with Drill Hole", per each.

10 The unit Contract price per each, "Tie Bar with Drill Hole" is full payment for furnishing, and installing tie bars and any
 11 costs for drilling holes, and all other costs associated with installation of tie bars.

12 11. "Cement Concrete Compliance Adjustment", by calculation.

13 Payment for "Cement Concrete Compliance Adjustment" will be calculated by multiplying the unit Contract unit cost for
 14 the cement concrete Bid Items, times the areas for adjustment, times 100 percent less the percent of the composite pay factor
 15 (CPF), and subtract the Contract unit cost for the cement concrete, times the areas for adjustment, times the deficiency
 16 adjustment factor (DAF) listed in Section 5-05.5(2)A. Both of these adjustments will be negative amounts; thus deductions.

17 Adjustment =

18 Unit Price x quantity area¹ x (CPF-1)

19 + Unit Price x quantity area² x DAF

20 Calculate for each area¹, (lot, subplot not included in a lot, and/or other areas as determined by the Engineer), and for
 21 each area² (primary units or secondary units as determined by the Engineer) where a thickness deficiency exists.

22 12. **Reserved**

23 13. "Patterned Cement Concrete Treatment, Roadway, (pattern)", per square yard.

24 The Bid Item price for "Patterned Cement Concrete" includes all costs for additional work as specified in Section 5-
 25 05.3(20) and necessary to imprint cement concrete with a pattern referenced in the Bid Item description.

26 5-05.5(1) MISCELLANEOUS ITEMS

27 All mix designs, submittals, plans, joints filling and saw cutting, cure boxes, curing, protection, and associated labor,
 28 materials, and equipment are included in associated Bid Items of work.

29 The cost of construction and removal of the test panels must be included in the Bid Item price for the specified exposed
 30 aggregate, colored, and/or imprinted cement concrete.

31 5-05.5(2) PAVEMENT THICKNESS

32 Cement concrete pavement must be constructed per the thickness requirements in the Drawings and Specifications.
 33 Tolerances allowed for subgrade construction and other Specifications, which may affect thickness, must not be construed to
 34 change such thickness requirements.

35 A primary unit of pavement is defined as the area of pavement placed in each Day's paving operations or a complete
 36 intersection. Within such primary unit of pavement there may be an area or areas that are deficient in thickness by more than
 37 0.60 inch. The deficient area or areas will be defined as a secondary unit or units. If secondary units are found to exist, the
 38 primary unit area will be reduced by the secondary unit area included therein. At a time determined by the Engineer, thickness
 39 measurements will be made in each primary unit of pavement. Impact-echo tests or cores will be taken at the discretion of the
 40 Engineer. If taken, the exact location and number of thickness measurements within each primary unit, both longitudinally and
 41 transversely, will be determined by the Engineer. Tests will not be taken within 18 inches of joints

42 If thickness deficiencies greater than 0.60 inches are found to exist, supplemental thickness measurements will be made
 43 as specified in Section 5-05.5(2)B. Pavement thickness variations, if any, from the thickness requirements in the Drawings and
 44 Specifications will be determined by comparing the actual thickness measurement with the thickness specified at the
 45 measurement location. Such variation will be determined to the nearest 0.02 inches as either excess or deficient thickness.

46 Additional impact-echo tests or cores may be requested by the Contractor to isolate the area of thickness deficiency.
 47 These impact-echo tests or cores will be used to create a secondary unit. All costs for the additional impact-echo tests or
 48 cores including grouting the core holes are borne by the Contractor.

49 If no impact-echo tests or core at taken by the Engineer for a primary unit, no "Deficiency Adjustment" will be made for
 50 that primary unit.

51 5-05.5(2)A THICKNESS DEFICIENCY ADJUSTMENT

52 If no thickness measurements in a primary unit are deficient by more than 0.60 inches plus 3 percent of the specified
 53 thickness when measured using the Impact-Echo Method per ASTM C-1383, or 0.60 inches when measured using the cores
 54 per AASHTO T 24 and AASHTO T 22, all thickness measurements in the primary unit will be averaged to the nearest 0.02
 55 inches to determine the average thickness deficiency, if any. For the purpose of determining the average thickness deficiency,

1 an excess thickness variation of more than 0.50 inches will be considered to be 0.50 inches greater than the specified
 2 thickness.

3 For each primary unit of pavement which is deficient in average thickness by not more than 0.60 inches plus 3 percent of
 4 the specified thickness when measured using the Impact-Echo Method, or 0.60 inches when measured using the cores, the
 5 Contractor must pay to the Owner, or the Owner may deduct from any moneys due or that may become due the Contractor
 6 under the Contract, a sum computed by multiplying the deficiency adjustment from the following table by the unit Contract
 7 price by the area of the primary unit.

8 Primary units for thickness measurements are independent of lot, sublots, or representative areas for compressive
 9 strength and air measurement. Determination of primary units, and secondary units, are determined by the Engineer.

| Average Thickness Deficiency (inches) by Echo | Average Thickness Deficiency (inches) by Core | Deficiency Adjustment (per square yard) |
|--|--|--|
| $\leq 0.10 + (.03 \times D)$ | ≤ 0.10 | -0.02 |
| $> 0.10 + (.03 \times D)$ & $\leq 0.20 + (.03 \times D)$ | > 0.10 & ≤ 0.20 | -0.04 |
| $> 0.20 + (.03 \times D)$ & $\leq 0.30 + (.03 \times D)$ | > 0.20 & ≤ 0.30 | -0.09 |
| $> 0.30 + (.03 \times D)$ & $\leq 0.40 + (.03 \times D)$ | > 0.30 & ≤ 0.40 | -0.16 |
| $> 0.40 + (.03 \times D)$ & $\leq 0.50 + (.03 \times D)$ | > 0.40 & ≤ 0.50 | -0.25 |
| $> 0.50 + (.03 \times D)$ & $\leq 0.60 + (.03 \times D)$ | > 0.50 & ≤ 0.60 | -0.36 |

11 NOTE: D = specified thickness (in)

13 **5-05.5(2)B THICKNESS DEFICIENCY REJECTION**

14 When a thickness deficiency greater than 0.60 inches is encountered, the Engineer will determine from supplemental
 15 thickness measurements the limits of the secondary unit area. Thickness measurements will be made in each panel of
 16 pavement adjacent transversely and longitudinally to the panel of the original measurement. This procedure will continue,
 17 regardless of unit boundaries, until such secondary unit area is bounded by panels with a thickness deficiency of 0.60 inches
 18 or less. Cores taken to isolate the secondary unit are not used to compute average thickness of the primary unit.

19 Panels are the areas bounded by longitudinal and transverse joints and pavement edges. If longitudinal or transverse
 20 joints are eliminated by the Contract, or for any other reasons, the limits of panels will be determined by the Engineer as if
 21 such joints had been constructed.

22 The secondary unit area will be made up of entire panels only. The entire panel will be considered to be of the thickness
 23 shown by measurement.

24 After the Engineer has determined the limits of the secondary unit area, a further determination will be made whether any
 25 panels within this area are usable and may be left in place. Following this determination, the Contractor must remove and
 26 replace all designated panels at no expense to the Owner, per the following:

- 27 1. If the area to be removed is not bounded by longitudinal or transverse joints, the Contractor must saw, at no expense
 28 to the Owner, weakened plane joints at the locations designated by the Engineer. The subgrade must be lowered to
 29 comply with the full thickness requirements. The replaced pavement will be tested for thickness with additional
 30 measurements and will be subject to all requirements of this Section.
- 31 2. Usable panels may be removed and replaced as outlined above at the option of the Contractor, or these panels will
 32 be permitted to remain in place, provided that no payment will be made for any panels left in place, and that a further
 33 penalty will be assessed in the amount of 25 percent of the Contractor's unit Bid price for all such panels. The Owner
 34 may deduct such amount from any moneys due or that may become due the Contractor under the Contract.
- 35 3. The cost of all thickness measurements made to determine the secondary unit areas, including filling the core holes
 36 with concrete, will be deducted at the rate of \$200.00 per core from any moneys due or that may become due the
 37 Contractor under the Contract.
- 38 4. All additional Work required and any delay to the Contractor's operations as a result of this Specification are not
 39 cause for additional pay or extension of time.

40 **SECTION 5-06 PERVIOUS CEMENT CONCRETE SIDEWALK**

41 **5-06.1 DESCRIPTION**

42 Section 5-06 describes constructing pervious cementitious sidewalk and walkway applications including excavation,
 43 subgrade preparation, geotextile, and aggregate discharge subbase, which must allow surface water to permeate through the
 44 pervious surface into the supporting materials to allow infiltration or detention of surface waters.

45 **5-06.2 MATERIALS**

46 Materials must comply with the requirements of the following Sections:

1

| Material | Section |
|---|-------------------|
| Portland Cement and Blended Hydraulic Cement | Section 9-01 |
| Fine Aggregate for Portland Cement Concrete | Section 9-03.1(2) |
| Aggregates for Pervious Pavements | Section 9-03.1(5) |
| Crushed Gravel (Mineral Aggregate) | Section 9-03.9 |
| Premolded Joint Filler for Through, Construction and Expansion Joints | Section 9-04.1(2) |
| Curing Materials and Admixtures | Section 9-23 |
| Water | Section 9-25 |
| Construction Geotextiles | Section 9-37 |

2

3 Portland cement must be Type II, Type IP, or Type IS. Blended hydraulic cement must conform to the requirements of
4 Section 9-01.2(3).

5 Allowable Pozzolans:

- 6 1. Fly ash, if used, must be Class F as specified in Section 9-23.6.
- 7 2. Ground granulated blast furnace slag, if used, must be as specified, in Section 9-23.7.
- 8 3. Microsilica fume is not allowed.

9 See Section 9-01 and Section 9-23 for additional constraints.

10 Fine aggregate for pervious concrete must be Class 1 as specified in Section 9-03.1(2).

11 Coarse aggregates for pervious concrete must conform to the requirements of Section 9-03.1(3).

12 Unless otherwise specified or shown on the Drawings, aggregates for the discharge subbase gravel must comply with
13 the requirements of Mineral Aggregate Type 24 as specified in Section 9-03 or substitute material approved by the Engineer.

14 Premolded joint filler for isolation joints must conform to the requirements of Section 9-04.1(2).

15 Curing Materials must be sheet Materials as specified in Section 9-23.1.

16 Hydration stabilizing admixtures must comply with the requirements of ASTM C494, Type B or Type D.

17 Microfibers must conform to the requirements of ASTM C 1116, Type III and must be 1/2 inch in length.

18 Unless otherwise specified or shown on the Drawings, geotextile must be nonwoven and must comply with the
19 requirements of Tables 1 and 2 of Section 9-37.2 for Moderate Survivability and Class C.

20 5-06.3 CONSTRUCTION REQUIREMENTS

21 5-06.3(1) PERVIOUS CONCRETE MIX DESIGN

22 The Contractor must propose a mix design for pervious concrete and must submit the mix design to the Engineer for
23 acceptance before constructing the test panels. Do not place pervious concrete in the test panels without a mix design that
24 has been reviewed and accepted by the Engineer.

25 5-06.3(1)A MIX DESIGN CRITERIA

26 The Contractor must include the following elements and results of the described procedures in the proposed mix design:

- 27 1. The cementitious content, including pozzolans if used, must be a minimum of 500 pounds per cubic yard.
- 28 2. The mix must incorporate a hydration stabilizing admixture.
- 29 3. The mix must incorporate 1/2-inch microfibers at a rate of 1.5 pounds per cubic yard.
- 30 4. The mix must be designed to have a total void content greater than 15 percent and less than 30 percent, in place, as
31 constructed. (Void content of the mix will be determined from a minimum 3 samples of 4-inch diameter core samples
32 from a finished test panels of the proposed mix design using the method specified in Section 5-06.3(4)A1.
- 33 5. The water/cement ratio must be between 0.27 and 0.35.
- 34 6. Fine aggregate may be added to the mix, but must not exceed 3 cubic feet per cubic yard.
- 35 7. No more than 30 percent of Portland cement in the mix, by weight, may be replaced by fly ash, ground granulated
36 blast furnace slag, or a combination of both.

37 5-06.3(1)B JOB MIX FORMULA (JMF)

38 Once accepted by the Engineer, the mix design must become the Job Mix Formula and must not be modified in any way.
39 The JMF must be determined from information submitted under Section 5-06.3(2) and from results of test panels testing as
40 specified in Section 5-06.3(7)B. The JMF must include the following:

- 41 1. Batch weights of all constituents
- 42 2. Portland cement type and brand

- 1 3. Pozzolan type and source
- 2 4. Microfiber brand
- 3 5. Admixture type and brand
- 4 6. Aggregate sources and gradations
- 5 7. Fresh density of the pervious concrete
- 6 8. Unit weight of the hardened pervious concrete

7 Modifications to the JMF are not allowed and any modified mix placed in the Work will be rejected. Proposed
 8 modifications to the JMF must be submitted as a new mix design require new test panels to validate the proposed mix design
 9 and determine the new JMF. If accepted by the Engineer, the new mix design must become the JMF. Only 1 JMF is valid at
 10 any time. Admixture dosages may be modified as needed to maintain mix properties.

11 **5-06.3(2) SUBMITTALS**

12 As specified in Section 1-05.3, the Contractor must submit the following items to the Engineer for acceptance before
 13 placing any pervious concrete pavement or test panels:

- 14 1. The source of all materials proposed for use in constructing pervious concrete sidewalks.
- 15 2. Batch weights for all constituents of 1 cubic yard of the proposed pervious concrete mix.
- 16 3. The specific gravity of all aggregates to be used in the proposed pervious concrete mix.
- 17 4. The proposed gradation of coarse and fine, if used, aggregates used in pervious concrete.
- 18 5. The designed volume in cubic feet of 1 cubic yard of the proposed pervious concrete mix.
- 19 6. The target voids content of the cured proposed cured pervious concrete mix.
- 20 7. The design water: cement ratio of the proposed mix design.
- 21 8. The fresh density of the proposed pervious concrete mixture as determined using the jiggling procedure outlined in
 22 ASTM C29.
- 23 9. The proposed gradation of aggregates to be used in the discharge subbase gravel.
- 24 10. Catalogue cuts for all proposed admixtures and geotextiles.
- 25 11. Chemical analyses of the Portland cement and pozzolans, if used, for the current lot to be used in the production of
 26 the proposed pervious concrete mix. The Contractor must maintain this submittal throughout the duration of the
 27 project as lots change.
- 28 12. Manufacturer certification that the current lot of Portland cement and pozzolans, if used, conform to the requirements
 29 of Section 5-06.2. The Contractor must maintain this submittal throughout the duration of the project as lots change.
- 30 13. Current certification by the National Ready Mix Concrete Association (NRMCA) for the batch plant to be used in the
 31 production of pervious concrete.
- 32 14. Current certifications by the NRMCA for the trucks to be used in transporting pervious concrete from the batch plant
 33 to the point of placement.
- 34 15. Current certifications by the NRMCA for the Contractor's personnel who will install sidewalk for Pervious Concrete
 35 Installer and Pervious Concrete Technician, as applicable.

36 **5-06.3(3) EQUIPMENT**

37 The Contractor must provide all equipment necessary for handling materials and performing all parts of the Work.
 38 Vibrators must not be used for placement of pervious concrete.

39 **5-06.3(3)A BATCHING PLANT**

40 Pervious concrete must be mixed in a batch plant as specified in Section 6-02.3(4)A.

41 **5-06.3(3)B MIXER TRUCKS**

42 Pervious concrete must be transported to the location of placement by a rolling drum mixer truck with current (within 12
 43 months) certification by the NRMCA. Non-agitating trucks must not be used for the transport of pervious concrete.

44 **5-06.3(3)C SIDE FORMS**

45 Pervious concrete sidewalks must be constructed using side forms. Slip form paving is not allowed. Forms for pervious
 46 concrete sidewalks must be made of steel or wood and must be in good condition, clean and be capable of being anchored in
 47 place so that they will be to true to grade, line, and slope. Forms that are bent, warped, unclean, or otherwise deemed
 48 inadequate by the Engineer must not be used. If pervious concrete will be placed against a curb or other existing Structure,
 49 use the curb or Structure must as a side form for the pervious concrete sidewalk paving.

50 Before inspection by the Engineer, the Contractor must inspect all forms for line, grade, and slope. Do not place pervious
 51 concrete until the forms are inspected and accepted by the Engineer.

1 5-06.3(3)D FINISHING EQUIPMENT

2 Finishing equipment for pervious concrete sidewalk paving must be designed for the intended work, must be clean and
3 be in good operating condition.

4 Do not use vibrating screeds to strike off the pervious concrete. Equipment used for striking off the pervious concrete
5 must leave a smooth surface at the planned grades and must not cause excess paste to be left on, or drawn to, the surface.
6 Set up the strike off apparatus to allow the forms to be overfilled by 1/2 to 3/4 inch, or as necessary, to allow for compaction of
7 the pervious concrete to grade.

8 If rollers are used to compact, the rollers must be of sufficient weight and width to compact the pervious concrete to
9 grade without marring the surface. Rollers used for compacting pervious concrete must not cause the surface to close or
10 otherwise clog and must produce a surface that is free of ridges or other imperfections. Rollers used for producing contraction
11 joints must be designed and manufactured for the purpose, must have sufficient weight to produce the joint, and must not
12 otherwise damage or mar the surface.

13 Tamps, hand finishing equipment, and tools for joints must be in good repair and adequate for the intended use.

14 5-06.3(3)E JOINT SAWING EQUIPMENT

15 Equipment for sawing joints in pervious concrete sidewalks must be power driven concrete saws. Concrete saws must
16 not tear, spall, or otherwise damage the pervious concrete. The Contractor must maintain concrete saws in good operating
17 condition and must keep an adequate supply of blades on hand. Implement measures to collect dust and slurry during
18 sawcutting operations. There must be enough concrete saws and equipment on the project so that sawing may occur at a rate
19 to prevent random cracking of the pervious concrete sidewalk, including contingency in the event of a breakdown.

20 5-06.3(3)F SMOOTHNESS TESTING EQUIPMENT

21 The Contractor must provide a 10-foot straight edge to be used for measuring the profile of the pervious concrete
22 sidewalk. The straight edge device must be designed to easily move from location to location without marring the surface of
23 the freshly compacted pervious concrete. The 10-foot straight edge must be accepted by the Engineer before placing pervious
24 concrete.

25 5-06.3(4) MEASURING AND BATCHING MATERIALS

26 Measuring and batching Materials for pervious concrete sidewalks must conform to the requirements of Section 5-
27 05.3(4)A.

28 5-06.3(4)A ACCEPTANCE

29 For acceptance, pervious concrete sidewalk will be divided into lots as determined by the Engineer. A single lot will
30 typically be represented by the lesser of 1 day's production or 360 square yards of pervious concrete in place. Where the
31 Contractor has more than 1 crew placing pervious concrete, lots may be associated with each crew. Representative lot size
32 will be determined to the nearest square yards. If no sample is taken on a Day that Day's quantities may be included in the
33 next or previous Day's lots. Acceptance of a lot of pervious concrete sidewalk will be based on these criteria:

- 34 1. Grade: Pervious concrete sidewalk must be true to planned grades \pm 1/2 inch and must not deviate from grade more
35 than 1/4 inch in 10 feet. Where abutting existing facilities such as sidewalks, walkway, curbs, driveways, or other
36 pavements, the pervious concrete sidewalk must be flush and provide a transition that does not deviate more than
37 1/4 inch in 10 feet.
- 38 2. Line: Pervious concrete sidewalk margins must be true to planned lines \pm 1/2 inch at any point.
- 39 3. Slope: Pervious concrete sidewalk must be sloped as shown on the Drawings. Slope must be consistent to within 1/4
40 inch in 10 feet.
- 41 4. Conformance to JMF: The pervious concrete used must conform to the JMF as specified in Section 6-02.3(5)C and
42 as determined from the accepted test panel.
- 43 5. Thickness (test panel only or when determined by the engineer): 3 core samples of 4 inches in diameter may be
44 taken from each test panel or lot for acceptance per ASTM C42. The Contractor must provide measures to collect
45 slurry and debris during coring operation to avoid sealing adjacent pavement. Each Core Sample must be equal to
46 the minimum section depth or more as specified in the Drawings (minimum 5 inches). After core's length and
47 diameter is measured, trim cores to uniform depth as specified in Section 5-06.3(4)A1 for determining the weight.
48 Core holes must be filled by the Contractor with concrete meeting the JMF and must match adjacent pavement
49 texture and grade.
- 50 6. Unit Weight (test panel only or when determined by the engineer): The unit weight of each core sample taken for
51 acceptance will be determined using the method specified in Section 5-06.3(4)A1. The unit weight of the core sample
52 for each lot must be within 8 pounds per cubic foot of the unit weight as accepted in the JMF.
- 53 7. Infiltration Rate: The infiltration rate of each lot will be tested at 4 random locations within the lot as specified in
54 Section 5-06.3(4)A2. The average of all 4 tests must be greater than 100 inches per hour.
- 55 8. Fresh Density: The fresh density will be measured using the jigging procedure outlined in ASTM C29 at the point of
56 placement must be within or equal to 5 pounds per cubic foot of the fresh density indicated by the JMF.

- 1 9. Manufacturer's certificate of compliance: Each load of pervious concrete transported to the location of placement
 2 must have an original manufacturer's certificate of compliance as specified in Section 6-02.3(5)B delivered with the
 3 load. Photo copies, carbon copies, or facsimiles are not acceptable.
- 4 10. Appearance: Each lot of finished pervious concrete sidewalk will be inspected for appearance. The pervious concrete
 5 sidewalk must have a consistent surface texture; must have no more than 5 percent of the surface area within each
 6 panel, joint to joint, filled with paste; must not be raveled; must be free of ridges or other surface imperfections; must
 7 have joints that are in the specified location and are constructed per specification; and must be free of cracks.

8 Quality Assurance Testing: Before final acceptance by the Engineer, the Contractor must pressure wash the pervious
 9 concrete sidewalk. Pressure washing must be provided and completed by using portable washer equipment working at a
 10 minimum of 3000 psi at 1.0 gpm. The nozzle must be held a maximum of 3 inches off the concrete surface. The Contractor
 11 must pressure test 3 locations per lot or as determined by the Engineer. Any section of pervious concrete that breaks up,
 12 ravel, or does not infiltrate must be removed and replaced with acceptable pervious concrete to the nearest joints. The
 13 Engineer will determine the acceptability of the concrete after pressure washing.

14 The Contractor must decide, after placing the pervious concrete, when to perform the quality assurance pressure wash
 15 testing for the acceptance.

16 **5-06.3(4)A1 VOID CONTENT OF THE MIX; LAB TEST:**

17 The test panels will not be accepted unless each of the cores has a void content between 15 and 30 percent.

18 Determine the bulk specific gravity (GB) of the core using the method described in ASTM D1188. Core samples must be
 19 trimmed to 4-1/2 inches in depth to provide increased uniformity of test results. Trimming must be squared and from the
 20 bottom of each pavement core samples.

21 Dry the core samples at a temperature not to exceed 150° F until a constant mass (± 0.1 percent) is obtained and allow
 22 to cool to ambient temperature. Remove paraffin coating from core samples.

23 Weigh the core and record weight to the nearest 0.1 g.

24 Use the pycnometer apparatus as described in ASTM D2041.

25 Place core samples in calibrated pycnometer and cover completely with water. If the core sample is too large to be
 26 placed into the pycnometer, it may be broken into pieces and placed into the pycnometer together or the pieces may be
 27 evaluated separately.

28 Place the lid on pycnometer and fasten it on a mechanical agitation device.

29 Turn on the agitation device and slowly apply a vacuum to the pycnometer until the vacuum reaches 3.7 ± 0.3 kPa (27.5
 30 ± 2.5 mm Hg). The vacuum should be reached in less than 2 minutes.

31 After the vacuum is achieved, maintain vacuum and agitation for a period of 15 ± 2 minutes.

32 Slowly release the vacuum and determine the weight of the sample and pycnometer as described in paragraph 9.5.1 or
 33 paragraph 9.5.2 in ASTM 2041.

34 Calculate specific gravity (G_{mm}) as described in paragraph 10.1.1 or paragraph 10.1.2 in ASTM 2041, as appropriate.

35 If multiple procedures are run for separate pieces of the core, the weighted average of all runs will be the specific gravity
 36 (G_{mm}) of the core as a whole.

$$G_{mm} = \text{sum}(G_{mm1} \times Wt_1 + G_{mm2} \times Wt_2 + \dots + G_{mmi} \times Wt_i) / Wt_{\text{total}}$$

37 The percentage of air voids will be calculated as:

$$V = (G_{mm} - G_B) / G_{mm} \times 100\%$$

38 Where:

39 V = Voids in the Sample (percent)

40 G_{mm} = Specific Gravity of the Core Material Less Air Voids

41 G_B = Bulk Specific Gravity of the Core per ASTM D1188

42 This Void Content lab test information must be part of the Mix Design submittal.

43 **5-06.3(4)A2 INFILTRATION RATE OF THE MIX; FIELD TEST:**

44 Pervious concrete mix must also have an infiltration rate equal to or greater than 100 inches per hour, in place, as
 45 constructed. The locations for conducting the infiltration tests are determined by the Engineer. The Contractor must coordinate
 46 and schedule inspections with the Engineer a minimum of 5 Working Days in advance. The infiltration rate will be measured in
 47 the following manner:

48 Testing procedure: must

49 1. Place a premeasured quantity of water into the container. Water must be free of suspended solids. The volume of
 50 water must be determined to 2 significant figures.

51 2. Pour the water onto the surface in 1 spot. Control the discharge rate by manually adjusting the angle of the spout so
 52 that the diameter of the pool of water stays between 10 to 30 inches. Empty the container holding the spout over the
 53 spot until the pool of water vanishes. A 16-inch to 24-inch diameter tube, typically PVC 3 inches to 6 inches in height,
 54
 55

1 and plumper's putty may be used to control the diameter of the pool (controlled method) as desired by the Engineer.
 2 When using the controlled method, the height of the water in the tube should be maintained at approximately 1/4
 3 inch.

4 3. Start the stopwatch when the water initially touches the concrete surface and stop it when the pool disappears from
 5 the surface.

6 4. Measure the longest dimension (d1) of the dampened area. Measure the width (d2) of the pool perpendicular to d1.
 7 Use inside diameter of tube for the controlled method

8 5. Repeat this procedure at a minimum of 4 separate locations.

9 Calculate the Infiltration Rate (IR) using the following formula:

$$IR = (V \times 3,326,400) / (\pi \times d1 \times d2 \times t) \text{ inches per hour}$$

11 Where:

12 IR is Infiltration Rate

13 V is the volume of water in gallons (typically 1 gallon or more)

14 d1 and d2 are the dimensions that were measured in inches

15 π is approximately 3.14159

16 t is the time in seconds

17 **5-06.3(4)B REJECTION**

18 Pervious concrete sidewalk that does not comply with the acceptance criteria specified in Section 5-06.3(4)A will be
 19 rejected by the Engineer on a lot by lot basis. At the discretion of the Engineer, a localized area of pervious concrete sidewalk
 20 not meeting the requirements of items 1, 2, 3 and 8 of Section 5-06.3(4)A may be broken into a subplot bounded by planned
 21 joints.

22 Pervious concrete sidewalk that has been rejected by the Engineer, or the Contractor, must be removed and replaced at
 23 no additional cost to the Owner.

24 **5-06.3(5) MIXING PERVIOUS CONCRETE**

25 Pervious concrete must be batched and centrally mixed at a semi-automatic or automatic batching plant with a current
 26 (within 2 years) certification from the NRMCA. Pervious concrete must not be shrink mixed or transit mixed.

27 The mixing time, after all materials have been delivered to the drum, must not be less than 50 seconds or more than 90
 28 seconds. The pervious concrete aggregates must be uniformly coated with paste and must be of the required consistency.
 29 After mixing, the pervious concrete must be delivered to a truck as specified in Section 5-06.3(3)B for transport to the Job Site.
 30 Pervious concrete must be placed no more than 90 minutes from the time water is added to the cement. Pervious concrete
 31 must not be retempered.

32 **5-06.3(5)A LIMITATIONS OF MIXING PERVIOUS CONCRETE**

33 Pervious concrete must not be mixed, placed, compacted, or finished when the natural light is inadequate, as determined
 34 by the Engineer, unless an adequate and accepted lighting system is in operation.

35 Mixing and placing concrete must be discontinued when a descending air temperature in the shade away from artificial
 36 heat reaches 50 °F and must not resume until an ascending air temperature in the shade and away from artificial heat reaches
 37 45 °F.

38 Mixing and placing pervious concrete must only occur when the ambient air temperature, as measured at the placement
 39 location away from the shade and away from artificial cooling sources, is less than 80 °F.

40 The temperature of pervious concrete must not be less than 60 °F when placed and must at no time be greater than 90
 41 °F.

42 Do not mix pervious concrete with aggregates less than 32 °F.

43 **5-06.3(6) AGGREGATE DISCHARGE SUBBASE**

44 Pervious concrete sidewalk must be constructed on an aggregate discharge subbase over the prepared subgrade. The
 45 aggregate discharge subbase must be constructed to the lines, grades, and thickness shown on the Drawings. Aggregate
 46 discharge subbase is specified in Section 5-06.2.

47 Aggregate discharge subbase material must be a minimum of 6 inches placed over the preplaced geotextile as specified.
 48 Geotextile is specified in Section 5-06.2. Aggregate discharge subbase must be placed in lifts not to exceed 12 inches non-
 49 compacted. The aggregate discharge subbase must be compacted to the satisfaction of the Engineer. The compaction
 50 equipment must be of sufficient weight and dimensions so as not to break or degrade the aggregate. In areas that are not
 51 accessible to equipment, other mechanical means may be used to compact the aggregate discharge subbase. Equipment
 52 used for compaction of the aggregate discharge subbase must be accepted by the Engineer before use.

53 The aggregate discharge subbase must be true to grade and slope \pm 0.5 inches after compaction. Where the grade is
 54 low, the surface of the aggregate discharge subbase must be scarified to a depth of 2 inches, additional material added, and
 55 recompacted. If there are high areas, the material must be removed and the area recompacted.

1 The Contractor must take care to protect the aggregate discharge subbase from damage and contamination. Damage to
 2 the aggregate discharge subbase must be repaired to the satisfaction of the Engineer at no additional cost. Contaminated
 3 aggregate discharge subbase must be removed and replaced to limits determined by the Engineer. The aggregate discharge
 4 subbase must be inspected and accepted by the Engineer before placing any pervious concrete sidewalk.

5 **5-06.3(6)A SUBGRADE PREPARATION**

6 Subgrade for pervious concrete sidewalk must be excavated, graded and compacted as specified in Section 8-14.3(2)
 7 except that the subgrade must be compacted to a relative density of 92 percent of optimum density of the subgrade soil per
 8 ASTM D 698. Before placing the geotextile fabric, the surface of the subgrade must be scarified to a depth of 1/4 to 1/2 inch.
 9 Once scarified, materials or equipment must not be stored or permitted within the prepared subgrade area to avoid re-
 10 compaction of the scarified areas and diminishing the infiltration rate of the subgrade.

11 Geotextile must be placed on the prepared subgrade before placing aggregate discharge subbase as shown on the
 12 Drawings. Take care to provide full coverage and to prevent the geotextile from being torn. Damaged geotextile must be
 13 repaired as indicated by the manufacturer and to the satisfaction of the Engineer. Overlaps of the geotextile must be a
 14 minimum 1 foot or to the manufactures recommendation, whichever is greater.

15 **5-06.3(7) PLACING, SPREADING, AND COMPACTING PERVIOUS CONCRETE**

16 Standard methods of placing, spreading, and compacting must be as specified. However, the Contractor may submit
 17 alternative methods of work that deviate from the standard methods described in this specification for review and approval by
 18 the Engineer. Such methods must be demonstrated through the test panels trial and will require final acceptance by the
 19 Engineer. Alternate methods that are rejected through the test panels must be discontinued.

20 **5-06.3(7)A CONTRACTOR'S QUALIFICATIONS**

21 Unless otherwise specified, the Contractor must employ no less than 1 NRMCA certified Pervious Concrete Craftsman,
 22 who must be on-site overseeing each placement crew during all pervious concrete placement, or no less than 3 NRMCA
 23 certified Pervious Concrete Installers, who must be on the Job Site working as members of each placement crew during all
 24 pervious concrete placement, or no less than 3 NRMCA certified Pervious Concrete Technicians and 1 Pervious Concrete
 25 Installer, who must be on the Job Site working as members of each placement crew during all concrete placement.. For those
 26 crews with NRMCA certified Pervious Concrete Technician personnel, the placement crew must also successfully pass a
 27 Performance Evaluation required under NRMCA Pervious Concrete Installer certification.

28 The pervious cement concrete sidewalk test panels installed at the Project Site may be used as the mock-up placement
 29 required for the NRMCA mock-up Performance Evaluation exam for Pervious Concrete Installer certification. If the mock up
 30 placement installed for NRMCA certification does not comply with the project Specifications, the mock up placement must be
 31 removed at the Contractor's expense and a new pervious concrete sidewalk test panels must be installed, tested, and
 32 submitted for acceptance.

33 Documentation of NRMCA certifications for the Contractor's personnel must be submitted as specified in Section 5-
 34 06.3(2) before proceeding with production placement of the pervious concrete sidewalks.

35 If, in the opinion of the Engineer, personnel used for installing pervious concrete sidewalk are unqualified, inattentive to
 36 quality, or unsafe, they must be removed or reassigned from installation of pervious concrete sidewalk.

37 **5-06.3(7)B TEST PANELS**

38 Production placement of pervious concrete must not start until the Contractor has completed test panels of pervious
 39 concrete sidewalk that meet all acceptance criteria here and are accepted by the Engineer. The Contractor should allow time
 40 in their schedule for the construction and acceptance of the test panels.

41 The Contractor must construct test panels of pervious concrete sidewalk with a minimum area of 225 square feet. Test
 42 panels may be placed non-contiguously. The width of the test panels must be equal to the nominal width of the sidewalk to be
 43 placed. The test panels must be equivalent and representative of the production pervious concrete sidewalk in all aspects
 44 including subbase depth and preparation. The Engineer will observe and accept each element of pervious concrete sidewalk
 45 construction. Construction and evaluation of the test panels will occur as follows:

- 46 1. Notify the Engineer at least 10 Working Days before installing pervious concrete sidewalk test panels.
- 47 2. Coordinate the location of the test panels with the Engineer.
- 48 3. Install the test panels per the Specifications and Drawings.
- 49 4. Notify the Engineer when each element of the test panels is ready for inspection.
- 50 5. Remove, replace, and dispose of any unsatisfactory portions of test panels as determined by the Engineer and at no
 51 additional cost.

52 Failure to install acceptable test panels of pervious concrete will indicate an unqualified installer.

53 Production sections of this Work must not be placed until achieving test panels that fully comply with the Drawings and
 54 Specifications and receiving written acceptance from the Engineer.

55 Use the completed test panels to validate the pervious concrete mix design and establish the JMF. Unless otherwise
 56 determined by the Engineer, 3 core samples of 4 inches in diameter will be cut per ASTM C42 and used to validate the mix
 57 design. See Sections 5-06.3(1)A for design criteria and 5-06.3(4)A for acceptance criteria. The average unit weight of the

1 cores per ASTM D1188 must be within 8 pounds per cubic foot of the average of the 3 cores. The average unit weight of the
2 cores must be the unit weight used for the JMF. Core holes must be filled by the Contractor with concrete meeting the
3 proposed JMF and must match adjacent pavement color, texture, and grade.

4 3 infiltration tests will be conducted in the test panels for acceptance. Each of the infiltration tests must comply with the
5 minimum infiltration rate as specified in Section 5-06.3(4)A.

6 The completed and accepted test panels must be maintained and protected throughout the duration of the Work and may
7 not be demolished and disposed of without written permission from the Engineer. If the test panels are incorporated into the
8 Work, they must remain in place accepted as a single lot.

9 **5-06.3(7)C PLACING, SPREADING AND COMPACTING**

10 Before placing pervious concrete, the Engineer will inspect and accept all formwork and subbase/subgrade. All surfaces
11 that will contact the finished pervious concrete must be damp with no standing water. Pervious concrete must not be placed on
12 standing water or frozen materials.

13 Pervious concrete sidewalk must be placed on the prepared subbase as close to its final position as possible in a
14 continuous operation to minimize evaporation. Where necessary, the pervious concrete may be spread with square edged
15 shovels or rakes before strike off. The pervious concrete must be struck off or screeded to a depth sufficient to allow for
16 compaction to grade. Pervious concrete must be placed in a single lift. The Contractor's personnel must avoid foot traffic in the
17 pervious concrete to prevent non-uniform compaction and to keep contaminating material from the mix. Foot traffic on fresh
18 concrete is not allowed after it has been struck off.

19 Within 20 minutes of discharge from the truck, the concrete must be compacted, finished, and covered for curing. The
20 compacted effort must be sufficient to compact the fresh pervious concrete to grade, not draw excessive paste to the surface
21 and to leave a smooth finish. In areas where the roller cannot be brought to bear, hand tamping or other methods accepted by
22 the Engineer may be used to compact the pervious concrete. Edges and plastic formed joints must be finished by hand tooling
23 with a 1/2 inch radius edging tool. Defects must be repaired immediately.

24 Pervious concrete must be placed continuously. Where placement has been halted for a period of 15 minutes, a header
25 must be placed between the forms and a construction joint formed. The construction joint must be at the same spacing where
26 a contraction joint would be. The pervious concrete must be compacted and finished to the header before placement may
27 continue. Upon resuming placement, the header may be carefully removed and a construction joint formed at that location.
28 Any sloughing or sagging of the previously placed pervious concrete at the header location must be corrected before placing
29 new pervious concrete against the joint.

30 **5-06.3(8) JOINTS**

31 Joints may be of 3 types: construction, contraction, or isolation. Construction joints must be formed at the end of a day's
32 work or when necessary to stop production for any reason. Use contraction joints to control random cracking. Use isolation
33 joints where the pervious concrete abuts existing facilities or where shown on the Drawings. Wherever possible, the angle
34 between intersecting joint must be between 80 and 100 degrees.

35 **5-06.3(8)A CONSTRUCTION JOINTS**

36 Construction joints must be located as near as possible to the location of a planned contraction or isolation joint.
37 Construction joints are formed by placing a header between the forms, at right angles, to the full depth of the finished pervious
38 concrete, and set to the height of the forms. Pervious concrete must be placed against the header and compacted and finished
39 as normal, including edging. Upon resuming paving, the header must be carefully removed and new pervious concrete placed
40 directly against the existing pervious concrete. The new pervious concrete must be compacted and finished against the
41 hardened pervious concrete as if it were a form. If an isolation joint is planned at this location, then the premolded joint filler
42 must be placed against the existing pervious concrete and the new pervious concrete must be placed against the premolded
43 joint filler. The joint must be tooled on both sides of the premolded joint filler.

44 **5-06.3(8)B CONTRACTION JOINTS**

45 Contraction joints must be placed every 20 feet unless otherwise shown on the Drawings. Contraction joints must be
46 have a depth of 1/3 the thickness of the pervious concrete and a width of no more than 1/8 inch. Contraction joints may be
47 formed in the plastic concrete using a roller designed for this purpose or by other methods accepted by the Engineer. Plastic
48 formed contraction joints must be tooled on both sides of the joint with a radius of 1/2 inch.

49 At the option of the Contractor, contraction joints may be saw cut after the pervious concrete has hardened. If saw cutting
50 the contraction joints, saw cutting must occur as soon as the concrete is sufficiently cured so that it may be cut without raveling
51 or dislodging aggregate from the finished surface. Measures to collect dust and slurry during sawcutting operations are
52 required. To minimize drying, remove curing materials only as needed to make cuts and must be replaced immediately after
53 cutting.

54 **5-06.3(8)C ISOLATION JOINTS**

55 Isolation joints must be placed where the pervious concrete abuts existing Structures or where shown on the Drawings.
56 Isolation joints must continue through the depth of the pervious concrete using a 3/8-inch premolded joint filler. Isolation joints
57 may be formed by inserting the premolded joint filler into the plastic concrete or by forming a construction joint, affixing the
58 premolded joint filler against one side of the joint, and placing fresh pervious concrete against it. Isolation joints and filler must

1 be flush with the surrounding pervious concrete and must not deviate from the acceptance criteria for smoothness as specified
2 in Section 5-06.3(4)A. The edges of the pervious concrete on either side of the premolded joint filler must be hand tooled with
3 a 1/2-inch radius.

4 **5-06.3(9) SURFACE SMOOTHNESS**

5 The surface of the pervious concrete sidewalk will be checked immediately after compaction for grade and slope using
6 the 10-foot straight edge specified in Section 5-06.3(3)F. Where the surface is out of specification as determined by the criteria
7 specified in Section 5-06.3(4)A, it must be immediately corrected by recompacting, removing excess pervious concrete, or by
8 adding pervious concrete; as necessary.

9 If it is necessary to correct grade or slope by removing excess pervious concrete, the surface must be recompacted and
10 the edges retooled. If the grade or slope is corrected by the addition of pervious concrete, the surface must be lightly scarified
11 and the new material added. The surface must be recompacted to grade and the edges retooled. Any corrections to the
12 surface must occur before the pervious concrete has set or has dried. Pervious concrete sidewalk that is out of specification
13 with regard to grade or slope will be rejected to the nearest joints.

14 Pervious concrete sidewalk that has been corrected must be indistinguishable from the adjacent, undisturbed pervious
15 concrete sidewalk. If in the opinion of the Engineer, the corrected pervious concrete sidewalk is distinguishable from the
16 adjacent Work, the repaired area will be rejected to the nearest joints.

17 **5-06.3(10) CURING**

18 Immediately after the pervious concrete sidewalk has been compacted and checked for grade and slope, apply the sheet
19 curing Material as specified in Section 9-23.1. If the surface appears dry, lightly mist the surface with water before applying the
20 sheet curing Material. The sheet curing Material must be fixed in place by methods that does not damage the pervious
21 concrete sidewalk and is accepted by the Engineer. The pervious concrete must be placed, struck off, finished, and the curing
22 Material in place within 20 minutes of the time the pervious concrete is discharged from the truck. This time may be shortened
23 if conditions exist that promote excessive drying. Forms and sheet curing Material must remain in place for a minimum of 10
24 days.

25 With the exception of saw cutting equipment, all traffic must be kept off of the pervious concrete sidewalk during the
26 curing period. For saw cutting contraction joints, only the quantity of sheet curing Material necessary to accomplish the saw
27 cutting must be removed and the surface of the exposed pervious concrete sidewalk must be kept moist for the entire duration
28 of the exposure.

29 No testing for acceptance will occur until the end of the curing period.

30 **5-06.3(11) COLD WEATHER WORK**

31 When concrete is being placed and the ambient air temperature is expected to drop below 50° F during the day or night,
32 the Contractor must, at no expense to the Owner, protect the concrete from freezing. The Contractor must provide a Cold
33 Weather Plan before placing concrete when ambient air temperature below 50° F may occur or when requested by the
34 Engineer.

35 Under the Cold Weather Plan, the Contractor must, at no expense to the Owner, provide a sufficient supply of straw, hay,
36 blankets, or other suitable blanketing material and spread it over the pavement to a sufficient depth to prevent freezing of the
37 concrete. The blanket material must be covered with a layer of burlap or plastic sheeting, weighted, or anchored to prevent the
38 wind from displacing the insulation. The Engineer may require recording thermometers if daytime temperature is below 50 °F.

39 The protection must be maintained for 10 Days. The Contractor must replace any concrete damaged by freezing at no
40 additional cost to the Owner.

41 The Contractor is responsible for the quality of the concrete thus cured. Any concrete injured by frost action or freezing
42 must be removed and replaced at the Contractor's expense as specified in this Section.

43 **5-06.3(12) PROTECTION OF PERVIOUS CONCRETE SIDEWALK**

44 As part of the CSECP, rain runoff, surface water of any kind, and sediment must be prevented from entering the area of
45 pervious pavement construction, including excavation, until the pervious concrete application has cured and the adjacent
46 areas that sheet flow/drain onto the pervious pavement are permanently stabilized from erosion and plantings are established.
47 Once pavement is placed, protective covers must continually be maintained until adjacent areas are permanently stabilized
48 and pavement has been accepted.

49 The Contractor must take every precaution to protect the pervious concrete sidewalk from damage, including the
50 introduction of foreign materials to the surface, throughout the course of the work. Pervious concrete sidewalk that is damaged
51 or has been adversely impacted by the introduction of foreign materials will be rejected and must be replaced to the nearest
52 joint.

53 **5-06.4 MEASUREMENT**

54 Measurement for "Pervious Concrete Sidewalk" will be by the square yard for the surface of pervious concrete walk
55 placed. Deduction will be made for blocked out areas, castings or other discontinuities in the sidewalk 9 square feet or larger.

1 **5-06.5 PAYMENT**

2 1. **“Pervious Concrete Sidewalk”**, per square yard.

3 The Bid Item price for “Pervious Concrete Sidewalk” includes all costs for the work required to construct the pervious
4 concrete sidewalk as specified in this Section, including but not limited to; performing mix designs, testing, excavation, and
5 subgrade preparation; and, furnishing and installing geotextile, aggregate discharge subbase, and pervious concrete.

6 Payment of the volume of earthwork involved in excavating Material above the top surface of the sidewalk will be made
7 as specified in Section 2-04.5 as specified in Section 2-04.1(2).

8

9

10

END OF DIVISION

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1 DIVISION 6 STRUCTURES**2 SECTION 6-01 GENERAL REQUIREMENTS - STRUCTURES****3 6-01.1 DESCRIPTION**

4 Section 6-01 describes structural and incidental items used in any or all types of existing or proposed Structures. These
5 provisions supplement the detailed Specifications supplied for any Structure. These provisions apply only when relevant and
6 when they do not conflict with the Contract.

7 6-01.2 FOUNDATION DATA

8 If obtained, foundation data in the Contract (from test borings, test pits, or other sources) are only to guide the Owner in
9 planning and designing the project. These data reasonably represent the information at the test sites when the investigations
10 were made, see Section 1-02.4(2).

11 6-01.3 CLEARING THE SITE

12 The Contractor must clear the entire Job Site of the proposed Structure to the limits shown on the Drawings or
13 determined by the Engineer.

14 6-01.4 APPEARANCE OF STRUCTURES

15 To achieve a more pleasing appearance, the Engineer may require the Contractor to adjust the height and alignment of
16 bridge railings, traffic barrier, and structural curbs.

17 6-01.5 LOAD RESTRICTIONS ON BRIDGES UNDER CONSTRUCTION

18 Bridges under construction must remain closed to all traffic, including construction equipment, until the substructure and
19 the superstructure, through the bridge deck, are complete for the entire Structure, except as provided here. Completion
20 includes release of all falsework, removal of all forms, and attainment of the minimum design concrete strength and specified
21 age of the concrete per these Specifications. Once the Structure is complete, Section 1-07.7 must governs all traffic loading,
22 including construction traffic and equipment.

23 If necessary and safe to do so, and if the Contractor requests it in writing, the Engineer may approve traffic on a bridge
24 before completion. The maximum distributed load at each construction equipment support must not exceed the design load by
25 more than 33 percent. The written request must:

- 26 1. Describe the extent of the Structure completion at time of the proposed equipment loading.
- 27 2. Describe the loading magnitude, arrangement, movement, and position of traffic (equipment) on the bridge, including
28 but not limited to:
 - 29 a. Location of construction equipment, including outriggers, spreader beams, and supports for each, relative to the
30 bridge framing plan (bridge girder layout).
 - 31 b. Mechanism of all load transfer (load path) to the bridge.
- 32 3. Provide stress calculations per AASHTO LRFD Bridge Design Specifications, current edition design criteria, prepared
33 by, or under the direction of, a professional engineer, licensed under Title 18 RCW State of Washington, and carrying
34 the professional engineer's signature and seal, including but not limited to the following:
 - 35 a. Supporting calculations showing the flexural and shear stresses in the main load carrying members due to the
36 construction load are within the allowable stresses.
 - 37 b. Supporting calculations showing the flexural and shear stresses in the bridge deck due to the construction load
38 are within the allowable stresses.
- 39 4. Provide supporting material properties, catalogue cuts, and other information describing the construction equipment
40 and all associated outriggers, spreader beams, and supports.
- 41 5. State that the Contractor assumes all risk for damage.

42 6-01.6 NAVIGABLE STREAMS

43 The Contractor must keep navigable streams clear so water traffic may pass safely, providing and maintaining all lights
44 and signals required by the U.S. Coast Guard. The Contractor must also comply with all channel depth and clearance line
45 requirements of the U.S. Corps of Engineers. This may require removing material deposited in the channel during
46 construction.

47 6-01.7 APPROACHES TO MOVABLE SPANS

48 No bridge deck or sidewalk slab on the approach span at either end of a movable span may be placed until after the
49 movable span has been completed, adjusted, and closed.

50 6-01.8 WORKING DRAWINGS

51 The Contractor must submit supplemental working drawings with calculations as required for the performance of the
52 Work. The drawings must be on sheets measuring 22" x 34", 11" x 17", or on sheets with dimensions in multiples of 8-1/2" x

1 11". All drawings must be to scale in keeping with standard drafting procedures. The design calculations must be on sheets
2 measuring 8-1/2" x 11". They must be legible, with all terms identified, and may include computer printouts. The drawings and
3 calculations must be provided far enough in advance of actual need to allow for the review process by the Owner which may
4 involve rejection, revision, or resubmittal. The Engineer will require up to 30 Calendar Days from the date the submittals are
5 received until they are sent to the Contractor. This time will increase if the drawings submitted do not comply with the Contract
6 requirements or contain insufficient details.

7 Unless designated otherwise by the Contractor, submittals of working drawings will be reviewed in the order they are
8 received by the Engineer. If several working Drawing are submitted simultaneously, the Contractor must specify the sequence
9 in which these plans are to be reviewed. The Engineer's review times are specified above for the first plan in the specified
10 sequence and up to an additional 2 weeks for each plan lower in the specified sequence. A plan is identified as 1 or more
11 working drawings that pertain to a unit of superstructure or a complete pier. If the Contractor does not submit a working
12 Drawing review sequence for simultaneous plan submittals, the review sequence is at the Engineer's discretion

13 Working drawings and calculations must be prepared by, or under the direction of, a Professional Engineer, licensed
14 under Title 18 RCW, State of Washington, and must carry the Professional Engineer's signature and seal.

15 If more than the specified numbers of days are required for the Engineer's review of any individual submittal or
16 resubmittal, an extension of time will be considered as specified in Section 1-08.8.

17 **6-01.9 NAME PLATES**

18 The Contractor must not install permanent plates or markers on a Structure unless the Drawings show it.

19 **6-01.10 FINAL CLEANUP - STRUCTURE**

20 When the Structure is completed, the Contractor must leave it and the entire Job Site in a clean and orderly condition.
21 Structure decks must be swept and washed. Temporary buildings, falsework, piling, lumber, equipment, and debris must be
22 removed. The Contractor must level and fine grade all excavated material not used for backfill, and must fine grade all slopes
23 and around all piers, bents, and abutments. This clean-up work includes the Specifications of Section 1-04.10.

24 **6-01.11 ARCHITECTURAL FEATURES**

25 To ensure uniform texture and color, the Contractor must obtain all cement for the Structure from the same
26 manufacturing plant unless the Engineer waives this requirement in writing.

27 **6-01.12 PREMOLDED JOINT FILLER**

28 When the Drawings call for premolded joint filler, the Contractor must fasten it with galvanized wire nails to one side of
29 the joint. The nails must not be more than 6 inches apart and must be 1-1/2 inches from the edges over the entire joint area.
30 The nails must be at least 1-1/2 inches longer than the thickness of the filler.

31 The Contractor may substitute for the nails any adhesive approved by the Engineer. This adhesive, however, must be
32 compatible with the Material specified in Section 9-04.1(2) and capable of bonding the filler to Portland cement concrete.

33 **6-01.13 NORMAL TEMPERATURE**

34 Bridge Drawings state dimensions at a normal temperature of 64 °F. Unless otherwise noted, these dimensions are
35 horizontal or vertical.

36 **6-01.14 MAINTENANCE OF BRIDGE DRAINS**

37 Unless measures are necessary to prevent construction stormwater discharge, the Contractor must keep existing and
38 new bridge drains open and functioning during construction. Before bridge drain work starts, the Contractor must verify
39 existing drains are clear and free flowing, and if not, must immediately notify the Engineer. Maintenance includes keeping
40 drains clean, free of debris, and free flowing. During the construction, drainage must be addressed per the applicable
41 Construction Stormwater Pollution Prevention Plans (Section 8-01). Before acceptance of the bridge drains, the existing and
42 new bridge drains must be tested for drainage, and clogged or non-flowing drains must be cleaned and cleared to a free
43 flowing state acceptable to the Engineer.

44 **SECTION 6-02 CEMENT CONCRETE STRUCTURES AND CEMENT CONCRETE FOR MISC WORK**

45 **6-02.1 DESCRIPTION**

46 Section 6-02 describes the construction of all Structures and their parts made of cement concrete with or without
47 reinforcement, including bridge approach slabs. Any part of a Structure to be made of other materials must be built as these
48 Specifications require elsewhere. This Section also provides cement concrete requirements for miscellaneous Work by
49 reference.

50 **6-02.2 MATERIALS**

51 Materials must comply with the requirements of the following Sections:

52

| Material | Section |
|--|-----------------|
| Portland Cement and Blended Hydraulic Cement | Section 9-01 |
| Aggregates for Portland Cement Concrete | Section 9-03.1 |
| Pit Run Sand, Washed Sand, and Gravel Backfill | Section 9-03.10 |
| Joint and Crack Sealing Materials | Section 9-04 |
| Reinforcing Steel | Section 9-07 |
| Epoxy-Coated Reinforcing Steel | Section 9-07 |
| Pigmented Sealer Materials for Coating of Concrete Surface | Section 9-08.3 |
| Prestressed Concrete Girders | Section 9-19 |
| Grout | Section 9-20.3 |
| Mortar | Section 9-20.4 |
| Concrete Curing Materials, Pozzolans and Admixtures | Section 9-23 |
| Fly Ash | Section 9-23.6 |
| Ground Granulated Blast Furnace Slag (GGBFS) | Section 9-23.7 |
| Microsilica Fume | Section 9-23.8 |
| Metakaolin | Section 9-23.9 |
| Plastic Waterstop | Section 9-24 |
| Water | Section 9-25 |
| Elastomeric Bearing Pads | Section 9-35 |

1

2 **6-02.3 CONSTRUCTION REQUIREMENTS**3 **6-02.3(1) CLASSIFICATION OF STRUCTURAL CONCRETE**

4 The class of concrete to be used must be as noted in the Drawings and these Specifications. The class includes the
5 specified minimum compressive strength in psi at 28 days (numerical class) and may include a letter suffix to denote structural
6 concrete for a specific use. Letter suffixes include A for bridge approach slabs, D for bridge decks, P for piling and shafts, and
7 W for underwater. The numerical class without a letter suffix denotes structural concrete for general purposes.

8 Concrete of a numerical class greater than 4000 must conform to the requirements specified for either Class 4000 if
9 general-purpose, or for the appropriate Class 4000 with a letter suffix, as follows:

- 10 1. Mix ingredients and proportioning specified in Sections 6-02.3(2) and 6-02.3(2)A.
- 11 2. Consistency requirements specified in Section 6-02.3(4)C.
- 12 3. Curing requirements specified in Section 6-02.3(11).

13 The Contractor may request, in writing, permission to use a different class of concrete with either the same or a higher
14 compressive strength than specified. The substitute concrete must be evaluated for acceptance based on the specified class
15 of concrete. The Engineer will respond in writing. The Contractor must bear any added costs that result from the change.

16 The phrase "w/ ___% minimum pozzolans" under the class of concrete and any designation identifies a minimum use of
17 Pozzolans (fly ash and/or ground granulated blast furnace slag) not exceeding 40 percent is required. Ground granulated blast
18 furnace slag and fly ash maximums must not be exceeded individually. See table Cementitious Requirement for Concrete in
19 Section 6-02.3(2).

20 **6-02.3(2) PROPORTIONING MATERIALS**

21 The soluble chloride ion content is determined by the concrete Supplier and included with the mix design. The soluble
22 chloride ion content is determined by (1) testing mixed concrete cured at least 28 Days or (2) totaled from tests of individual
23 concrete ingredients (cement, aggregate, admixtures, water, fly ash, ground granulated blast furnace slag, and other
24 supplementary cementing materials). Chloride ion limits for admixtures and water are in Section 9-23 and Section 9-25.
25 Soluble chloride ion limits for mixed concrete must not exceed the following percent by mass of cement when tested per
26 AASHTO T260:

27

| Category | Acid-Soluble | Water-Soluble |
|----------------------|--------------|---------------|
| Prestressed concrete | 0.08 | 0.06 |
| Reinforced concrete | 0.10 | 0.08 |

28

29 Unless otherwise specified, the Contractor must use Type I or II Portland cement in all concrete as defined in Section 9-
30 01.2(1).

The use of fly ash is required for Class 4000D and 4000P concrete. Ground granulated blast furnace slag may be substituted for fly ash at a 1:1 ratio. The use of fly ash and ground granulated blast furnace slag is optional for all other classes of concrete and may be substituted for Portland cement at a 1:1 ratio as noted in the table below.

Cementitious Requirement for Concrete

| Class of Concrete | Minimum Pounds of Cementitious Material per Cubic Yard | Minimum Percent Replacement of Pozzolans for Portland Cement | Maximum Percent Replacement of Fly Ash for Portland Cement | Maximum Percent Replacement of Ground Granulated Blast Furnace Slag for Portland Cement |
|---------------------|--|--|--|---|
| 6000 | 658 | 0 ¹ | 35 | 40 |
| 5000 | 611 | 0 ¹ | 35 | 40 |
| 4000 | 564 | 0 ¹ | 35 | 50 |
| 4000A | 564 | 0 ¹ | 20 | 30 |
| 4000D | 660 | 10 ¹ | 20 | 30 |
| 4000P | 600 | 15 ¹ | 35 | 50 |
| 4000W | 564 | 0 ¹ | 35 | 50 |
| 3000 | 564 | 0 ¹ | 35 | 50 |
| Commercial Concrete | N/A | 0 | 35 | 50 |
| Lean Concrete | 145 ² | 0 | 35 | 50 |

NOTES:

1. Unless otherwise specified in Bid Item.
2. Maximum of 200 pounds.

When both ground granulated blast furnace slag and fly ash are included in the concrete mix, the total weight of both these materials is limited to 40 percent by weight of the total cementitious material.

The water-cement ratio must be calculated on the total weight of cementitious material. The following are considered cementitious materials: Portland cement, fly ash, ground granulated blast furnace slag, microsilica fume and metakaolin. With the Engineer's written approval, microsilica fume and metakaolin can be used in all classifications of Class 4000, Class 3000, and commercial concrete and is limited to a maximum of 10 percent of the cementitious material.

As an alternative to fly ash, ground granulated blast furnace slag and cement as separate components, a blended hydraulic cement that meets the requirements of Section 9-01.2(3) may be used.

6-02.3(2)A CONTRACTOR MIX DESIGN

The Contractor must provide a mix design in writing to the Engineer for all classes of concrete specified in the Drawings except for those accepted based on a certificate of compliance. Do not place concrete until the Engineer has reviewed the mix design. The required average 28 Day compressive strength must be selected per ACI 318, Chapter 5, Section 5.3.2. ACI 211.1 and ACI 318 must be used to determine proportions. All proposed concrete mix must comply with the cementitious material requirements listed in the table titled Cementitious Requirement for Concrete in Section 6-02.3(2).

The Contractor's submittal of a mix design must be per Section 1-05.2(2) and must provide a unique identification for each mix design. Each mix design, must include the mix proportions per cubic yard, the proposed sources, the average 28 Day compressive strength, the fineness modulus, and the water-cement ratio. The Contractor is responsible for concrete placeability, workability, and strength. The Contractor must notify the Engineer in writing of any mix design modifications.

Fine aggregate must conform to Section 9-03.1(2) Class 1 or Class 2.

Coarse aggregate must conform to Section 9-03.1(3). An alternate combined aggregate gradation conforming to Section 9-03.1(4) may also be used. The nominal maximum size aggregate for Class 4000P must be 3/8 inch. The nominal maximum size aggregate for Class 4000D must be 1 inch. The nominal maximum size aggregate for Class 4000A must be 1 inch.

Nominal maximum size for concrete aggregate is defined as the smallest standard sieve opening through which the entire quantity of the aggregate is permitted to pass.

Class 4000D and 4000P concrete must include a water reducing admixture in the quantity recommended by the manufacturer. A retarding admixture is required in concrete Class 4000P. Water reducing and retarding admixtures are optional for all other concrete classes.

A high-range water reducer (superplasticizer) may be used in all mix designs. Microsilica fume may be used in all mix designs. The use of a high-range water reducer or microsilica fume must be submitted as a part of the Contractor's concrete mix design.

1 Air content must be a minimum of 4.5 percent and a maximum of 7.5 percent for all concrete placed above the finished
2 groundline.

3 **6-02.3(2)B COMMERCIAL CONCRETE**

4 Commercial concrete must have a minimum compressive strength at 28 Days of 3000 psi per AASHTO T 22.
5 Commercial concrete placed above the finished groundline must be air entrained and have an air content from 4.5 percent to
6 7.5 percent per AASHTO T 152. Commercial concrete does not require plant approval, mix design, or source approvals for
7 cement, aggregate, and other admixtures.

8 Where concrete Class 3000 is specified for items such as culvert headwalls, plugging culverts, concrete pipe collars, pipe
9 anchors, thrust blocks, monument cases, light standard foundations, pedestals, cabinet bases, guardrail anchors, signpost
10 foundations, fence post footings, sidewalks, curbs, and gutters, the Contractor may use commercial concrete. If commercial
11 concrete is used for sidewalks, curbs, and gutters, it must have a minimum cementitious material content of 564 pounds per
12 cubic yard of concrete, must be air-entrained, and the tolerances of Section 6-02.3(5)C must apply. Commercial concrete must
13 not be used for items such as bridges, retaining walls, box Culverts, curb walls, stairs, or foundations for high mast luminaires,
14 mast arm traffic signals, cantilever signs, and sign bridges. The Engineer may approve the use of commercial concrete for
15 other applications not listed above.

16 **6-02.3(2)C LEAN CONCRETE**

17 Lean concrete must contain between 145 and 200 pounds of cement per cubic yard and have a maximum water-cement
18 ratio of 2:1.

19 **6-02.3(3) ADMIXTURES**

20 Concrete admixtures must be added to the concrete mix when batching the concrete or per the manufacturer's written
21 procedure and as approved by the Engineer. A copy of the manufacturer's written procedure must be furnished to the
22 Engineer before use of any admixture. Any deviations from the manufacturer's written procedures must be submitted to the
23 Engineer for acceptance as specified in Section 1-05.3. Admixtures must not be added to the concrete with the modified
24 procedures until the Engineer has accepted them in writing.

25 When the Contractor is proposing to use admixtures from different admixture manufacturers they must provide evidence
26 to the Engineer that the admixture will be compatible and not adversely affect the air void system of the hardened concrete.
27 Test results complying with ASTM C 457 must be provided as the evidence to satisfy this requirement. Proposed combinations
28 must comply with this requirement.

29 Do not use accelerators.

30 Do not use air entrained cement to air entrain concrete.

31 **6-02.3(4) READY-MIX CONCRETE**

32 All concrete, except commercial concrete and lean concrete must be batched in a prequalified manual, semi-automatic,
33 or automatic plant as specified in Section 6-02.3(4)A. The Engineer is not responsible for any delays to the Contractor due to
34 problems in getting the plant certified.

35 **6-02.3(4)A QUALIFICATION OF CONCRETE SUPPLIERS**

36 Batch Plant Prequalification may be obtained through one of the following methods:

- 37 1. Certification by the National Ready Mix Concrete Association (NRMCA): Information concerning NRMCA certification
38 may be obtained from the NRMCA at 900 Spring Street, Silver Springs, MD 20910 or online at <http://www.nrmca.org/>.
39 The NRMCA certification must be good for a 2-year period. When this method of certification is used the following
40 documentation must be submitted to the Engineer:
 - 41 a. A copy of the current NRMCA Certificate of Conformance, the concrete mix design, along with copies of the truck
42 list, batch plant scale certification, admixture dispensing certification, and volumetric water batching devices
43 (including water meters) verification.
- 44 2. Independent evaluation certified by a Professional Engineer using NRMCA checklist. The Professional Engineer must
45 be licensed under title 18 RCW, State of Washington, qualified in civil engineering. The independent certification
46 using the NRMCA checklist must be good for a 2 year period. When this method of certification is used the following
47 documentation must be submitted to the Engineer.
 - 48 a. A copy of the Professional Engineer's stamped and sealed NRMCA Verification of Inspection and Application for
49 Certificate page from the NRMCA checklist, the concrete mix design, along with copies of the truck list, batch
50 plant scale certification, admixture dispensing certification, and volumetric water batching devices (including water
51 meters) verification.
- 52 3. Inspection conducted by the Plant Manager, defined as the person directly responsible for the daily plant operation,
53 using the NRMCA Plant Certification checklist. The Plant Manager certification must be done before the start of a
54 project, and every 6 months throughout the life of the project, and comply with the following requirements:
 - 55 a. The Agreement to Regularly Check Scales and Volumetric Batching Dispensers page in the NRMCA Plant
56 Certification checklist must be signed by the Plant Manager and notarized.

- b. The signed and notarized Agreement to Regularly Check Scales and Volumetric Batching Dispensers page and a copy of the NRMCA Plant Certification checklist cover page showing the plant designation, address, and Company operating plant must all be submitted to the Engineer with the concrete mix design, along with copies of the truck list, batch plant scale certification, admixture dispensing certification, and volumetric water batching devices (including water meters) verification.
- c. The NRMCA Plant Certification checklists must be maintained by the Plant Manager and are subject to review at any time by the Owner.
- d. Volumetric water batching devices (including water meters) must be verified every 90 Days.

For central-mixed concrete, the mixer must be equipped with a timer that prevents the batch from discharging until the batch has been mixed for the prescribed mixing time. A mixing time of 1 minute is required after all materials and water have been introduced into the drum. Shorter mixing time may be allowed if the mixer performance is tested per AASHTO M 157 Annex A1 Concrete Uniformity Requirements. Tests must be conducted by an independent testing lab or by a commercial concrete producer's lab. If the tests are performed by a producer's lab, the Engineer or a representative will witness all testing.

For shrink-mixed concrete, the mixing time in the stationary mixer must not be less than 30 seconds or until the ingredients have been thoroughly blended.

For transit-mixed or shrink-mixed concrete, the mixing time in the transit mixer must be a minimum of 70 revolutions at the mixing speed designated by the manufacturer of the mixer. Following mixing, the concrete in the transit mixer may be agitated at the manufacturer's designated agitation speed. A maximum of 320 revolutions (total of mixing and agitation) will be permitted before discharge.

All transit-mixers must be equipped with an operational revolution counter and a functional device for measurement of water added. All mixing drums must be free of concrete buildup and the mixing blades must comply with the minimum specifications of the drum manufacturer. A copy of the manufacturer's blade dimensions and configuration must be on file at the concrete producer's office. All clearly visible metal data plates attached to each mixer and agitator must display the maximum concrete capacity of the drum or container for mixing and agitating and the rotation speed of the drum or blades for both the agitation and mixing speeds. Mixers and agitators must always operate within the capacity and speed-of-rotation limits set by the manufacturer. Any mixer, when fully loaded, must keep the concrete uniformly mixed. All mixers and agitators must be capable of discharging the concrete at a steady rate. Only those transit-mixers which comply with the above requirements will be allowed to deliver concrete to any Owner project covered by these Specifications.

In transit-mixing, mixing must start within 30 seconds after the cement is added to the aggregates.

Central-mixed concrete, transported by truck mixer/agitator, must not undergo more than 250 revolutions of the drum or blades before discharging. To remain below this limit, the supplier may agitate the concrete intermittently within the prescribed time limit. When water or admixtures are added after the load is initially mixed, an additional 30 revolutions will be required at the recommended mixing speed.

For each project, at least biannually, or as required, the Plant Manager will examine mixers and agitators to check for any buildup of hardened concrete or worn blades. If this examination reveals a problem, or if the Engineer wishes to test the quality of the concrete, slump tests may be performed with samples taken at approximately the 1/4 and 3/4 points as the batch is discharged. The maximum allowable slump difference must be as follows:

If the average of the 2 slump tests is < 4 inches, the difference must be < 1 inch or if the average of the 2 slump tests is >4 inches, the difference must be < 1-1/2 inches.

If the slump difference exceeds these limits, the equipment must not be used until the faulty condition is corrected. However, the equipment may continue in use if longer mixing times or smaller loads produce batches that pass the slump uniformity tests.

All concrete production facilities will be subject to verification inspections at the discretion of the Engineer. Verification inspections are a check for current scale certifications, accuracy of water metering devices, accuracy of the batching process, and verification of coarse aggregate quality.

If the concrete producer fails to pass the verification inspection, the following actions will be taken:

1. For the first violation, a written warning will be provided.
2. For the second violation, the Engineer will provide written notification and the Owner will assess a price reduction equal to 15 percent of the invoice cost of the concrete supplied from the time of the infraction until the deficient condition is corrected.
3. For the third violation, the concrete Supplier is suspended from providing concrete until all such deficiencies causing the violation have been permanently corrected and the plant and equipment have been reinspected and meet all prequalification requirements.
4. For the fourth violation, the concrete Supplier must be disqualified from supplying concrete for 1 year from the date of disqualification. At the end of the suspension period the concrete Supplier may request the facilities be inspected for prequalification.

6-02.3(4)B JOB SITE MIXING

For small quantities of concrete, the Contractor may mix concrete on the Job Site provided the Contractor has requested in writing and received written permission from the Engineer. The Contractor's written request must include a mix design,

1 batching and mixing procedures, and a list of the equipment performing the Job Site mixing. All Job Site mixed concrete must
2 be mixed in a mechanical mixer.

3 If the Engineer permits, hand mixing of concrete will be permitted for pipe collars, pipe plugs, fence posts, or other items
4 approved by the Engineer, provided the hand mixing is done on a water tight platform in a way that distributes materials evenly
5 throughout the mass. Mixing must continue long enough to produce a uniform mixture. Hand mixed batches must not exceed
6 1/2 cubic yard.

7 Concrete mixed at the Job Site is never permitted for placement in water.

8 **6-02.3(4)C CONSISTENCY**

9 The maximum slump for concrete is:

- 10 1. 3.5 inches for vibrated concrete placed in all bridge decks, bridge approach slabs, and flat slab bridge
11 superstructures.
- 12 2. 4.5 inches for all other vibrated concrete.
- 13 3. 7 inches for non-vibrated concrete (includes Class 4000P and 4000W).
- 14 4. 9 inches for shafts when using Class 4000P, provided the water-cement ratio does not exceed 0.44 and a water
15 reducer is used meeting the requirements of 9-23.4.

16 When a high range water reducer is used, the maximum slump listed in 1, 2 and 3 above may be increased an additional
17 2 inches.

18 **6-02.3(4)D TEMPERATURE AND TIME FOR PLACEMENT**

19 Concrete temperatures must remain between 55 °F and 90 °F while it is being placed. Precast concrete that is heat
20 cured per Section 6-02.3(25)D must remain between 50 °F and 90 °F while being placed. The batch of concrete must be
21 discharged at the Project Site no more than 1-1/2 hours after the cement is added to the concrete mixture. The time to
22 discharge may be extended to 1-3/4 hours if the temperature of the concrete being placed is less than 75 °F. With the approval
23 of the Engineer and as long as the temperature of the concrete being placed is below 75 °F, the maximum time to discharge
24 may be further extended to 2 hours. When conditions are such that the concrete may experience an accelerated initial set, the
25 Engineer may require a shorter time to discharge. The time to discharge may be extended upon written request from the
26 Contractor. This discharge time extension will be considered case by case and requires the use of specific retardation
27 admixtures and the approval of the Engineer.

28 **6-02.3(5) ACCEPTANCE OF CONCRETE**

29 **6-02.3(5)A GENERAL**

30 Lean concrete and commercial concrete will be accepted based on a certificate of compliance to be provided by the
31 Supplier as specified in Section 6-02.3(5)B.

32 All other concrete will be accepted based on conformance to the requirement for temperature, slump, air content for
33 concrete placed above finished groundline, and the specified compressive strength at 28 Days for sublots as tested and
34 determined by the Owner.

35 A subplot is defined as the material represented by an individual strength test. An individual strength test is the average
36 compressive strength of cylinders from the same sample of material.

37 Each subplot will be deemed to have met the specified compressive strength requirement when both of the following
38 conditions are met:

- 39 a. Individual strength tests do not fall below the specified strength by more than 12.5 percent or 500 psi, whichever is
40 least.
- 41 b. An individual strength test averaged with the 2 preceding individual strength tests meets or exceeds specified
42 strength (for the same class and exact mix I.D. of concrete on the same Contract).

43 When compressive strengths but the individual strength tests do not fall below the specified strength, the Engineer may
44 core at locations determined by the Engineer.

45 When compressive strengths fail to satisfy one or both of the above requirements, the Contractor may:

- 46 1. Request acceptance based on the Contractor/Suppliers strength test data for cylinders made from the same
47 truckload of concrete as the Owner cylinders provided:
 - 48 a. The Contractor's test results are obtained from testing cylinders fabricated, handled, and stored for 28 Days per
49 AASHTO T 23 and tested per AASHTO T 22. The test cylinders must be the same size cylinders as those cast by
50 the Owner.
 - 51 b. The technician fabricating the cylinders is qualified by either ACI, Grade 1 or WAQTC to perform this Work.
 - 52 c. The laboratory performing the tests per AASHTO T 22 has an equipment calibration/certification system, and a
53 technician training and evaluation process per AASHTO R-18.
 - 54 d. Both the Contractor and Owner have at least 15 test results from the same mix to compare. The Contractor's
55 results could be used if the Contractor's computed average of all their test results is within 1 standard deviation of

1 the Owner's average test result. The computed standard deviation of the Contractor's results must also be within
2 ± 200 psi of the Owner's standard deviation.

3 2. Request acceptance of in-place concrete strength based on core results. This method is not used if the Engineer
4 determines coring would be harmful to the integrity of the Structure. Cores, if allowed, will be obtained by the
5 Contractor per AASHTO T 24 and delivered to the Owner for testing per AASHTO T 22. If the concrete in the
6 Structure will be dry under service conditions, the core will be air dried at a temperature of between 60 °F and 80 °F
7 and at a relative humidity of less than 60 percent for 7 Days before testing, and will be tested air dry.

8 Acceptance for each subplot by the core method requires that the average compressive strength of 3 cores be at least 85
9 percent of the specified strength with no 1 core less than 75 percent of the specified strength. When the Contractor requests
10 strength analysis by coring, the results obtained will be accepted by both parties as conclusive and supersede all other
11 strength data for the concrete subplot.

12 If the Contractor elects to core, cores must be obtained 50 Days after initial concrete placement. The Engineer will
13 concur in the locations to be cored. The Contractor is responsible for repair of cored areas. The cost incurred in coring and
14 testing these cores, including repair of core locations, are borne by the Contractor.

15 **6-02.3(5)B CERTIFICATION OF COMPLIANCE**

16 The concrete producer must provide a certificate of compliance for each truckload of concrete. The certificate of
17 compliance must verify that the delivered concrete complies with the mix design, and must include:

- 18 1. Manufacturer plant (batching facility)
- 19 2. Owner Contract number
- 20 3. Date
- 21 4. Time batched
- 22 5. Truck number
- 23 6. Initial revolution counter reading
- 24 7. Quantity (quantity batched this load)
- 25 8. Type of concrete by class and producer design mix number
- 26 9. Cement producer, type, and mill certification number (The mill test number as required by Section 9-01.2 is the basis
27 for acceptance of cement.)
- 28 10. Fly ash (if used) brand and type
- 29 11. Approved aggregate gradation designation
- 30 12. Mix design weight per cubic yard and actual batched weights for:
 - 31 a. Cement
 - 32 b. Fly ash (if used)
 - 33 c. Coarse concrete aggregate and moisture content (each size)
 - 34 d. Fine concrete aggregate and moisture content
 - 35 e. Water (including free moisture in aggregates)
 - 36 f. Admixtures brand and total quantity batched:
 - 37 1) Air-entraining admixture
 - 38 2) Water reducing admixture
 - 39 3) Other admixture

40 For concretes that use combined aggregate gradation, the certificate of compliance must include the aggregate
41 components and moisture contents for each size instead of the aggregate information described above.

42 The certificate of compliance must be signed by a responsible representative of the concrete producer, affirming the
43 accuracy of the information provided. Instead of providing a machine produced record containing all above information, the
44 concrete producer may use the Owner-provided printed forms, which must be completed for each load of concrete delivered to
45 the project.

46 For commercial concrete, the certificate of compliance must include, as a minimum, the batching facility, date, and
47 quantity batched per load.

48 **6-02.3(5)C CONFORMANCE TO MIX DESIGN**

49 Cement, coarse and fine aggregate weights must be within the following tolerances of the mix design:
50

| Batch Volumes less than or equal to 4 cubic yards | | |
|--|------|-----|
| Cement | +5% | -1% |
| Aggregate | +10% | -2% |
| Batch Volumes more than 4 cubic yards | | |
| Cement | +5% | -1% |
| Aggregate | +2% | -2% |

If the total cementitious material weight includes different components, these component weights must be within the following tolerances:

1. Portland cement weight plus 5 percent or minus 1 percent of that specified in the mix design.
 2. Fly ash and ground granulated blast furnace slag weight \pm 5 percent of that specified in the mix design.
 3. Microsilica weight \pm 10 percent of that specified in the mix design.
- Water must not exceed the maximum water specified in the mix design.

6-02.3(5)D TEST METHODS

Acceptance testing will be performed by the Owner. The test methods to be used with this Specification are:

| Standard | Test |
|-----------------|--|
| AASHTO T 22 | Compressive Strength of Cylindrical Concrete Specimens |
| AASHTO T 23 | Making and Curing Concrete Test Specimens in the Field |
| AASHTO T 119 | Slump of Hydraulic Cement Concrete |
| WAQTC TM 2 | Sampling Freshly Mixed Concrete |
| AASHTO T 152 | Air Content of Freshly Mixed Concrete by the Pressure Method |
| AASHTO T 231 | Capping Cylindrical Concrete Specimens |
| AASHTO T 309 | Temperature of Freshly Mixed Portland Cement Concrete |

6-02.3(5)E POINT OF ACCEPTANCE

Determination of concrete properties for acceptance will be made based on samples taken, as follows.

Concrete samples must be collected from the end of the placement system at the point of placement. If a tremie is used, concrete samples must be collected at the entrance point to the tremie.

It is the Contractor's responsibility to provide adequate and representative samples of the fresh concrete to a location designated by the Engineer for testing concrete properties and making of cylinder specimens. Samples must be provided as directed in Sections 1-06.1 and 1-06.2. Once the Contractor has turned over the concrete for acceptance testing, no more mix adjustment will be allowed. The concrete will either be accepted or rejected.

6-02.3(5)F WATER-CEMENT RATIO CONFORMANCE

The actual water-cement ratio must be determined from the certified proportions of the mix, adjusting for on-the-job additions. No water may be added after acceptance testing or after placement has begun, except for concrete used in slip forming. For slip formed concrete, water may be added during placement but must not exceed the maximum water-cement ratio in the mix design, and must comply with the requirements for consistency as described in Section 6-02.3(4)C. If water is added, an air and temperature test must be taken before resuming placement to ensure that Specification conformance has been maintained.

6-02.3(5)G SAMPLING AND TESTING FREQUENCY FOR TEMPERATURE, CONSISTENCY, AND AIR CONTENT

Concrete properties must be determined from concrete as delivered to the project and as accepted by the Contractor for placement. The Owner will test for acceptance of concrete for slump, temperature, and air content, if applicable, as follows:

Sampling and testing will be performed before concrete placement from the first truck load. Concrete must not be placed until tests for slump, temperature, and entrained air (if applicable) have been completed by the Engineer, and the results indicate that the concrete is within acceptable limits. Except for the first load of concrete, up to 1/2 cubic yard may be placed before testing for acceptance. Sampling and testing will continue for each load until 2 successive loads comply with all applicable acceptance test requirements. After 2 successive tests indicate that the concrete is within specified limits, the sampling and testing frequency may decrease to 1 for every 5 truckloads. Loads to be sampled will be selected per the random selection process as outlined in WAQTC FOP for TM 2.

When the results for any subsequent acceptance test indicates that the concrete as delivered and approved by the Contractor for placement does not conform to the specified limits, the sampling and testing frequency will be resumed for each

1 truck load. Whenever 2 successive subsequent tests indicate that the concrete is within the specified limits, the random
2 sampling and testing frequency of 1 for every 5 truckloads may resume.

3 Sampling and testing for placing 1 class of concrete consisting of 50 cubic yards or less will be as listed above, except:

- 4 1. Sampling and testing will continue until 1 load meets all acceptance requirements, and
- 5 2. After 1 set of tests indicate that the concrete is within specified limits, the remaining concrete to be placed may be
6 accepted by visual inspection.

7 **6-02.3(5)H SAMPLING AND TESTING FOR COMPRESSIVE STRENGTH AND INITIAL CURING**

8 Acceptance testing for compressive strength must be conducted at the same frequency as the acceptance tests for
9 temperature, consistency, and air content.

10 The Contractor must provide and maintain cure boxes for curing concrete cylinders. The Contractor must also provide,
11 maintain, and operate all necessary power sources and connections needed to operate the curing box. Concrete cylinders
12 must be cured in a cure box per AASHTO T 23. The cure boxes must maintain a temperature between 60 °F and 80 °F for
13 concrete with specified strengths less than 6000 psi and between 68 °F and 78 °F for concrete with specified strengths of 6000
14 psi and higher. A minimum/maximum thermometer must be installed to measure the internal temperature of the cure box. The
15 thermometer must be readable from outside of the box and be capable of recording the high and low temperatures in a 24-
16 hour period. The cure boxes must create an environment that prevents moisture loss from the concrete specimens. The top
17 must have a working lock and the interior must be rustproof. A moisture-proof seal must be provided between the lid and the
18 box. The cure box must be the appropriate size to accommodate the number of concrete acceptance cylinders necessary or
19 the Contractor must provide additional cure boxes. Once concrete cylinders are placed in the cure box, the cure box must not
20 be moved until the cylinders have been cured per these Specifications. When concrete is placed at more than 1 location
21 simultaneously, multiple cure boxes must be provided.

22 The Contractor must protect concrete cylinders in cure boxes from excessive vibration and shock waves during the
23 curing period as specified in Section 6-02.3(6)D.

24 **6-02.3(5)I REJECTING CONCRETE**

25 The Engineer, before sampling, may reject any batch or load of concrete that appears defective in composition; such as
26 in cement content or aggregate proportions. Rejected material must not be incorporated in the Structure.

27 **6-02.3(5)J CONCRETE WITH NON-CONFORMING STRENGTH**

28 Concrete with cylinder compressive strengths (f_c) that fail to comply with acceptance level requirements must be
29 evaluated for structural adequacy. If the material is found to be adequate, payment must be adjusted using the following
30 formula:

$$31 \text{ Pay adjustment} = 2(f'c - f_c)(UP)(Q) / f'c$$

32 Where:

33 $f'c$ = Specified minimum compressive strength at 28 Days.

34 f_c = Compressive strength at 28 days as determined by AASHTO Test Methods.

35 UP = Unit Contract price per cubic yard for the class of concrete involved.

36 Q = Quantity of concrete represented by an acceptance test based on the required frequency of testing.

37
38 Concrete that fails to comply with minimum acceptance levels using the coring method will be evaluated for structural
39 adequacy. If the material is found to be adequate, payment must be adjusted using the following formula:

$$40 \text{ Pay adjustment} = 3.56(.85f_c - f_{\text{cores}})(UP)(Q) / f'c$$

41 Where:

42 $f'c$ = Specified minimum concrete compressive strength at 28 Days.

43 f_{cores} = Compressive strength of the cores as determined by AASHTO T-22.

44 UP = Unit Contract price per cubic yard for the class of concrete involved.

45 Q = Quantity of concrete represented by an acceptance test based on the required frequency of testing.

46
47 Where these Specifications designate payment for the concrete except on a per cubic yard basis, the unit Contract price
48 of concrete must be taken as \$300 per cubic yard for concrete Class 4000, 5000, and 6000. For concrete Class 3000, the unit
49 Contract Price for Concrete must be \$160 per cubic yard.

50 **6-02.3(6) PLACING CONCRETE**

51 The Contractor must not place concrete:

- 52 1. On frozen or ice-coated ground or subgrade.
- 53 2. Against or on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.

- 1 3. Under rainy conditions placing of concrete must be stopped before the quantity of surface water is sufficient to affect
- 2 or damage surface mortar quality or cause a flow or wash the concrete surface.
- 3 4. In any foundation until the Engineer has approved its depth and character.
- 4 5. In any form until the Engineer has approved it and placing any reinforcing in it.
- 5 6. In any Work area when vibrations from nearby Work may harm the concrete's initial set or strength.

6 When a foundation excavation contains water, the Contractor must pump it dry before placing concrete. If this is
7 impossible, an underwater concrete seal must be placed that complies with Section 6-02.3(6)B. This seal must be thick
8 enough to resist any uplift.

9 All foundations, forms, and contacting concrete surfaces must be moistened with water just before the concrete is placed.
10 Any standing water on the foundation, on the concrete surface, or in the form must be removed.

11 The Contractor must place concrete in the forms promptly after mixing, as specified in Section 6-02.3(4)D. Concrete
12 placement must be continuous, with no interruption longer than 30 minutes between adjoining layers unless the Engineer
13 approves a longer time. Each layer must be placed and consolidated before the preceding layer takes initial set. After initial
14 set, the forms must not be jarred, and projecting ends of reinforcing bars must not be disturbed. The submittal to the Engineer
15 must include justification that the concrete mix design will remain fluid for interruptions longer than 30 minutes between
16 placements.

17 In girders or walls, concrete must be placed in continuous, horizontal layers 1.5 to 2.5 feet deep. Consolidation must
18 leave no line of separation between layers. In each part of a form, the concrete must be deposited as near its final position as
19 possible.

20 Any method for placing and consolidating must not segregate aggregates or displace reinforcing steel. Any method must
21 leave a compact, dense, and impervious concrete with smooth faces on exposed surfaces. Plastering is not permitted. Any
22 section of defective concrete must be removed at the Contractor's expense.

23 To prevent aggregates from separating, the length of any conveyor belt used to transport concrete must not exceed 300
24 feet. If the mix needs protection from sun or rain, the Contractor must cover the belt. When concrete pumps are used for
25 placement, a Contractor's representative must, before use on the first placement of each day, visually inspect the pumps water
26 chamber for water leakage. Do not use a pump that allows free water to flow past the piston.

27 If a concrete pump is used as the placing system, the pump priming slurry must be discarded before placement. Initial
28 acceptance testing may be delayed until the pump priming slurry has been eliminated from the concrete being pumped.
29 Eliminating the priming slurry from the concrete may require that several cubic yards of concrete are discharged through the
30 pumping system and discarded. Use of a concrete pump requires a reserve pump or other backup equipment at the site.

31 If the concrete will drop more than 5 feet, it must be deposited through a sheet metal or other approved conduit. If the
32 form slopes, the concrete must be lowered through approved conduit to keep it from sliding down one side of the form. Do not
33 use aluminum conduits or tremies to pump or place concrete.

34 Before placing concrete for bridge decks on steel spans, the Contractor must release the falsework under the bridge and
35 let the span swing free on its supports. Concrete in flat slab bridges must be placed in one continuous operation for each span
36 or series of continuous spans.

37 Concrete for bridge decks and the stems of T-beams or box-girders must be placed in separate operations if the stem of
38 the beam or girder is more than 3 feet deep. First the beam or girder stem must be filled to the bottom of the slab fillets. Bridge
39 deck concrete must not be placed until enough time has passed to allow the earlier concrete to shrink (at least 12 hours). If
40 stem depth is 3 feet or less, the Contractor may place concrete in one continuous operation if the Engineer approves.

41 Between expansion or construction joints, concrete in Structures such as beams, girders, bridge decks, piers, columns,
42 walls, and traffic and pedestrian barriers must be placed in a continuous operation.

43 Do not place traffic or pedestrian barrier until after the bridge decks are complete for the entire Structure. Do not place
44 concrete barriers until the falsework has been released and the span supports itself. The Contractor may choose not to
45 release the deck overhang falsework before the barrier placement. The Contractor must submit calculations to the Engineer
46 indicating the loads induced into the girder webs due to the barrier weight and any live load placed on the Structure does not
47 exceed the design capacity of the girder component. This analysis is not required for bridges with concrete superstructures.
48 Do not place barrier, curb, or sidewalk on steel or prestressed concrete girder bridges until the bridge deck reaches a
49 compressive strength of at least 3,000 psi.

50 The Contractor may construct traffic and pedestrian barriers by the slip form method. However, the barrier may not
51 deviate more than 1/4 inch when measured by a 10-foot straight edge held longitudinally on the front face, back face, and top
52 surface. Electrical conduit within the barrier must be constructed as specified in Section 8-30.

53 When placing concrete in arch rings, the Contractor must ensure that the load on the falsework remains symmetrical and
54 uniform.

55 Unless the Engineer approves otherwise, arch ribs in open spandrel arches must be placed in sections. Small key
56 sections between large sections must be filled after the large sections have shrunk.

1 6-02.3(6)A WEATHER AND TEMPERATURE LIMITS TO PROTECT CONCRETE**2 6-02.3(6)A1 HOT WEATHER PROTECTION**

3 If concrete is to be placed between June 1 and September 30, the Contractor must prepare and submit a Project Site
4 specific Hot Weather Concrete Placement and Curing Plan as specified in Section 1-05.3. The Plan must be submitted to the
5 Engineer 15 Working Days before the scheduled placement of concrete. Concrete must not be placed during this period until
6 the Project Site specific Hot Weather Concrete Placement and Curing Plan has been submitted and approved by the
7 Engineer. The Plan must include the following elements, which the Contractor must implement when the temperature
8 thresholds of this Section are exceeded:

- 9 1. Methods to control the temperature of forms, reinforcement, and other materials in contact with fresh concrete.
- 10 2. Methods to control the temperature of fresh concrete.
- 11 3. Methods to control evaporation of freshly placed concrete, including evaporation from wind.
- 12 4. Methods to control evaporation from finished concrete during curing.
- 13 5. Methods of controlling temperature of finished concrete during curing.
- 14 6. Method of recording the internal temperature of the concrete during curing.

15 The Contractor must provide concrete within the specified temperature limits by:

- 16 a. Shading or cooling aggregate piles . Sprinkling of fine aggregate piles with water is not allowed. If sprinkling of the
17 coarse aggregates is used, the piles moisture content must be monitored and the mixing water adjusted for the free
18 water in the aggregate. When removing the coarse aggregate, it must be removed from at least 1 foot above the
19 bottom of the pile.
- 20 b. Refrigerating mixing water; or replacing all or part of the mixing water with crushed ice, provided the ice is completely
21 melted by placing time.

22 If the concrete would probably exceed 90 °F using normal methods, concreting must be suspended until the temperature
23 of fresh concrete delivered to the Project Site can be maintained below 90 °F. Concrete with a temperature of 90 °F or more
24 must not be placed and will be rejected by the Engineer.

25 If air temperature exceeds 90 °F, the Contractor must use water spray or other approved methods to cool all concrete-
26 contact surfaces to less than 90 °F. These surfaces include forms, reinforcing steel, steel beam flanges, and any others that
27 touch the mix. The Contractor must reduce the time between mixing and placing to a minimum and must not allow mixer trucks
28 to remain in the sun while waiting to discharge concrete. Chutes, conveyors, and pump lines must be shaded.

29 If bridge decks are placed while air temperature exceeds 90 °F, the Contractor must:

- 30 1) Cover the top layer of reinforcing steel with clean, wet burlap immediately before concrete placement.
- 31 2) Sprinkle cool water on the forms and reinforcing steel just before the placement if the Engineer requires it.
- 32 3) Finish the concrete slab without delay.
- 33 4) Provide at the Project Site water-fogging equipment to be used if needed after finishing to prevent plastic cracks.

34 If the evaporation rate where the concrete is being placed is 0.10 pounds per square foot of surface per hour or more as
35 determined from the Surface Evaporation from Concrete table below, the Contractor must surround the fresh concrete with an
36 enclosure. This enclosure will protect the concrete from wind blowing across its surface until the curing method is applied. If
37 casting deck concrete that is 80 °F or hotter, the Contractor must install approved equipment at the Project Site to show
38 relative humidity and wind velocity.

39 The Contractor is solely responsible for protecting concrete from inclement weather during the entire curing period.
40 Permission provided by the Engineer to place concrete during hot weather will in no way ensure acceptance of the Work by
41 the Owner. Should the concrete placed under such conditions prove unsatisfactory in any way, the Engineer will still have the
42 right to reject the Work although the plan and the Work were carried out with the Engineer's permission.

43 All costs associated with the development, submittal and implementation of the Hot Weather Concrete Placement and
44 Curing Plan are incidental to the various concrete Bid Items and no separate payment will be made.

45 6-02.3(6)A2 COLD WEATHER PROTECTION

46 If concrete is to be placed between October 1 and May 31, the Contractor must prepare and submit a Project Site
47 specific Cold Weather Concrete Placement and Curing Plan as specified in Section 1-05.3. The Plan must be submitted to the
48 Engineer 15 Working Days before the scheduled placement of concrete. Concrete must not be placed during this period until
49 the Project Site specific Cold Weather Concrete Placement and Curing Plan has been submitted and approved by the
50 Engineer. The Plan must detail how the Contractor will adequately cure the concrete and prevent the internal concrete
51 temperature from falling below 50 °F internally or 35 °F at the surface. The Plan must be implemented when the temperature
52 thresholds of this Section are exceeded.

53 If ambient air temperature is predicted to be 35 °F, or less, the Contractor must implement the approved Project Site
54 Specific Cold Weather Concrete Placement and Curing Plan. The weather forecast is based on predictions from the Western
55 Region Headquarters of the National Weather Service. This forecast can be found at <http://www.wrh.noaa.gov/>. Failure to
56 implement the approved Project Site specific Cold Weather Concrete Placement and Curing Plan will be cause to reject the
57 concrete.

1 To achieve adequate curing, the internal temperature of the concrete must not be allowed to drop below 50 °F during the
2 entire curing period or 7 Days, whichever is greater. The concrete surface temperature must not be allowed to fall below 35 °F
3 during this time. Extra protection must be provided for areas especially vulnerable to freezing, such as exposed top surfaces,
4 corners and edges, thin sections, and concrete placed into steel forms. Concrete placement will only be allowed if the
5 Contractor's Project Site specific Cold Weather Concrete Placement and Curing Plan has been implemented and accepted by
6 the Engineer.

7 The Contractor must not mix nor place concrete while the air temperature is below 35 °F, unless the water or aggregates
8 (or both) are heated to provide concrete at least 70 °F. The aggregate must not exceed 150 °F. If the water is heated to more
9 than 150 °F, it must be mixed with the aggregates before the cement is added. Any equipment and methods must heat the
10 materials evenly. Concrete placed in shafts and piles is exempt from such preheating requirements.

11 The Contractor may warm stockpiled aggregates with dry heat or steam, but not by applying flame directly or under sheet
12 metal. If the aggregates are in bins, steam or water coils or other heating methods may be used if aggregate quality is not
13 affected. Live steam heating is not permitted on or through aggregates in bins. If using dry heat, the Contractor must increase
14 mixing time enough to allow the super-dry aggregates to absorb moisture.

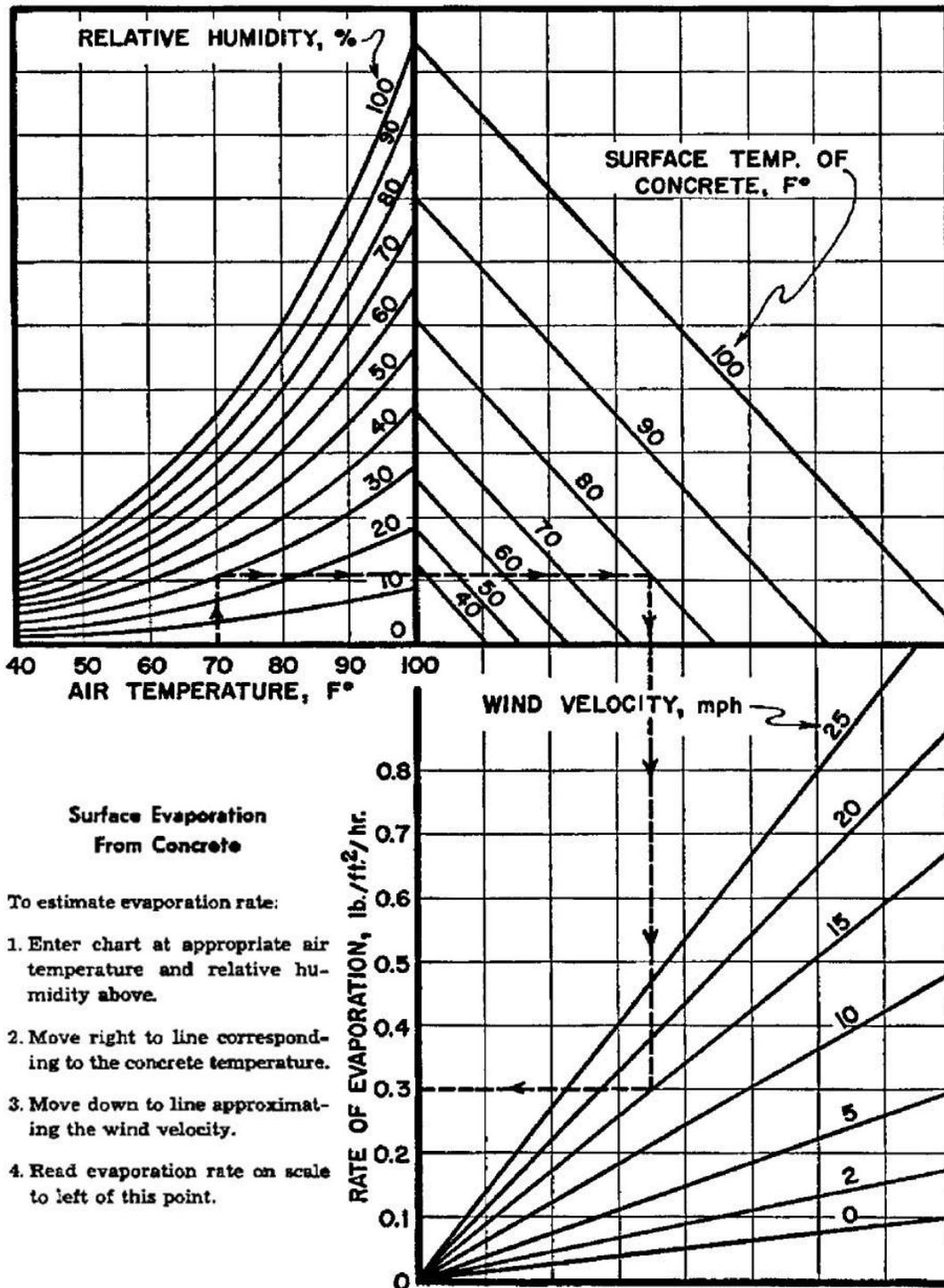
15 The Contractor must provide and maintain a maturity meter sensor, continuously recording time and temperature during
16 the curing period, in the concrete at a location specified by the Engineer for each concrete placement. The Contractor must
17 also provide recording thermometers or other approved devices to monitor the surface temperature of the concrete. During
18 curing, data from the maturity meter and recording thermometer must be readily available to the Engineer. The Contractor
19 must record time and temperature data on hourly intervals. Data must be provided to the Engineer upon request.

20 Starting immediately after placement, the concrete temperatures measured by the maturity meter and recording
21 thermometer must be maintained at or above 50 °F and the relative humidity must be maintained above 80 percent. These
22 conditions must be maintained for a minimum of 7 Days or for the cure period required by Section 6-02.3(11), whichever is
23 longer. During this time, if the temperature falls below 50 °F on the maturity meter or recording thermometer, no curing time is
24 awarded for that day. Should the Contractor fail to adequately protect the concrete and the temperature of the concrete falls
25 below 50° F internally or 35 °F at the surface during curing, the Engineer may reject the concrete. Concrete that has frozen
26 during the curing period will be rejected.

27 The Contractor is solely responsible for protecting concrete from inclement weather during the entire curing period.
28 Permission provided by the Engineer to place concrete during cold weather will in no way ensure acceptance of the Work by
29 the Owner. Should the concrete placed under such conditions prove unsatisfactory in any way, the Engineer will still have the
30 right to reject the Work although the plan and the Work were carried out with the Engineer's permission.

31 All costs associated with the development, submittal, any resubmittals, and implementation of the Cold Weather
32 Concrete Placement and Curing Plan are incidental to the various concrete Bid Items and no separate payment will be made.
33

Surface Evaporation from Concrete



1

2 **6-02.3(6)B PLACING CONCRETE IN FOUNDATION SEALS**

3 If the Drawings require a concrete seal, the Contractor must place the concrete underwater inside a water tight
 4 cofferdam, tube, or caisson. Seal concrete must be placed in a compact mass in still water. It must remain undisturbed and in
 5 still water until fully set. While seal concrete is being deposited, the water elevation inside and outside the cofferdam must

1 remain equal to prevent any flow through the seal in either direction. The cofferdam must be vented at the vent elevation
2 shown on the Drawings. The thickness of the seal is based on this vent elevation.

3 The seal must be at least 18 inches thick unless the Drawings show otherwise. The Engineer may change the seal
4 thickness during construction which may require redesign of the footing and the pier shaft or column. Although seal thickness
5 changes may cause the use of more or less concrete, reinforcing steel, and excavation, payment will remain as originally
6 defined in unit Contract prices.

7 To place seal concrete underwater, the Contractor must use a concrete pump or tremie. The tremie must have a hopper
8 at the top that empties into a water tight tube at least 10 inches in diameter. The discharge end of the tube on the tremie or
9 concrete pump must include a device to seal out water while the tube is first filled with concrete. Tube supports must allow the
10 discharge end to move freely across the entire Work area and to drop rapidly to slow or stop the flow. 1 tremie may be used to
11 concrete an area up to 18 feet per side. Each additional area of this size requires 1 additional tremie.

12 Throughout the underwater concrete placement operation, the discharge end of the tube must remain submerged in the
13 concrete and the tube must always contain enough concrete to prevent water from entering. The concrete placement must be
14 continuous until the Work is completed, resulting in a seamless, uniform seal. If the concreting operation is interrupted, the
15 Engineer may require the Contractor to prove by core drilling or other tests that the seal contains no voids or horizontal joints.
16 If testing reveals voids or joints, the Contractor must repair them or replace the seal at no expense to the Owner.

17 Use concrete Class 4000W must for seals, which must comply with the consistency requirements of Section 6-02.3(4)C.

18 **6-02.3(6)C DEWATERING CONCRETE SEALS AND FOUNDATIONS**

19 After a concrete seal is constructed, the Contractor must pump the water out of the cofferdam and place the rest of the
20 concrete in the dry. This pumping must not start until the seal has set enough to withstand the hydrostatic pressure (3 days for
21 gravity seals and 10 days for seals containing piling or shafts). The Engineer may extend these waiting periods to ensure
22 structural safety or to comply with a condition of the operating permit.

23 If weighted cribs are used to resist hydrostatic pressure at the bottom of the seal, the Contractor must anchor them to the
24 foundation seal. Any method used (such as dowels or keys) must transfer the entire weight of the crib to the seal.

25 Do not pump during or for 24 hours after concrete placement unless done from a suitable sump separated from the
26 concrete Work by a water tight wall. Pumping must be done in a way that rules out any chance of concrete being carried away.

27 **6-02.3(6)D PROTECTION AGAINST VIBRATION**

28 Freshly placed concrete must not be subjected to excessive vibration and shock waves during the curing period until it
29 has reached a 2000 psi minimum compressive strength for structural concrete and lower-strength classes of concrete. After
30 the first 5 hours from the time the concrete has been placed and consolidated, the Contractor must keep all vibration
31 producing operations at a safe horizontal distance from the freshly placed concrete by following either the prescriptive safe
32 distance method or the monitoring safe distance method. These requirements to protect freshly placed concrete against
33 vibration do not apply for plant cast concrete, nor must they apply to the vibrations caused by the traveling public.

34 **6-02.3(6)D1 PRESCRIPTIVE SAFE DISTANCE METHOD**

35 After the concrete has been placed and consolidated, the Contractor must keep all vibration producing operations at a
36 safe horizontal distance from the freshly placed concrete as follows:

| Minimum Compressive Strength, f 'c | Safe Horizontal Distance ¹ | |
|------------------------------------|---------------------------------------|--------------------------------|
| | EQUIPMENT CLASS L ² | EQUIPMENT CLASS H ³ |
| < 1000 psi | 75 ft | 125 ft |
| 1000 psi to < 1400 psi | 30 ft | 50 ft |
| 1400 psi to 2000 psi | 15 ft | 25 ft |

37 NOTES:

- 38 1. The safe horizontal distance must be reduced to 10 feet for small rubber tire construction equipment like backhoes
39 under 50,000 pounds, concrete placing equipment, and legal Highway vehicles if such equipment travels at speeds
40 of:
41
 - 42 a. ≤ 5 mph on relatively smooth roadway surfaces or
 - 43 b. ≤ 3 mph on rough roadway surfaces (i.e. with potholes)
- 44 2. Equipment Class L (Low Vibration) must include tracked dozers under 85,000 pounds, track vehicles, trucks (unless
45 excluded above), hand-operated jack hammers, cranes, auger drill rig, caisson drilling, vibratory roller compactors
46 under 30,000 pounds, and grab-hammers.
- 47 3. Equipment Class H (High Vibration) must include pile drivers, vibratory hammers, machine-operated impact tools,
48 pavement breakers, and other large pieces of equipment.

49
50 After the concrete has reached a minimum compressive strength specified above, the safe horizontal distance
51 restrictions no longer apply.

6-02.3(6)D2 MONITORING SAFE DISTANCE METHOD

The Contractor may monitor the vibration producing operations to decrease the safe horizontal distance requirements of the prescriptive safe distance method. If this method is chosen, all construction operations that produce vibration or shock waves in the vicinity of freshly placed concrete must be monitored by the Contractor with monitoring equipment sensitive enough to detect a minimum peak particle velocity (PPV) of 0.10 inches per second. Monitoring devices must be placed on or adjacent to the freshly placed concrete when the measurements are taken. After the concrete placement, the Contractor must stop all vibration or shock producing operations in the vicinity of the newly placed concrete when the monitoring equipment detects excessive vibration and shock waves defined as exceeding the following PPV's:

| Minimum Compressive Strength, f 'c | Maximum PPV |
|------------------------------------|-------------|
| < 1000 psi | 0.10 in/sec |
| 1000 psi to < 1400 psi | 1.0 in/sec |
| 1400 psi to 2000 psi | 2.0 in/sec |

After the concrete has reached a minimum compressive strength specified above, the safe horizontal distance restrictions no longer apply.

6-02.3(7) CONCRETE EXPOSED TO SEA WATER

If sea water will contact a completed concrete Structure, the Contractor must:

1. Mix the concrete for at least 2 minutes.
2. Control water content to produce concrete that will be as impermeable as possible.
3. Consolidate the concrete as the Engineer requires, avoiding the formation of any stone pockets.
4. Place only clean, rust-free reinforcement bars in the concrete.
5. Coat form surfaces heavily with shellac and any approved form release agent.
6. Leave forms intact for at least 30 Days after concrete placement or longer if the Engineer requires to prevent sea water from contacting the concrete.
7. Leave the surface of concrete just as it comes from the forms.
8. Provide special handling for any concrete piles used in sea water to avoid even slight deformation cracks.

The Engineer must decide the range of disintegration possible by exposure to sea water. This range must extend from a point below the level of extreme low tide up to a point above the level of extreme high tide. Wave action and other conditions will also affect the Engineer's decision on this range. The Contractor must not locate construction joints within this range without Engineer approval. All concrete within this range must be poured in the dry.

6-02.3(8) CONCRETE EXPOSED TO ALKALINE SOILS OR WATER

The requirements for concrete in seawater must also apply to concrete in alkaline soils or water. The Contractor must:

1. Let the concrete set at least 30 Days (longer if possible) before allowing soil or water to contact it directly.
2. Vibrate each batch of concrete immediately after it has been placed into the forms, using enough vibrating tampers to do this effectively.
3. Hand tamp, if necessary, to produce smooth, dense outside surfaces.

6-02.3(9) VIBRATION OF CONCRETE

The Contractor must supply enough vibrators to consolidate any concrete (except that placed underwater) according to the requirements of this Section. Each vibrator must:

1. Be designed to operate while submerged in the concrete.
2. Vibrate at a rate of at least 7,000 pulses per minute.
3. Receive the Engineer's approval on its type and method of use.

Immediately after concrete is placed, vibration must be applied in the fresh batch at the point of deposit. In doing so, the Contractor must:

- a. Space the vibrators evenly, no farther apart than twice the radius of the visible effects of the vibration.
- b. Ensure vibration intensity is great enough to visibly affect a weight of 1-inch slump concrete across a radius of at least 18 inches.
- c. Insert the vibrators slowly to a depth that will effectively vibrate the full depth of each layer, penetrating into the previous layer on multilayer pours.
- d. Protect partially hardened concrete (i.e. non-plastic, which prevents vibrator penetration when only its own weight is applied) by preventing the vibrator from penetrating it or making direct contact with steel that extends into it.
- e. Not allow vibration to continue in one place long enough to form pools of grout.

- 1 f. Continue vibration long enough to consolidate the concrete thoroughly, but not so long as to segregate it.
- 2 g. Withdraw the vibrators slowly when the process is complete.
- 3 h. Not use vibrators to move concrete from one point to another in the forms.

4 When vibrating and finishing top surfaces that will be exposed to weather or wear, the Contractor must not draw water or
5 laitance to the surface. In high lifts, the top layer must be shallow and made up of a concrete mix as stiff as can be effectively
6 vibrated and finished.

7 To produce a smooth, dense finish on outside surfaces, the Contractor must hand tamp the concrete.

8 **6-02.3(10) BRIDGE DECKS AND BRIDGE APPROACH SLABS**

9 **6-02.3(10)A PREOPERATIONAL MEETING**

10 A pre-operational meeting must be held 5 to 10 Working Days before placing concrete to discuss construction
11 procedures, personnel, and equipment to be used. Those attending must include:

- 12 1. (Representing the Contractor) The superintendent and all foremen in charge of placing the concrete and finishing it,
- 13 2. (Representing the Owner) The Engineer, key inspections, and a design representative.

14 If the project includes more than 1 deck or slab, and if the Contractor's key personnel change between concreting
15 operations, or at request of the Engineer, an additional conference must be held just before each deck or slab is placed.

16 The Contractor must not place bridge decks until the Engineer agrees that:

- 17 a. Concrete producing and placement rates will be high enough to meet placing and finishing deadlines.
- 18 b. Finishers with enough experience have been used.
- 19 c. Adequate finishing tools and equipment are at the site.
- 20 d. Curing procedures consistent with the Specification requirements are used.

21 **6-02.3(10)B SCREED RAIL SUPPORTS**

22 The Contractor must place screed rails outside the finishing area. When screed rails cannot be placed outside the
23 finishing area, they must rest on adjustable supports that can be removed with the least possible disturbance to the screeded
24 concrete. The supports must rest on structural members or on forms rigid enough to resist deflection. Supports must be
25 removable to at least 2 inches below the finished surface. For staged constructed bridge decks, the finishing machine screed
26 rails must not be supported on the completed portion of deck and must not deflect with the portion of structure under
27 construction.

28 Screed rails and their supports must be strong enough and stiff enough to allow the finishing machine to operate
29 effectively on them. All screed rails must be placed and secured for the full length of the deck/slab before the concreting starts.
30 If the Engineer approves in advance, the Contractor may move rails ahead onto previously set supports while concreting
31 progresses. However, such movable rails and their supports must not change the set elevation of the screed.

32 On steel truss and girder spans, screed rails and bulkheads may be placed directly on transverse steel floorbeams, with
33 the strike-board moving at right angles to the centerline of the roadway.

34 **6-02.3(10)C FINISHING EQUIPMENT**

35 The finishing machine must be self-propelled and be capable of forward and reverse movement under positive control.
36 The finishing machine must be equipped with a rotating cylindrical single or double drum screed not exceeding 60 inches in
37 length. The finishing machine must have the adjustments to produce the required cross-section, line, and grade. Provisions
38 must be made for the raising and lowering of all screeds under positive control. The upper vertical limit of screed travel must
39 allow the screed to clear the finished concrete surface.

40 For bridge deck widening of 20 feet or less, and for bridge approach slabs, or where Job Site conditions do not allow
41 using the conventional configuration finishing machines described above, the Contractor may propose using a hand-operated
42 motorized power screed such as a "Texas" or "Bunyan" screed. This screed must be capable of finishing the bridge deck and
43 bridge approach slab to the same standards as the finishing machine. The Contractor must not start placing bridge deck or
44 bridge approach slab concrete until receiving the Engineer's approval of this screed and the placing procedures.

45 On bridge decks, the Contractor may use hand-operated strike boards only when the Engineer approves special
46 conditions where self-propelled or motorized hand-operated screeds cannot be used. These boards must be sturdy and able
47 to strike off the full placement width without intermediate supports. Strike-boards, screed rails, and any specially made
48 auxiliary equipment must receive the Engineer's approval before use. All finishing requirements in these Specifications apply
49 to hand-operated finishing equipment.

50 **6-02.3(10)D CONCRETE PLACEMENT, FINISHING, AND TEXTURING**

51 Before placing bridge approach slab concrete, the subgrade must be constructed as specified in Section 2-09 and
52 Section 5-05.3(6).

53 Before any concrete is placed, the finishing machine must be operated over the entire length of the deck/slab to check
54 screed deflection. Concrete placement may start only if the Engineer approves after this test.

1 Immediately before placing concrete, the Contractor must check and adjust, if necessary, all falsework and wedges to
2 minimize settlement and deflection from the added mass of the concrete deck/slab. The Contractor must also install devices,
3 such as telltales, by which the Engineer can readily measure settlement and deflection.

4 The Contractor must schedule the concrete placement so it can be completely finished during daylight. Finishing after
5 dark is permitted if the Engineer approves and if the Contractor provides adequate lighting.

6 The placement operation must cover the full width of the roadway or the full width between construction joints. The
7 Contractor must locate any construction joint over a beam or web that can support the deck/slab on either side of the joint. The
8 joint must not occur over a pier unless shown on the Drawings. Each joint must be formed vertically and in true alignment. The
9 Contractor must not release falsework or wedges supporting pours on either side of a joint until each side has aged as these
10 Specifications require.

11 Placement of concrete for bridge decks and bridge approach slabs must comply with Section 6-02.3(6). The Engineer
12 must approve the placement method. In placing the concrete, the Contractor must:

- 13 1. Place it without segregation against concrete placed earlier, as near as possible to its final position, approximately to
14 grade, and in shallow, closely spaced piles.
- 15 2. Consolidate it around reinforcing steel by using vibrators before strike-off by the finishing machine.
- 16 3. Not use vibrators to move concrete.
- 17 4. Not revibrate any concrete surface areas where workers have stopped before screeding.
- 18 5. Remove any concrete splashed onto reinforcing steel in adjacent segments before concreting them.
- 19 6. Tamp and strike off the concrete with a template or strike-board moving slowly forward at an even speed.
- 20 7. Maintain a slight excess of concrete in front of the cutting edge across the entire width of the placement operation.
- 21 8. Make enough passes with the strike-board without over-finishing and bringing excessive quantities of mortar to the
22 surface to create a surface true and ready for final finish.
- 23 9. Leave a thin, even film of mortar on the concrete surface after the last pass of the strike-board.

24 Workers must complete all post-screeding operations without walking on the concrete. This may require work bridges
25 spanning the full width of the slab.

26 After removing the screed supports, the Contractor must fill the voids with concrete (not mortar).

27 If necessary, as determined by the Engineer, the Contractor must float the surface left by the finishing machine to
28 remove roughness, minor irregularities, and seal the surface of the concrete. Floating must leave a smooth and even surface.
29 Float finishing must be kept to a minimum number of passes so air bubbles in the concrete are not released. The floats must
30 be at least 4 feet long. Each transverse pass of the float must overlap the previous pass by at least half the length of the float.
31 The first floating must be at right angles to the strike-off. The second floating must be at right angles to the centerline of the
32 span. A smooth riding surface must be maintained across construction joints.

33 Expansion joints must be finished with a 1/2 inch-radius edger.

34 After floating, but while the concrete remains plastic, the Contractor must test the entire deck/deck slab for flatness while
35 allowing for crown, camber, and vertical curvature. The testing must be done with a 10-foot straight edge held on the surface.
36 The straight edge must be advanced in successive positions parallel to the centerline, moving not more than 1/2 the length of
37 the straight edge each time it advances. This procedure must be repeated with the straight edge held perpendicular to the
38 centerline. An acceptable surface must be free from deviations of more than 1/8 inch under the 10-foot straight edge.

39 If the test reveals depressions, the Contractor must fill them with freshly mixed concrete, strike off, consolidate, and
40 refinish them. High areas must be cut down and refinished. Retesting and refinishing must continue until an acceptable,
41 deviation-free surface is produced. The hardened concrete must comply with all smoothness requirements of these
42 Specifications even though the tests require corrective Work.

43 The Contractor must texture the bridge deck and bridge approach slab by combing the final surface perpendicular to the
44 centerline. Made of a single row of metal tines, the comb must leave striations in the fresh concrete approximately 3/16 inch
45 deep by 1/8 inch wide and spaced approximately 1/2 inch apart. The Engineer will decide actual depths at the site. If the comb
46 has not been approved, the Contractor must obtain the Engineer's approval by demonstrating it on a test section.

47 The Contractor may operate the combs manually or mechanically, either singly or with several placed end to end. The
48 timing and method used must produce the required texture without displacing larger particles of aggregate. Texturing must end
49 2 feet from curb lines. This 2-foot untextured strip must be hand-finished with a steel trowel.

50 If the Drawings call for an overlay to be constructed under the same Contract, such as hot mix asphalt, latex modified
51 concrete, epoxy concrete, or similar, the Contractor must produce the final finish by dragging a strip of damp, seamless burlap
52 lengthwise over the full width of the deck/slab or by brooming it lightly. A burlap drag must equal the deck/slab in width.
53 Approximately 3 feet of the drag must contact the surface, with the least possible bow in its leading edge. It must be kept wet
54 and free of hardened lumps of concrete. When it fails to produce the required finish, the Contractor must replace it. When not
55 in use, it must be lifted clear of the slab.

56 After the deck/slab has cured, the surface must not vary more than 1/8 inch under a 10-foot straight edge placed parallel
57 and perpendicular to the centerline.

1 The Contractor must cut high spots down with a diamond-faced, saw-type cutting machine. This machine must cut
2 through mortar and aggregate without breaking or dislodging the aggregate or causing spalls.

3 Low spots must be built up using a grout or concrete with a strength equal to or greater than the required 28 day strength
4 of the deck/slab. The method of build-up must be submitted to the Engineer for acceptance as specified in Section 1-05.3.

5 The surface texture on any area cut down or built up must match closely that of the surrounding bridge deck or bridge
6 approach slab area. The entire bridge deck and bridge approach slab must provide a smooth riding surface.

7 **6-02.3(10)E SIDEWALK ON STRUCTURES**

8 Concrete for sidewalk must be well compacted, struck off with a strike-board, and floated with a wooden float to achieve
9 a surface that does not vary more than 1/8 inch under a 10-foot straight edge. Use an edging tool to finish all sidewalk edges
10 and expansion joints. The final surface must have a granular texture that will not turn slick when wet.

11 **6-02.3(10)F BRIDGE APPROACH SLAB ORIENTATION AND ANCHORS**

12 Bridge approach slabs must be constructed full bridge deck width from outside usable shoulder to outside usable
13 shoulder at an elevation to match the Structure. Unless otherwise shown on the Plans, the pavement end of the bridge
14 approach slab must be constructed normal to the roadway centerline. The bridge approach slabs must be modified as shown
15 on the Drawings to accommodate the grate inlets at the bridge ends if the grate inlets are required.

16 Bridge approach slab anchors must be installed as shown on the Drawings, and the anchor rods, couplers, and nuts
17 must conform to Section 9-06.4(1). The steel plates must conform to ASTM A 36. All metal parts must receive 1 coat of paint
18 conforming to Section 9-08.2 Item 18-B, (1) Primer or be galvanized per AASHTO M232. The pipe must be any non-perforated
19 PE or PVC pipe of the diameter specified in the Drawings. Polystyrene must conform to Section 9-04.6. The anchors must be
20 installed parallel both to profile grade and centerline of roadway. The Contractor must secure the anchors to ensure they will
21 not be misaligned during concrete placement. For Method B anchor installations, the epoxy bonding agent used to install the
22 anchors must be Type IV conforming to Section 9-26.1. The compression seal must be as noted in the Contract documents.
23 Dowel bars must be installed in the bridge approach slabs as specified in the Standard Plans, Drawings and Section 5-
24 05.3(10).

25 The compression seal must be a 2-1/2-inch wide gland selected from the current Qualified Products List.

26 After curing bridge approach slabs as specified in Section 6-02.3(11), the bridge approach slabs may be opened to traffic
27 when a minimum compressive strength of 3,000 psi is achieved.

28 **6-02.3(11) CURING CONCRETE**

29 After placement, concrete surfaces must be cured as follows:

- 30 1. Bridge sidewalks, roofs of cut and cover tunnels — curing compound covered by white, reflective type sheeting or
31 continuous wet curing. Curing by either method must be for at least 10 days.
- 32 2. Bridge decks — See Section 6-02.3(11)B.
- 33 3. Bridge approach slabs (Class 4000A concrete) – 2 coats of curing compound and continuous wet cure for at least 10
34 days.
- 35 4. Concrete barriers and rail bases – See Section 6-02.3(11)A.
- 36 5. All other concrete surfaces — continuous wet cure for at least 3 days.

37 When continuous moisture or wet curing is required, the Contractor must keep the concrete surfaces wet with water
38 during curing.

39 During the continuous wet cure, the Contractor must keep all exposed concrete surfaces saturated with water. Formed
40 concrete surfaces must be kept in a continuous wet cure by leaving the forms in place. If forms are removed during the
41 continuous wet cure period, the Contractor must treat the concrete as an exposed concrete surface. Runoff water must be
42 collected and disposed of per all applicable regulations. Do not allow runoff water to enter any lakes, streams, or other surface
43 waters.

44 When curing Class 4000A, 2 coats of curing compound that comply with Section 9-23.2 must be applied within 15
45 minutes after tinning any portion of the bridge approach slab. The continuous wet cure must be established as soon as the
46 concrete has set enough to allow covering without damaging the finish.

47 For all other concrete requiring curing compound, the Contractor must apply 2 coats that comply with Section 9-23.2 and
48 are manufactured specifically for colored concrete when applicable, to the fresh concrete. The compound must be applied
49 immediately after finishing. Application of the second coat must run at right angles to that of the first. The 2 coats must total at
50 least 1 gallon per 150 square feet and must obscure the original color of the concrete. If any curing compound spills on
51 construction joints or reinforcing steel, the Contractor must clean it off before the next concrete placement.

52 If the Drawings call for an asphalt overlay on the bridge approach slab, the Contractor must use clear curing compound,
53 Type 1D, Class B, applying at least 1 gallon per 150 square feet to the concrete surface. Otherwise, the Contractor must use
54 white pigmented curing compound, Type 2, agitating it thoroughly just before and during application. If other materials are to
55 be bonded to the surface, the Contractor must remove the curing compound by sandblasting or acceptable high pressure
56 water washing.

1 The Contractor must have back-up spray equipment on the site, enough workers, and a bridge from which they will apply
2 the curing compound. The Engineer may require the Contractor to demonstrate, at least 1 day before the scheduled concrete
3 placement, that the crew and equipment can apply the compound acceptably.

4 The Contractor must cover the top surfaces with white, reflective sheeting, leaving it in place for at least 10 days.
5 Throughout this period, the sheeting must be kept in place by taping or weighting the edges where they overlap.

6 **6-02.3(11)A CURING AND FINISHING CONCRETE TRAFFIC AND PEDESTRIAN BARRIER**

7 The Contractor must supply enough water and workers to cure and finish concrete barrier as required in this Section.

8 **6-02.3(11)A1 FIXED FORM BARRIER**

9 The edge chamfers must be formed by attaching chamfer strips to the barrier forms.

10 After troweling and edging a barrier and while the forms remain in place, the Contractor must:

- 11 1. Brush the top surface with a fine bristle brush.
- 12 2. Cover the top surface with heavy, quilted blankets.
- 13 3. Spray water on the blankets and forms at intervals short enough to keep them thoroughly wet for 3-Days.

14 After removing the forms, the Contractor must:

- 15 a. Remove all lips and edgings with sharp tools or chisels.
- 16 b. Fill all holes with mortar conforming to Section 9-20.4(2).
- 17 c. True up corners of openings.
- 18 d. Remove concrete projecting beyond the true surface by stoning or grinding.
- 19 e. Cover the barrier with heavy, quilted blankets (not burlap).
- 20 f. Keep the blankets continuously wet for at least 7-Days.

21 The Contractor may do the finishing Work described in steps a. through d. above during the second (the 7-Day) curing
22 period if the entire barrier is kept covered except the immediate Work area. Otherwise, no finishing Work may be done until at
23 least 10 Days after pouring.

24 After the 10-Day curing period, the Contractor must remove from the barrier all form-release agent, mud, dust, and other
25 foreign substances in either of 2 ways: by light sandblasting and washing with water, or by spraying with a high-pressure water
26 jet. The water jet equipment must use clean fresh water and must produce at the nozzle at least 1,500 psi with a discharge of
27 at least 3 gpm. The water jet nozzle must have a 25 degree tip and must be held no more than 9 inches from the surface being
28 washed.

29 After cleaning, the Contractor must use brushes to rub mortar conforming to Section 9-20.4(2) at a ratio of 1:1
30 cement/aggregate ratio into air holes and small crevices on all surfaces except the brushed top. As soon as the mortar takes
31 its initial set, the Contractor must rub it off with a piece of sacking or carpet. The barrier must then be covered with wet
32 blankets for at least 48 hours.

33 Do not use curing compounds on fixed-form concrete barrier. The completed surface of the concrete must be even in
34 color and texture.

35 **6-02.3(11)A2 SLIP FORM BARRIER**

36 The edge radius must be formed by attaching radius strips to the barrier slip form.

37 The Contractor must finish slip form barrier by steel troweling to close all surface pockmarks and holes and, for plain
38 surface barrier, lightly brushing the front and back face with vertical strokes and the top surface with transverse strokes.

39 After finishing, the Contractor must cure the slip form barrier by using either method A, curing compound, or method B,
40 wet blankets, described below.

41 Method A. Under the curing compound method, the Contractor must:

- 42 1. Spray 2 coats of clear curing compound (Type 1D) on the concrete surface after the free water has disappeared.
43 Coverage of combined coats must equal at least 1 gallon per 150 square feet.
- 44 2. Before the morning after applying the curing compound, cover the barrier with white, reflective sheeting for at least 10
45 Days.
- 46 3. After the 10 Day curing period, remove the curing compound as necessary by light sandblasting or by spraying with a
47 high-pressure water jet to produce an even surface appearance. The water jet equipment must use clean fresh water
48 and must produce at the nozzle at least 2,500 psi with a discharge of at least 4 gpm. The water jet nozzle must have
49 a 25-degree tip and must be held no more than 9 inches from the surface being cleaned. The Contractor may
50 propose to use a curing compound/concrete sealer. The Engineer will evaluate the proposal and if found acceptable
51 will accept the proposal in writing. As a minimum, the Contractor's proposal must include:
 - 52 a. Product identity
 - 53 b. Manufacturer's recommended application rate
 - 54 c. Method of application and necessary equipment

1 d. Material Safety Data Sheet (MSDS)

2 e. Sample of the material for testing

3 Allow 14 Working Days for the Engineer to evaluate the proposal and to test the material.

4 Method B. Under the wet cure method, the Contractor must:

5 a. Provide an initial cure period by continuous fogging or mist spraying for at least the first 24 hours.

6 b. After the initial cure period, cover the barrier with a heavy quilted blanket.

7 c. Keep the blankets continuously wet for at least 10 Days. No additional finishing is required at the end of the curing
8 period.

9 **6-02.3(12) CONSTRUCTION JOINTS**

10 **6-02.3(12)A CONSTRUCTION JOINTS IN NEW CONSTRUCTION**

11 If the Engineer approves, the Contractor may add, delete, or relocate construction joints shown on the Drawings. Any
12 request for such changes must be in writing, accompanied by a drawing that depicts them. The Contractor must bear any
13 added costs that result from such changes.

14 All construction joints must be formed neatly with grade strips or other approved methods. The Owner will not accept
15 irregular or wavy pour lines. All joints must be horizontal, vertical, or perpendicular to the main reinforcement. The Contractor
16 must not use an edger on any construction joint, and must remove any lip or edging before making the adjacent pour.

17 If the Drawings require a roughened surface on the joint, the Contractor must strike it off to leave grooves at right angles
18 to the length of the member. The grooves must be 1/2 inch to 1 inch wide, 1/4 inch to 1/2 inch deep, and spaced equally at
19 twice the width of the groove. If the first strike-off does not produce the required roughness, the Contractor must repeat the
20 process before the concrete reaches initial set. The final surface must be clean and without laitance or loose material.

21 If the Drawings do not require a roughened surface, the Contractor must include shear keys at all construction joints.
22 These keys must provide a positive, mechanical bond. Shear keys must be formed depressions and the forms must not be
23 removed until the concrete has been in place at least 12 hours. Forms must be slightly beveled to ensure ready removal.
24 Raised shear keys are not allowed.

25 Shear keys for the tops of beams, at tops and bottoms of boxed girder webs, in diaphragms, and in crossbeams must:

26 1. Be formed with 2" x 8" wood blocks.

27 2. Measure 8 inches lengthwise along the beam or girder stem.

28 3. Measure 4 inches less than the width of the stem, beam, or crossbeam, measured transverse of the stem.

29 4. Be spaced at 16 inches center to center.

30 Unless the Drawings show otherwise, in other locations not named above, shear keys must equal approximately 1/3 of
31 the joint area and must be approximately 1-1/2 inches deep.

32 Before placing fresh concrete against cured concrete, the Contractor must thoroughly clean and saturate the cured
33 surface. All loose particles, dust, dirt, laitance, oil, or film of any sort must be removed by methods as approved by the
34 Engineer. The cleaned surface must be saturated with water for a minimum of 4 hours before the fresh concrete is placed.

35 Before placing the reinforcing mat for footings on seals, the Contractor must remove all scum, laitance, and loose gravel
36 and sediment; clean the construction joint at the top of the seals; and chip off any high spots on the seals that would prevent
37 the footing steel from being placed in the position required by the Drawings.

38 **6-02.3(12)B CONSTRUCTION JOINTS BETWEEN EXISTING AND NEW CONSTRUCTION**

39 If the Contract requires a roughened surface on the joint, the Contractor must thoroughly roughen the existing surface to
40 a uniformly distributed 1/4-inch minimum amplitude surface profile, with peaks spaced at a maximum of 1 inch, by methods as
41 approved by the Engineer.

42 If the Contract does not require a roughened surface on the joint, the Contractor must remove all loose particles, dust,
43 dirt, laitance, oil, or film of any sort by methods as approved by the Engineer.

44 Before placing fresh concrete against existing concrete, the Contractor must thoroughly clean and saturate the existing
45 surface. All loose particles, dust, dirt, laitance, oil, or film of any sort must be removed by methods as approved by the
46 Engineer. The cleaned surface must be saturated with water for a minimum of 4 hours before the fresh concrete is placed.

47 **6-02.3(13) EXPANSION JOINTS**

48 This Section outlines the requirements of specific expansion joints shown on the Drawings. The Drawings may require
49 other types of joints, seals, or materials than those described here.

50 Joints made of a vulcanized, elastomeric compound with neoprene as the only polymer must be installed with an
51 approved lubricant adhesive as recommended by the manufacturer. The length of a seal must match that required in the
52 Drawings without splicing or stretching.

53 Open joints must be formed with a template made of wood, metal, or other suitable material. Insertion and removal of the
54 template must be done without chipping or breaking the edges or otherwise injuring the concrete.

1 Any part of an expansion joint running parallel to the direction of expansion must provide a clearance of at least 1/2 inch,
2 produced by inserting and removing a spacer strip, between the 2 surfaces. The Contractor must ensure that the surfaces are
3 precisely parallel to prevent any wedging from expansion and contraction.

4 All poured rubber joint sealer and any required primer must be as specified in Section 9-04.2(2).

5 **6-02.3(14) FINISHING CONCRETE SURFACES**

6 All concrete must show a smooth, dense, uniform surface after the forms are removed. If it is porous, the Contractor must
7 pay for repairing it. The Contractor must clean and refinish any stained or discolored surfaces that may have resulted from
8 their Work or from construction delays.

9 Sections A and B below describe 2 classes of surface finishing.

10 **6-02.3(14)A CLASS 1 SURFACE FINISH**

11 The Contractor must apply a Class 1 finish to all surfaces of concrete members to the limits designated in the Drawings.

12 The Contractor must comply with steps 1 through 8 below. When steel forms have been used and when the surface of
13 filled holes matches the texture and color of the area around them, the Contractor may omit steps 3 through 8. To create a
14 Class 1 surface, the Contractor must:

- 15 1. Remove all bolts and all lips and edgings where form members have met.
- 16 2. Fill all holes greater than 1/4 inch and float to an even, uniform finish with mortar conforming to Section 9-20.4(2) at a
17 1:2 cement/aggregate ratio.
- 18 3. Thoroughly wash the surface of the concrete with water.
- 19 4. Brush on a mortar conforming to Section 9-20.4(2) at a 1:1 cement/aggregate ratio, working it well into the small air
20 holes and other crevices in the face of the concrete.
- 21 5. Brush on no more mortar than can be finished in 1 day.
- 22 6. Rub the mortar off with burlap or a piece of carpet as soon as it takes initial set (before it reaches final set).
- 23 7. Fog-spray water over the finish as soon as the mortar paint has reached final set.
- 24 8. Keep the surface damp for at least 2 days.

25 If the mortar becomes too hard to rub off as described in step 6, the Contractor must remove it with a Carborundum
26 stone and water. Random grinding is not permitted.

27 **6-02.3(14)B CLASS 2 SURFACE FINISH**

28 The Contractor must apply a Class 2 finish to all above-ground surfaces not receiving a Class 1 finish unless otherwise
29 specified in the Contract. Surfaces covered with fill do not require a surface finish.

30 To produce a Class 2 finish, the Contractor must remove all bolts and all lips and edgings where form members have met
31 and fill all form tie holes.

32 **6-02.3(14)C PIGMENTED SEALER FOR CONCRETE SURFACES**

33 Concrete barrier surfaces must be finished as specified in Section 6-02.3(11)A. All other surfaces specified in the
34 Drawings to receive pigmented sealer must receive a Class 2 surface finish and a light brush sandblasting in order that
35 complete neutralization of the surface and subsequent penetration of the pigmented sealer is achieved. All curing agents and
36 form release agents must be removed. The surface must be dry, clean and prepared per the manufacturer's written
37 instructions. The Contractor must submit 4 copies of the manufacturer's written instructions.

38 The Contractor must not apply pigmented sealer from a batch greater than 12 months past the initial date of color sample
39 approval of that batch by the Engineer.

40 The pigmented sealer color or colors for specific concrete surfaces must be as specified in the Contract.

41 The pigmented sealer must be spray applied per the manufacturer's written instructions for application, air temperature
42 required for sealer application and curing, qualification of applicator, rate of application, and number of coats to apply.
43 Pigmented sealer must not be applied until the concrete has cured for at least 28 days. Pigmented sealer must not be applied
44 on damp surfaces, nor must it be applied when the air is misty, or otherwise unsatisfactory for the work, in the opinion of the
45 manufacturer or the Engineer. The final appearance must have an even and uniform color acceptable to the Engineer.

46 For concrete surfaces such as columns, retaining walls, pier walls, abutments, concrete fascia panels, and noise barrier
47 wall panels, the pigmented sealer must extend to 1 foot below the finish groundline, unless otherwise shown on the Drawings.

48 **6-02.3(15) DATE NUMERALS**

49 Standard date numerals must be placed where shown on the Drawings. The date must be for the year in which the
50 Structure is completed. When traffic barrier is placed on an existing Structure, the date must be for the year in which the
51 original Structure was completed. Unit Contract prices must cover all costs relating to these numerals.

6-02.3(16) PLANS FOR FALSEWORK AND FORMWORK

The Contractor must submit all plans for falsework and formwork for acceptance as specified in Section 1-05.3, and as described in Section 6-02.3(16)A. The Contractor must also submit 2 sets of the falsework and formwork plans to the Engineer. Approval does not reduce the Contractor's responsibility for ensuring the adequacy of the formwork and falsework. All falsework and formwork must be constructed per approved falsework and formwork plans.

Except to place falsework foundation pads and piles, constructing any unit of falsework must not start until the Engineer has reviewed and approved the falsework plans for that unit. Falsework driven piling, temporary concrete footings, or timber mudsills may be placed as described in Section 6-02.3(17)D before approval at the Contractor's own risk, except for the following conditions:

1. The falsework is over or adjacent to roadways or railroads as described in Section 6-02.3(17)C, or
2. The falsework requires prior placement of shoring or cofferdams as described in Section 2-07 and Section 2-08.

Costs associated with changing falsework to bring it into compliance with the approved falsework plans will be at the Contractor's expense.

The Engineer will review the falsework and formwork plans and calculations, and if they are acceptable, and unless otherwise specified in the Contract, will obtain the required approvals as applicable.

Plan approval is not required for footing or retaining walls unless they are more than 4 feet high, excluding pedestal height.

The design of falsework and formwork must be based on:

- a. Applied loads and conditions no less severe than those described in Section 6-02.3(17)A.
- b. Allowable stresses and deflections no greater than those described in Section 6-02.3(17)B.
- c. Special loads and requirements no less severe than those described in Section 6-02.3(17)C.
- d. Conditions required by other Sections of 6-02.3(17)

Plan approval can be done by the Engineer for footings and walls 4 feet to 8 feet high, excluding pedestal height, provided:

- 1) Concrete placement rate is 4 feet per hour or less.
- 2) Facing is 3/4 inch plywood with grade as specified in Section 6-02.3(17)J.
- 3) Studs, with plywood face grain perpendicular, are 2" x 4" spaced at 12 inches.
- 4) Walers with 3,000-pound safe working load ties spaced at 24 inches are 2" x 4" spaced at 24 inches.

Plan approval can be done by the Engineer for manufactured certified steel round column forming for column heights up to 20 feet. Concrete placement rate must not exceed 10 feet per hour. Bracing requirements must be per manufacturer's recommendations or submitted according to Section 6-02.3(16). The falsework and formwork plans must be scale drawings showing the details of proposed construction, including sizes and properties of all members and components; spacing of bents, posts, studs, wales, stringers, wedges and bracing; rates of concrete placement, placement sequence, direction of placement, and location of construction joints; identifying falsework devices and safe working load; and identifying any bolts or threaded rods used with the devices including their diameter, length, type, grade, and required torque. Show in the falsework plans the proximity of falsework to utilities or any nearby Structures including underground Structures. Formwork accessories must be identified according to Section 6-02.3(17)H. All assumptions, dimensions, material properties, and other data used in making the structural analysis must be noted on the drawing.

The Contractor must furnish the associated design calculations to the Engineer for examination as a condition for approval. The design calculations must show the stresses and deflections in load supporting members. Construction details which may be in the form of sketches on the calculation sheets must be in the falsework or formwork drawings as well. Falsework or formwork plans will not be approved where it is necessary to refer to the calculation sheets for information needed for complete understanding of the falsework and formwork plans or how to construct the falsework and formwork.

All falsework and formwork plans and design calculations submitted to Engineer must be prepared by or under the direct supervision of a Professional Engineer, licensed under Title 18 RCW, State of Washington, in the branch of Civil or Structural Engineering.

Design calculations and each sheet of falsework and formwork plans must comply with the Shop Drawing and Professional Engineer submittal requirements of Section 1-05.3.

6-02.3(16)A NONPREAPPROVED FALSEWORK AND FORMWORK PLANS

As specified in Section 1-05.3, the Contractor must submit all non-preapproved falsework and formwork plans, and design calculations, for review and acceptance.

Reviewed falsework and formwork plans will be returned to the Contractor within the time allowed according to Section 1-05.3. The time allowed starts when the Contractor's transmittal and submittal including all required copies of the falsework and/or formwork plans and calculations, catalog data, and other technical information are received.

Drawings returned to the Contractor for correction must be corrected and resubmitted as a clean submittals, with no previous Engineer stamps and comments, to the Engineer for review and acceptance.

1 The Contractor may change approved falsework and formwork plans, provided sufficient time is allowed for the
2 Engineer's review and approval before construction is started on the changed portions. Such additional time cannot be more
3 than that which was originally allowed per Section 1-05.3. After a plan or drawing is accepted and returned to the Contractor,
4 all changes that the Contractor proposed must be submitted to the Engineer for review and approval.

5 **6-02.3(17) FALSEWORK AND FORMWORK**

6 Formwork and falsework are both structural systems. Formwork contains the lateral pressure exerted by concrete placed
7 in the forms. Falsework supports the vertical and/or the horizontal loads of the formwork, reinforcing steel, concrete, and live
8 loads during construction.

9 The Contractor must set falsework to produce in the finished structure the lines and grades described in the Drawings.
10 The setting of falsework must allow for shrinkage, settlement, falsework girder camber, and any structural camber the
11 Drawings or the Engineer require.

12 Concrete forms must be mortar tight, true to the dimensions, lines, and grades of the structure. Curved surfaces shown
13 on the Drawings must be constructed as curved surfaces and not chorded, except as allowed in Section 6-02.3(17)J. Concrete
14 formwork must be of sufficient strength and stiffness to prevent overstress and excess deflection as defined in Section 6-
15 02.3(17)B. The rate of depositing concrete in the forms must not exceed the placement rate in the approved formwork plan.
16 The interior form shape and dimensions must also ensure that the finished concrete conforms with the Drawings.

17 If the new structure is near or part of an existing one, the Contractor must not use the existing structure or completed
18 elements of the new structure to suspend or support falsework unless the Contract states otherwise. With approval by the
19 Engineer, the bridge deck and the diaphragm forms from prestressed girder and T-beam bridge widenings or stage
20 construction, and the bridge deck forms from steel plate girder bridge widenings or stage construction, may be supported from
21 the existing structure or previous stage. See Section 6-02.3(17)E for additional conditions.

22 On bridge decks, do not use forms designed to stay in place made of steel or precast concrete panels.

23 For post-tensioned Structures, both falsework and forms must be designed to carry the additional loads caused by the
24 post-tensioning operations. The Contractor must construct supporting falsework in a way that leaves the superstructure free to
25 contract and lift off the falsework during post-tensioning. Forms that will remain inside box girders to support placing the bridge
26 deck concrete must, by design, resist girder contraction as little as possible. See Section 6-02.3(26) for additional conditions.

27 **6-02.3(17)A DESIGN LOADS**

28 The design load for falsework consists of the sum of dead and live vertical loads, and a design horizontal load. The
29 minimum total design load for any falsework must be at least 100 pounds per square foot for combined live and dead load
30 regardless of Structure thickness.

31 The entire superstructure cross-section, except traffic barrier, is considered placed at one time for purposes of
32 determining support requirements and designing falsework girders for their stresses and deflections, except as follows:

33 For concrete box girder bridges, the girder stems, diaphragms, crossbeams, and connected bottom slabs, if the stem wall
34 is placed more than 5 days before the top slab, may be considered to be self-supporting between falsework bents when the
35 top slab is placed, provided that the distance between falsework bents does not exceed 4 times the depth of the portion of the
36 girder placed in the preceding concrete placements.

37 Falsework bents must be designed for the entire live load and dead load, including all load transfer that takes place
38 during post-tensioning, and braced for the design horizontal load.

39 Dead loads must include the weight of all successive placements of concrete, reinforcing steel, forms and falsework, and
40 all load transfer that takes place during post-tensioning. The weight of concrete with reinforcing steel must be assumed to be
41 not less than 160 pounds per cubic foot.

42 Live loads must consist of the actual mass of any equipment to be supported by falsework applied as concentrated loads
43 at the points of contact, and a minimum uniform load of not less than 25 pounds per square foot. applied over the entire
44 falsework plan area supported, plus a minimum load of not less than 75 pounds per linear foot applied at the outside edge of
45 deck overhangs.

46 The design horizontal load to be resisted by the falsework bracing system in any direction must be the sum of all
47 identifiable horizontal loads due to equipment, construction sequence, side-sway caused by geometry or eccentric loading
48 conditions, or other causes, and an allowance for wind plus an additional allowance of 1 percent of the total dead load to
49 provide for unexpected forces. In no case must the design horizontal load be less than 3 percent of the total dead load.

50 The minimum horizontal load to be allowed for wind on each heavy-duty steel shoring tower having a vertical load
51 carrying capacity exceeding 30 kips per leg must be the sum of the products of the wind impact area, shape factor, and the
52 applicable wind pressure value for each height zone. The wind impact area is the total projected area of all elements in the
53 tower face normal to the applied wind. The shape factor for heavy-duty steel shoring towers must be taken as 2.2. Determine
54 wind pressure values from the following table:

55

Wind Pressure on Heavy-Duty Steel Shoring Towers

| Height Zone (Feet Above Ground) | Wind Pressure Value | |
|---------------------------------|---------------------|--------------------|
| | Adjacent to Traffic | At Other Locations |
| 0-30 | 20-psf | 15-psf |
| 30-50 | 25-psf | 20-psf |
| 50-100 | 30-psf | 25-psf |
| Over 100 | 35-psf | 30-psf |

The minimum horizontal load to be allowed for wind on all other types of falsework, including falsework girders and forms supported on heavy-duty steel shoring towers, must be the sum of the products of the wind impact area and the applicable wind pressure value for each height zone. The wind impact area is the gross projected area of the falsework support system, falsework girders, forms and any unrestrained portion of the permanent Structure, except the areas between falsework posts or towers where diagonal bracing is not used. Determine wind pressure values from the following table.

Wind Pressure on All Other Types of Falsework

| Height Zone (Feet Above Ground) | Wind Pressure Value | |
|---------------------------------|---|--------------------|
| | For Members Over and Bents Adjacent to Traffic Openings | At Other Locations |
| 0-30 | 2.0 Q psf | 1.5 Q psf |
| 30-50 | 2.5 Q psf | 2.0 Q psf |
| 50-100 | 3.0 Q psf | 2.5 Q psf |
| Over 100 | 3.5 Q psf | 3.0 Q psf |

NOTE: Determine the value of Q in the above tabulation as follows:

$Q = 1 + 0.2W$; but Q must not be more than 10.

Where W is the width of the falsework system, in feet, measured normal to the direction of the wind force being considered.

The falsework system must also be designed so it will be sufficiently stable to resist overturning before placing the concrete. The minimum factor of safety against falsework overturning in all directions from the assumed horizontal load for all stages of construction is 1.25. If the required resisting moment is less than 1.25 times the overturning moment, the difference must be resisted by bracing, cable guys, or other means of external support.

Design of falsework includes the vertical component, whether positive or negative, of bracing loads imposed by the design horizontal load. Design of falsework must investigate the effects of any horizontal displacement due to stretch of the bracing. This is particularly important when using cable or rod bracing systems.

If the concrete is to be post-tensioned, the falsework must be designed to support any increased or redistributed loads caused by the prestressing forces.

6-02.3(17)B ALLOWABLE DESIGN STRESSES AND DEFLECTIONS

The maximum allowable stresses listed in this Section are based on the use of identifiable, undamaged, high-quality materials. Stresses must be appropriately reduced if lesser quality materials are to be used.

These maximum allowable stresses include all adjustment factors, such as the short term load duration factor. The maximum allowable stresses and deflections used in the design of the falsework and formwork must be as follows:

6-02.3(17)B1 DEFLECTION

Deflection resulting from dead load and concrete pressure for exposed visible surfaces, 1/360 of the span.

Deflection resulting from dead load and concrete pressure for unexposed non-visible surfaces, including the bottom of the deck slab between girders, 1/270 of the span.

In the foregoing, the span length must be the center line to center line distance between supports for simple and continuous spans, and from the center line of support to the end of the member for cantilever spans. For plywood supported on members wider than 1-1/2 inches, the span length must be taken as the clear span plus 1-1/2 inches. Also, dead load must include the weight of all successive placements of concrete, reinforcing steel, forms and falsework self-weight. Only the self-weight of falsework girders may be excluded from the calculation of the above deflections provided that the falsework girder deflection is compensated for by the installation of camber strips.

Where successive placements of concrete are to act compositely in the completed Structure, deflection control becomes extremely critical. Maximum deflection of supporting members is 1/500 of the span for members constructed in several successive placements, such as concrete box girder and concrete T-beam girder Structures. Falsework components must be

1 sized, positioned, and/or supported to minimize progressive increases in deflection of the Structure which would preload the
 2 concrete or reinforcing steel before it becomes fully composite.

3 **6-02.3(17)B2 TIMBER**

4 Each species and grade of timber/lumber used in constructing falsework and formwork must be identified in the
 5 Drawings. The allowable stresses and loads must not exceed the lesser of stresses and loads given in the table below or
 6 factored stresses for designated species and grade in Table 7.3 of the Timber Construction Manual, latest edition, by the
 7 American Institute of Timber Construction.

| Type of Stress | Allowable Load |
|---|----------------|
| Compression perpendicular to the grain reduced to 300 psi for use when moisture content is 19 percent or more (areas exposed to rain, concrete curing water, green lumber). | 450 psi |
| Compression parallel to the grain but not to exceed 1,500 psi. | 480,000 psi |
| | $(L/d)^2$ |
| Flexural stress for members with a nominal depth greater than 8 inches. | 1,800 psi |
| Flexural stress for members with a nominal depth of 8 inches or less. | 1,500 psi |
| The maximum horizontal shear. | 140 psi |
| AXIAL tension. | 1,200 psi |
| The maximum modulus of elasticity (E) for timber. | 1,600,000 psi |

9
 10 Where:

11 L = the unsupported length

12 d = the least dimension of rectangular columns, or the width of a square of equivalent cross-sectional area for round
 13 columns, or the depth of beams.

14 The allowable stress for compression perpendicular to the grain, and for horizontal shear must not be increased by any
 15 factors such as short duration loading. Additional requirements are found in other parts of Section 6-02.3(17). Criteria for the
 16 design of lumber and timber connections are found in Section 6-02.3(17)I.

17 Plywood for formwork must be designed per the methods and stresses allowed in the APA Design/Construction Guide for
 18 Concrete Forming as published by the American Plywood Association, Tacoma, Washington. As concrete forming is a special
 19 application for plywood, use wet stresses and then adjusted for forming conditions such as duration of load, and experience
 20 factors. Concrete pour pressures must be per Section 6-02.3(17)J.

21 **6-02.3(17)B3 STEEL**

22 For identified grades of steel, design stresses must not exceed those specified in the Steel Construction Manual, latest
 23 edition, by the American Institute of Steel Construction, except as follows:

| Type of Stress | Allowable Load |
|--|----------------|
| Compression, flexural but not to exceed $0.6F_y$ | 12,000,000 psi |
| | Ld/bt |
| The modulus of elasticity (E) must be | 29,000,000 psi |

25
 26 When the grade of steel cannot be positively identified as with salvaged steel and if rivets are present, design stresses
 27 must not exceed the following:

| Type of Stress | Allowable Load |
|---|-----------------------------|
| Yield point f_y | 30,000 psi |
| Tension, axial, and flexural | 16,000 psi |
| Compression, axial except L/r must not exceed 120 | $14,150 - 0.37(KL/r)^2$ psi |
| Shear on gross section of the web of rolled shapes | 9,500 psi |
| Web crippling for rolled shapes | 22,500 psi |

| Type of Stress | Allowable Load |
|--|---------------------------|
| Compression, flexural but not to exceed 16,000 psi and L/b not greater than 39 | 16,000 - $5.2(L/b)^2$ psi |
| The modulus of elasticity (E) must be | 29,000,000 psi |

1

2 Where:

3 L = the unsupported length

4 d = the least dimension of rectangular columns, or the width of a square of equivalent cross-sectional area for round
5 columns, or the depth of beams

6 b = the flange width

7 t = the thickness of the compression flange

8 r = the radius of gyration of the compression flange about the weak axis of the member

9 F_y = the specified minimum yield stress, psi, for the grade of steel used

10 L = the unsupported length

11

12 All dimensions are expressed in inches.

13 **6-02.3(17)C FALSEWORK AND FORMWORK AT SPECIAL LOCATIONS**

14 In addition to the minimum requirements specified in Sections 6-02.3(17)A and 6-02.3(17)B, falsework towers or posts
15 supporting beams directly over roadways or railroads which are open to traffic or the public must be designed and constructed
16 so the falsework will be stable if subjected to impact by vehicles. Do not use damaged materials, unidentifiable material,
17 salvaged steel or steel with burned holes or questionable weldments for falsework described in this Section. For this
18 Specification the following public or private facilities must also be considered as roadways: pedestrian pathways and other
19 Structures such as bridges, walls, and buildings.

20 The dimensions of the clear openings to be provided through the falsework for roadways, railroads, or pedestrian
21 pathways must be as specified in the Contract.

22 Falsework posts or shoring tower systems which support members that cross over a roadway or railroad are considered
23 as adjacent to roadways or railroads. Other falsework posts or shoring towers are considered as adjacent to roadways or
24 railroads only if the following conditions apply:

- 25 1. Located in the row of falsework posts or shoring towers nearest to the roadway or railroad; and
- 26 2. Horizontal distance from the traffic side of the falsework to the edge of pavement is less than the total height of the
27 falsework and forms; or
- 28 3. The total height of the falsework and forms is greater than the horizontal clear distance between the base of the
29 falsework and a point 10 feet from the centerline of track.

30 The Contractor must provide any additional features for the Work needed to ensure that the falsework will be stable for
31 impact by vehicles; providing adequate safeguards, safety devices, protective equipment, and any other needed actions to
32 protect property and the life, health, and safety of the public; and must comply with the provisions in Section 1-07.23 and
33 Section 6-02.3(17)M. The falsework design at special locations, must incorporate the minimum requirements detailed in this
34 Section, even if protected by concrete median barrier.

35 The vertical load used for the design of falsework posts and towers which support the portion of the falsework over
36 openings, must be the greater of the following:

- 37 a. 150 percent of the design load calculated as specified in Section 6-02.3(17)B, but not including any increased or
38 redistributed loads caused by the post-tensioning forces; or
- 39 b. 100 percent of the design load plus the increased or redistributed loads caused by the post-tensioning forces.

40 Each falsework post or each shoring tower leg adjacent to roadways or railroads consists of either steel with a minimum
41 section modulus about each axis of 9.5 inches cubed or sound timbers with a minimum section modulus about each axis of
42 250 inches cubed.

43 Each falsework post or shoring tower leg adjacent to roadways or railroads must be mechanically connected to its
44 supporting footing at its base, or otherwise laterally restrained, to withstand a force of not less than 2,000 pounds applied at
45 the base of the post or tower leg in any direction except toward the roadway or railroad track. Posts or tower legs must be
46 connected to the falsework cap and stringer by mechanical connections capable of resisting a load in any horizontal direction
47 of not less than 1,000 pounds.

48 For falsework spans over roadways and railroads, all falsework stringers must be mechanically connected to the
49 falsework cap or framing. The mechanical connections must be capable of resisting a load in any direction, including uplift on
50 the stringer, of not less than 500 pounds. All associated connections must be installed before traffic is allowed to pass beneath
51 the span.

1 When timber members are used to brace falsework bents located adjacent to roadways or railroads, all connections must
2 be bolted through the members using 5/8-inch diameter or larger bolts.

3 Use concrete traffic barriers to protect all falsework adjacent to traveled roadways. The falsework must be located so
4 falsework footings, mudsills, or piles are at least 2 feet clear of the traffic barrier and all other falsework members must also be
5 at least 2 feet clear of the traffic barrier. Traffic barrier used to protect falsework must not be fastened, guyed, or blocked to
6 any falsework but must be fastened to the pavement according to details shown on the Drawings. The installation of concrete
7 traffic barrier must be completed before falsework erection is begun. The traffic barrier at the falsework must not be removed
8 until approved by the Engineer. Falsework openings provided for the Contractor's own use, not for public use, must also use
9 concrete traffic barrier to protect the falsework, except the minimum clear distance between the barrier and falsework footings,
10 mudsills, piles, or other falsework members must be at least 3 inches.

11 Falsework bents within 20 feet of the center line of a railroad track must be braced to resist the required horizontal load
12 or 2,000 pounds whichever is greater.

13 Pedestrian openings through falsework must be paved or surfaced with full width continuous wood walks which must be
14 wheel chair accessible and must be kept clear. Pedestrians must be protected from falling objects and water falling from
15 construction above. Overhead protection for pedestrians must extend at least 4 feet beyond the edge of the bridge deck.
16 Drawings and details of the overhead protection and pathway must be submitted with the falsework plans for review and
17 approval. Pedestrian openings through falsework must be illuminated by temporary lighting, constructed and maintained by the
18 Contractor. The temporary lighting must be constructed per local electrical code requirements. The temporary lighting must be
19 steady burning 60 watt, 120 volt lamps with molded waterproof lamp holders spaced at 25-foot centers maximum. All costs
20 relating to pedestrian pathway paving, wood walks, overhead protection, maintenance, operating costs, and temporary
21 pedestrian lighting are incidental to applicable adjacent items of Work.

22 **6-02.3(17)D FALSEWORK SUPPORT SYSTEMS: PILING, TEMPORARY CONCRETE FOOTINGS, TIMBER** 23 **MUDSILLS, MANUFACTURED SHORING TOWERS, CAPS, AND POSTS**

24 The Contractor must support all falsework on either driven piling, temporary concrete footings, or timber mudsills.
25 Temporary concrete footings must be designed as reinforced concrete which may be cast in place or precast. All components
26 for a falsework support system must be sized for the maximum design loads and allowable stresses described in the
27 preceding Sections.

28 The falsework drawings must include a superstructure placing diagram showing the concrete placing sequence, direction
29 of placements, and construction joint locations. When a sequence for placing concrete is shown on the Drawings or
30 Specifications, no deviation will be permitted.

31 If the Drawings call for piling or foundation shafts to support permanent Structures, the Contractor may not use mudsills
32 or temporary concrete footings for falsework support unless the underlying soil passes the settlement test described in this
33 Section.

34 **6-02.3(17)D1 PILING**

35 When using piling to support the falsework, the Contractor's falsework plans must specify the minimum required bearing
36 and depth of penetration for the piling. Also, the falsework drawings must show the maximum horizontal distance that the top
37 of a falsework pile may be pulled to position it under its cap. The falsework plans must show the maximum allowable deviation
38 of the top of the pile, in its final position, from a vertical line through the point of fixity of the pile. The calculations must account
39 for pile stresses due to combined axial and flexural stress and secondary stresses.

40 Untreated timber piling must be banded before driving. The falsework plans must identify lengths, minimum tip diameter,
41 and expected diameter at groundline. The Contractor must comply with the requirements of Section 9-10.1. The maximum
42 allowable load for timber piles is 45 tons. Steel piling must be identified in the falsework plans. If steel pipe piling is used, the
43 pipe diameter and wall thickness must be identified in the falsework plans. Steel piling must comply with the requirements of
44 Section 9-10.5. Use the formulas in Section 6-05.3(12) must to determine the bearing capacity of the falsework piling. If the
45 Engineer approves, the pile bearing capacity may instead be determined by test loading the piling to twice the falsework
46 design load. The Contractor must provide the Engineer an opportunity to witness these tests and provide a plan of the test and
47 cross-sections showing the locations and elevations of the proposed tests to the Engineer for approval.

48 **6-02.3(17)D2 TEMPORARY CONCRETE FOOTINGS AND TIMBER MUDSILLS**

49 Timber mudsills or temporary concrete footings may be used in place of driven piling, provided tests show that the soil
50 can support twice the falsework design load and that the mudsill or temporary concrete footing will not settle more than 1/4
51 inch when loaded with the design load. The tests must be done at the falsework site, at the same elevation of the mudsill, and
52 conducted under conditions representative of the actual Job Site conditions. The acceptable tests for various soil types are:

- 53 1. Granular Soil. The Contractor must conduct on-site tests according to AASHTO T 235. The Contractor must provide
54 the Engineer an opportunity to witness these tests and provide a plan of the test and cross-sections showing the
55 locations and elevations of the proposed tests to the Engineer for approval.
- 56 2. Fine Grained or Organic Soil. The Contractor must employ a Geotechnical Engineer to investigate the foundation
57 soils and certify in writing each mudsill or temporary footing will comply with the load-settlement requirements
58 described above. The allowable bearing capacities, elevations and locations of specific falsework mudsills must be

1 listed in the certification. Soils information used to determine the soil bearing capacity and settlement must be
2 submitted with the written certification to the Engineer for review and approval.

3 Timber mudsills or temporary concrete footings for falsework must be designed to carry the loads imposed on them
4 without exceeding the estimated soil bearing capacity and specified maximum settlement. Where mudsills or temporary
5 footings are used in the vicinity of permanent spread footings, the allowable mudsill bearing pressure must be less than that of
6 the permanent footings. This is because elevation difference, smaller bearing area, and the lack of surrounding overburden
7 provides a lower bearing capacity than the permanent spread footings. The mudsills must be designed for bearing capacities
8 at the location they are to be used. Timber mudsills or temporary concrete footings must be designed as unyielding
9 foundations under full design loads. The soil pressure bearing values assumed in the design of the falsework, normally not
10 more than 3,000 pounds per sq. ft., must be shown in the falsework drawings. The minimum edge distances from the edge of
11 the post or shoring tower leg to the edge or end of the mudsill member must be shown in the falsework drawings. Timber
12 mudsills and temporary concrete footings must be designed such that member deflections do not exceed 1/4 inch and that
13 member allowable stresses are not exceeded.

14 Full cross-sectional views of all falsework on timber mudsills or temporary concrete footings to be placed in side slopes
15 or above excavations must be shown in the falsework drawings. Footings or mudsills stepped or placed above an excavation
16 must have all related geometry and slope stability items identified in the falsework plan. Details and calculations for any
17 shoring system to support the embankment or excavation must be included.

18 Mudsills or temporary concrete footings placed in benches in slopes must be set back from the face of the slope 1/2 the
19 mudsill or temporary concrete footing width, but not less than 1 foot. The bench including the setback must be level in its
20 narrow dimension. Slopes between benches measured from the top of slope at one bench to the toe of slope at the next bench
21 below must be no steeper than 1-1/2 horizontal to 1 vertical.

22 Falsework must be founded on a solid footing, safe against undermining, protected from softening, and capable of
23 supporting the loads imposed. Preparing the soil to receive the temporary footing is important to ensure that the falsework
24 does not experience localized settlement that could cause falsework failure. In preparing the soil for a timber mudsill or
25 temporary concrete footing, the Contractor must:

- 26 a. Place it on dry soil either undisturbed or compacted to 95 percent of maximum density, as determined by the
27 compaction control tests in Section 2-11 and submitted to the Engineer for review.
- 28 b. Place mudsills or footings level with full contact bearing on the soil with no voids. Place each distribution plate or
29 corbel member between the post or tower leg and the mudsill members such that there is full contact bearing.
- 30 c. Place a compacted layer of fine material under the mudsill if it is supported by rock or coarse sand and gravel.
- 31 d. Provide the Engineer with a sample of any off-site material to be used under the mudsill.
- 32 e. Allow up to 5 Working Days for the Engineer's approval before using the off-site material.
- 33 f. Provide erosion control measures to protect the soil of the mudsill or footing from undermining and softening.

34 Anticipated total settlements and incremental settlements of falsework and forms due to successive concrete placements
35 must be shown in the falsework plans. These must include falsework footing settlement and joint take-up. Total anticipated
36 settlements must not exceed 1 inch including joint take-up. When using mudsills, the Contractor must prepare for the
37 possibility of reshoring with such devices as screw jacks or hydraulic jacks and adjustment of wedge packs. The placing of
38 concrete must be discontinued if unanticipated settlement occurs, including settlements that deviate more than $\pm 3/8$ inch from
39 those indicated on the approved falsework drawing. Concrete placement must not resume until corrective measures
40 satisfactory to the Engineer are provided. If satisfactory corrective measures are not provided before initial set of the concrete
41 in the affected area, placing of concrete must be discontinued at a location determined by the Engineer. All unacceptable
42 concrete must be removed as determined by the Engineer.

43 Where the maximum leg load exceeds 30 kips, foundations for individual steel towers must be designed and constructed
44 to provide uniform settlement at each tower leg for all loading conditions.

45 **6-02.3(17)D3 BENTS, SHORING TOWERS, PILING, POSTS, AND CAPS**

46 Drawings for falsework bents or shoring tower systems, including manufactured tower systems must have plan, cross-
47 section, and elevation view scale drawings showing all geometry. Show in the falsework plans the proximity of falsework to
48 utilities or any nearby Structures including underground Structures. The ground elevation, cross-slopes, relation of stringers to
49 one another, and dimensions to posts or piling must be shown in the falsework plans. Column, pile, or tower heights must be
50 indicated. Member sizes, wall thickness and diameter of steel pipe columns or piles must be shown in the falsework plans.
51 Location of wedges, minimum bearing area and type of wedge material must be identified in the falsework plans. Bracing size,
52 location, material and all connections must be described in the falsework plans.

53 Show the relationship of the falsework bents or shoring tower systems to the permanent Structure's pier and footing.
54 Load paths must be as direct as possible. Loads must be applied through the shear centers of all members to avoid torsion
55 and buckling conditions. Where loads cause twisting, biaxial bending, or axial loading with bending, the affected members
56 must be designed for combined stresses and stability.

57 Posts or columns must be constructed plumb with tops and bottoms carefully cut to provide full end bearing. Caps must
58 be installed at all bents supported by posts or piling unless approved falsework plans specifically allow otherwise. Caps must
59 be fastened to the piling or posts. The falsework must be capable of supporting non-uniform or localized loading without

1 adverse effect. For example, the loading of cantilevered ends of stringers or caps must not cause a condition of instability in
2 the adjacent unloaded members.

3 Timber posts and piling must be fastened to the caps and mudsills by through-bolted connections, drift pins, or other
4 approved connections. The minimum diameter of round timber posts must be shown in the falsework plans. Timber caps and
5 timber mudsills must be checked for crushing from columns or piling under maximum load.

6 Steel posts and piling must be welded or bolted to the caps, and must be bolted or welded to the foundation. Steel
7 members must be checked for buckling, web yielding, and web crippling.

8 Must use wedges to allow formwork to be taken up and released uniformly. Wedges must be oak or close-grained
9 Douglas fir. Cedar wedges or shims must not be used anywhere in a falsework or forming system. Must use wedges at the top
10 or bottom of shores, but not at both top and bottom. After the final adjustment of the shore elevation is complete, the wedges
11 must be fastened securely to the sill or cap beam. Only 1 set of wedges, with 1 optional block, must be used at one location.
12 Use screw jacks or other approved devices under arches to allow incremental release of the falsework.

13 Sand jacks may be used to support falsework and are used for falsework lowering only. Sand jacks must be constructed
14 of steel with snug fitting steel or concrete pistons. Sand jacks must be filled with dry sand and the jack protected from moisture
15 throughout its use. They must be designed and installed in such a way to prevent the unintentional migration or loss of sand.
16 All sand jacks must be tested per Section 6-02.3(17)G.

17 When falsework is over or adjacent to roadways or railroads, all details of the falsework system which contribute to the
18 horizontal stability and resistance to impact must be installed when each element of the falsework is erected and must remain
19 in place until the falsework is removed. For other requirements see Section 6-02.3(17)C.

20 Transverse construction joints in the superstructure must be supported by falsework at the joint location. The falsework
21 must be constructed in such a manner that subsequent pours will not produce additional stresses in the concrete already in
22 place.

23 **6-02.3(17)D4 MANUFACTURED SHORING TOWER SYSTEMS AND DEVICES**

24 Manufactured proprietary shoring tower systems must be identified in the falsework plans by make and model and safe
25 working load capacity per leg. The safe working load for shoring tower systems must be based on a minimum 2 1/2:1 factor of
26 safety.

27 The safe working load capacity, anticipated deflection or settlement, make and model must be identified in the falsework
28 plans for manufactured devices such as: single shores, overhang brackets, support bracket and jack assemblies, friction
29 collars and clamps, hangers, saddles, and sand jacks. The safe working load for shop manufactured devices must be based
30 on a minimum ultimate strength safety factor of 2:1. The safe working load for field produced devices and all single shores
31 must be based on a minimum ultimate strength safety factor of 3:1.

32 The safe working load of all devices must not be exceeded. The design loads must be as defined by Section 6-
33 02.3(17)A. The maximum allowable free end deflection of deck overhang brackets under working loads applied must not
34 exceed 3/16 inch measured at the edge of the concrete slab regardless of the fact that the deflection may be compensated for
35 by precambering or of setting the elevations high. The Contractor must comply with all manufacturer's Specifications including
36 those relating to bolt torque, placing washers under nuts and bolt heads, cleaning and oiling of parts, and the reuse of
37 material. Devices which are deteriorated, bent, warped, or have poorly fitted connections or welds, must not be installed.

38 Shoring tower or device capacity as shown on catalogs or brochures published by the manufacturer is considered as the
39 maximum load which the shoring can safely support under ideal conditions. These maximum values must be reduced for
40 adverse loading conditions; such as horizontal loads, eccentricity due to unbalanced spans or placing sequence, and uneven
41 foundation settlement.

42 Depending on load-carrying capacity, steel shoring systems are classified as pipe-frame systems, intermediate strength
43 systems, and heavy-duty systems. The 2 types of pipe-frame shoring base frames in general use are the ladder type and the
44 cross-braced type. In the ladder type, frame rigidity is provided by horizontal struts between the vertical legs, whereas in the
45 cross-braced type rigidity is provided by diagonal cross-bracing between the legs.

46 Copies of catalog data and/or other technical data must be furnished with the falsework plans to verify the load-carrying
47 capacity, deflection, and manufacturer's installation requirements of any manufactured product or device proposed for use.
48 Upon request by the Engineer, the Contractor must furnish manufacturer certified test reports and results showing load
49 capacity, deflection, test installation conditions, and identify associated components and hardware for shoring tower systems
50 or other devices. In addition to manufacturer's requirements, the criteria specified in the following Sections for manufactured
51 proprietary shoring tower systems and devices must be complied with when preparing falsework plans, calculations, and
52 installing these shoring tower systems and devices as falsework.

53 Alternative criteria and/or systems may be approved if a written statement on the manufacturer's letter head, signed by
54 the shoring or device manufacturer (not by a material Supplier or the Contractor) is submitted to the Engineer for approval and
55 addresses the following:

- 56 1. Identity of the specific Contract on which the alternative criteria and/or system will apply.
- 57 2. Description of the alternative criteria and/or system.
- 58 3. Technical data and test reports.
- 59 4. The conditions under which the alternative criteria may be followed.

5. That a design based on the alternative criteria will not overstress or over deflect any shoring component or device nor reduce the required safety factor.

Where the falsework drawings detail a manufactured product and the manufacturer's safe working load, load versus deflection curves, factor of safety, and installation requirements cannot be found in any catalog, the Engineer may require load testing per Section 6-02.3(17)G to verify the safe working load and deflection characteristics.

Tower leg loads must not exceed the limiting values under any loading condition or sequence. Frame extensions and any reduced capacity must be shown in the falsework plans. Screw jacks must fit tight in the leg assemblies without wobble. Screw jacks must be plumb and straight. Shoring towers must be installed plumb, and load distribution beams must be arranged such that vertical loads are distributed to all legs for all successive concrete placements. There must be no eccentric loads on shoring tower heads unless the heads have been designed for such loading. Shoring towers must remain square or rectangular in plan view and must not be skewed. There must be no interchanging of parts from one manufactured shoring system to another. Do not use bent or faulty components.

For manufactured shoring towers that allow ganging of frames, the number of ganged frames must be limited to 1 frame per opposing side of a tower, and the total number of legs per ganged tower must not exceed 8 legs. Ganged frames must be installed per the manufacturer's published standards using the manufacturer's components. Do not use other gang arrangements.

For manufactured steel shoring tower systems, the Contractor must have bracing designed and installed for horizontal loads and falsework overturning per Section 6-02.3(17)A. Minimum bracing criteria and allowable leg loads are described in the following paragraphs.

All shoring tower systems and bracing must be thoroughly inspected by the Contractor for plumb vertical support members, secure connections, and straight bracing members immediately before, at intervals during, and immediately after every concrete placement. For manufactured shoring tower systems, the maximum allowable deviation from the vertical is 1/8 inch in 3 feet. If this tolerance is exceeded, concrete must not be placed until adjustments have brought the shoring towers within the acceptable tolerance.

6-02.3(17)D5 CROSS-BRACED TYPE BASE FRAMES

The maximum allowable load per leg for cross-braced type base frame shoring is limited by the height of the extension frame and the type of screw jack, swivel or fixed head, used at the top of the frame. The maximum load on 1 leg of a frame must not exceed 4 times the load on the other leg under any loading condition or sequence. The maximum load on 1 of the 2 frames making up a tower must not exceed 4 times the load on the opposite frame under any loading condition or sequence. If swivel-head screw jacks are used, the allowable leg loads must not exceed that specified in the following table:

| Maximum Allowable Leg Load in Pounds | | | |
|---|--------------|--------------|--------------|
| Extension Frame Height | 2'-0" | 3'-0" | 4'-0" |
| Screw height 12" or less | 11,000 | 11,000 | 10,000 |
| Screw height exceeds 12" | 8,200 | 8,200 | 8,000 |

If fixed-head screw jacks are used at the top of the extension frame, the maximum allowable load per leg must be 11,000 pounds for all extension frame heights up to 5 feet with screw jack height extensions of 12 inches or less. Fixed-head screw jacks exceeding 12 inches must use the values in the table above. Screw jack extensions must not exceed the manufacturer's published recommendations. Extension frames must be braced. Side cross-braces are required for extension heights up to 2 feet. Both side and end cross-braces are required from over 2'-0" to 5'-0" extension heights.

Supplemental bracing must be installed on shoring towers 20 feet or more in height and must connect rows of towers to each other so rows of frames are continuously cross-braced in 1 plane. Supplemental bracing must be installed as follows:

- In the transverse direction (the direction parallel to the frame) 1 horizontal brace and 1 diagonal brace must be attached to each tower face, for every 3 frames of shoring height, including an extension frame if used. The lowest horizontal brace must be located near the top of the third tower frame, and any additional horizontal braces spaced no farther than 3 frames apart. The diagonal braces must be on opposite tower faces, and must run in opposite directions across the plane of the tower row.
- In the longitudinal direction (the direction perpendicular to the frames), when shoring height is 4 frames or more, a horizontal brace must be installed on 1 face of each tower, with the lowest brace located no higher than the top of the fourth frame and any additional horizontal braces spaced no farther than 4 frames apart. When shoring height is 6 frames or more, diagonal cross-bracing must be installed in the longitudinal direction similar to the transverse direction.
- When roadway grade, soffit profile, or superelevation exceeds 4 percent slope for any height of shoring tower, a continuous brace parallel to the slope must be attached to each frame extension or screw jack of the tower within 6 inches of the top. These braces must be in addition to bracing previously described.

The bracing must be fastened securely to each frame leg and must be located within 6 inches of the frame member intersections. Do not attach the ends of diagonal braces to shoring frames at locations where towers have little or no load. Diagonal brace ends must be attached to tower frames near the top and bottom at locations where significant gravity load is

1 maintained throughout all construction sequences, such as directly below box girder outside webs precluding lift-off due to the
2 vertical component of the brace reaction. Supplemental bracing must be shown in the falsework drawings. The connection
3 details, including the method of connection and exact location of the connecting devices per the manufacturer's
4 recommendations and must be shown in the falsework drawings.

5 **6-02.3(17)D6 LADDER TYPE BASE FRAMES**

6 Ladder type base frame shoring must be limited to the following maximum loads and conditions, regardless of any
7 conflicting information which may be found in manufacturer's catalogs or brochures:

- 8 1. If the shoring system consists of a single tier of braced base frames, leg loads must not exceed 10,000 pounds.
- 9 2. If the shoring system consists of 2 or 3 tiers of base frames, leg loads must not exceed 7,500 pounds.
- 10 3. If an extension staff is used, the maximum allowable leg load must be reduced to 6,000 pounds.
- 11 4. The maximum load on 1 leg of a frame must not exceed 4 times the load on the other leg under any loading condition
12 or sequence. The maximum load on 1 of the 2 frames making up a tower must not exceed 4 times the load on the
13 opposite frame under any loading condition or sequence.

14 Maximum allowable leg loads as shown above must apply when fixed-head screw jacks are used, or when swivel-head
15 jacks are used at either the top or bottom of the tower. A screw jack extension must not exceed 12 inches. Swivel-head screw
16 jacks must not be used at both the top and bottom of ladder-type frames. For any combination of ladder-type base frames or
17 base frames with staff extensions, the total height of the shoring must not exceed 20 feet, including screw jack extensions.

18 When roadway grade, soffit profile, or superelevation exceeds 4 percent slope for heights of shoring towers 20 feet or
19 less, a continuous brace parallel to the slope must be attached to each staff extension or screw jack of the tower within 6
20 inches of the top. These braces must be attached per conditions described previously for cross-braced frames.

21 **6-02.3(17)D7 INTERMEDIATE STRENGTH SHORING**

22 Steel shoring, consisting of cross-braced tubular members capable of carrying up to 25 kips per tower leg, is considered
23 intermediate strength shoring. The use of a 25-kip type falsework shoring system must comply with the following conditions
24 and limitations:

- 25 1. If swivel-head screw jacks are used at either the top or bottom of the tower, the maximum allowable load must be
26 reduced to 20 kips per tower leg.
- 27 2. The screw-jack extensions must not exceed 14 inches.
- 28 3. Extension frames must be braced. Side cross-braces are required for all extension-frame heights. End cross-braces
29 (braces across the face of the extension frame) must be provided for extension frame heights of 3 feet or more.
- 30 4. The maximum load on 1 leg of a frame, or on 1 frame of a tower must not exceed 4 times the load on the opposite leg
31 or frame under any loading condition or sequence.
- 32 5. Shoring towers 20 feet or more in height must have supplemental bracing installed per the criteria for bracing "Cross-
33 braced Type Base Frames," except that no supplemental bracing will be required in the longitudinal direction (the
34 direction perpendicular to the frame).
- 35 6. When roadway grade, soffit profile, or superelevation exceeds 4 percent slope for any height of shoring tower, a
36 continuous brace parallel to the slope must be attached to each frame extension or screw jack of the tower within 6
37 inches of the top. These braces must be in addition to bracing required in item 5.

38 The use of 25-kip shoring, when designed and erected in conformance with the above criteria, is acceptable for tower
39 heights up to 5 frames plus a fully-extended extension frame plus the maximum allowable screw-jack adjustment. For any
40 proposed use exceeding this limiting height, the Contractor must furnish a statement signed by the shoring manufacturer
41 covering the specific installation. The statement must provide assurance that the shoring will carry the loads to be imposed
42 without overstressing any shoring component or reducing the required safety factor.

43 **6-02.3(17)D8 HEAVY-DUTY SHORING SYSTEMS**

44 Shoring capable of carrying up to 100 kips per tower leg is considered heavy-duty shoring. The following criteria applies
45 to these systems.

46 If tower legs, including any extension unit, are used as single-post shores braced in one direction only, the shores must
47 be analyzed as individual steel columns.

48 If the total height of the shoring does not exceed the height of a single tower unit, including any extension unit, and if both
49 the base and extension units are fully braced in both directions per the manufacturer's recommendations, individual tower legs
50 may be considered as capable of carrying the safe working load recommended by the manufacturer without regard to the load
51 on adjacent legs.

52 If the shoring consists of 2 or more units stacked 1 above the other, either with or without an extension unit, the
53 differential leg loading within a tower unit must not exceed the following limitations:

54

Differential Leg Loading

| Maximum load on any leg in the tower unit | Maximum to Minimum load ratio |
|---|-------------------------------|
| 10 kips or less | 10-1 |
| 10 kips to 50 kips | 6-1 |
| 50 kips to 75 kips | 5-1 |
| 75 kips or more | 4-1 |

A complete stress analysis of steel beams used as continuous caps over 2 or more tower units must be performed to determine the effect of continuity on tower leg loads. Resulting moment shear must be added to or subtracted from the simple beam reaction to obtain the actual leg load and may produce a significant load differential.

Heavy-duty shoring must be diagonally braced or otherwise externally supported at the top unless the towers are stable against overturning as defined in Section 6-02.3(17)A. When designing external bracing, including cable bracing, attention must be given to the bracing connection to the falsework. Connections must be designed to transfer horizontal and vertical forces from the falsework to the bracing system without overstressing any tower component. All external bracing, attachment locations, and connection details must be shown in the falsework plans.

6-02.3(17)E STRINGERS, BEAMS, JOISTS, BRIDGE DECK SUPPORT, AND DECK OVERHANGS

All stringers, beams, joists, and bridge deck support must be designed for the design loads, deflections, and allowable stresses described in the preceding Sections 6-02.3(17)A, 6-02.3(17)B, and 6-02.3(17)C and for the following conditions.

At points of support, stringers, beams, joists, and trusses must be restrained against rotation about their longitudinal axis. The effect of biaxial bending must be investigated where falsework beams are not set plumb and the Structure cross-slope exceeds 3 percent.

For box girder and T-beam bridges, the centerline of falsework beams or stringers must be located within 2 feet of the bridge girder stems and preferably directly under the stems or webs. Stringers supporting formwork for concrete box girder and T-beam slab overhangs must be stiff enough so the differential deflection due to the bridge deck pour is no more than 3/16 inch between the outside edge of the bridge deck and the exterior web even if camber strips can compensate for the deflection.

Friction must not be relied on for lateral stability of beams or stringers. If the compression flange of a beam is not laterally restrained, the allowable bending stress must be reduced to prevent flange buckling. If flange restraint is provided and since it is impossible to predict the direction in which a compression flange will buckle, positive restraint must be provided in both directions. Flange restraint must be designed for a minimum load of 2 percent of the calculated compression force in the beam flange at the point under consideration.

Use camber strips to compensate for falsework take-up and deflection, vertical alignment, and the anticipated Structure dead load deflection shown on the camber diagram in the Drawings. Camber is the adjustment to the profile of a load-supporting beam or stringer so the completed Structure will have the lines and grades shown on the Drawings. The dead load camber diagram shown on the Drawings is the predicted Structure dead load deflection due to self-mass. This dead load camber must be increased by:

1. Quantity of anticipated falsework take up.
2. Anticipated deflection of the falsework beam or stringer under the actual load imposed.
3. Any vertical curve payment.

Camber strips must be fastened by nailing to the top of wood members, or by clamping or banding in the case of steel members. Camber strips must have sufficient contact bearing area to prevent crushing under total load. As a general rule, camber strips are not required unless the total camber adjustment exceeds 1/4 inch for exterior falsework stringers and 1/2 inch for interior stringers.

On concrete box girder Structures, the forms supporting the bridge deck must rest on ledgers or similar supports and must not be supported from the bottom slab except as provided below. The form supports must be fastened within 18 inches of the top of the web walls, producing a clear span between web walls. The bridge deck forms may be supported or posted from the bottom slab if the following conditions are met:

- a. Permanent access, shown on the Drawings, is provided to the cells, and the centerline to centerline distance between web walls is greater than 10 feet.
- b. Falsework stringers designed for total load, stresses and deflections per Section 6-02.3(17)A and 6-02.3(17)B are located directly below each row of posts.
- c. Posts have adequate lateral restraint.
- d. All forms, including the bridge deck forms, posts, and bracing are completely removed.

The falsework and forms on concrete box girder Structures supporting a sloping web and deck overhang must consist of a lateral support system designed to resist all rotational forces acting on the stem, including those caused by placing deck slab concrete, bridge deck formwork mass, finishing machine, and other live loads. Stem reinforcing steel must not be stressed by

1 constructing the bridge deck slab placement. Overhang brackets must not be used for the support of bridge deck forms from
2 sloping web concrete box girder bridges.

3 Deck slab forms between girders or webs must be constructed such that there is no differential settlement relative to the
4 girders. The support systems for form panels supporting concrete deck slabs and overhangs on girder bridges (such as steel
5 plate girders and prestressed girders) must be designed as falsework. Falsework supporting deck slabs and overhangs on
6 girder bridges must be supported directly by the girders so there will be no differential settlement between the girders and the
7 deck forms during placement of deck concrete.

8 **6-02.3(17)F BRACING**

9 All falsework bracing systems must be designed to resist the horizontal design load in all directions with the falsework in
10 either the loaded or unloaded condition. All bracing, connection details, specific locations of connections, and hardware used
11 must be shown in the falsework plans. Falsework diagonal bracing must be thoroughly analyzed with particular attention given
12 to the connections. The allowable stresses in the diagonal braces may be controlled by the joint strength or the compression
13 stability of the diagonal. Timber bracing for timber falsework bents must have connections designed as specified in Section 6-
14 02.3(17)I. Any damaged cross-bracing, such as split timber members must be replaced. Steel strapping must avoid making
15 sharp angles or right-angle bends. A means of preventing accidental loss of tension must be provided for steel strapping. See
16 Sections 6-02.3(17)A, 6-02.3(17)B, and 6-02.3(17)C for design loads and allowable stresses.

17 Bracing must not be attached to concrete traffic barrier, guardrail posts, or guardrail.

18 To prevent falsework beam or stringer compression flange buckling, cross-bracing members and connections must be
19 designed to carry tension and compression. All components, connection details and specific locations must be shown in the
20 falsework plans. Bracing, blocking, struts, and ties required for positive lateral restraint of beam flanges must be installed at
21 right angles to the beam in plan view. If possible, bracing in adjacent bays must be set in the same transverse plane. However,
22 if because of skew or other considerations, it is necessary to offset the bracing in adjacent bays, the offset distance must not
23 exceed twice the depth of the beam.

24 All falsework and bracing must be inspected by the Contractor for plumbness of vertical support members, secure
25 connections, tight cables, and straight bracing members immediately before, during, and immediately after every concrete
26 placement.

27 Bracing must be provided to withstand all imposed loads during erection of the falsework and all phases of construction
28 for falsework adjacent to any roadway, sidewalk, or railroad track open to the public. All details of the falsework system which
29 contribute to horizontal stability and resistance to impact, including the bolts in bracing, must be installed when each element
30 of the falsework is erected and must remain in place until the falsework is removed. The falsework plans must show provisions
31 for any supplemental bracing or methods to be used to conform to this requirement during each phase of erection and
32 removal. Wind loads must be included in the design of such bracing or methods. Loads, connections, and materials for
33 falsework adjacent to roadways, must also be as specified in Section 6-02.3(17)C.

34 **6-02.3(17)F1 CABLE OR TENSION BRACING SYSTEMS**

35 When cables, wire rope, steel rod, or other types of tension bracing members are used as external bracing to resist
36 horizontal forces, or as temporary bracing to support bents while falsework is being erected or removed adjacent to traffic, all
37 elements of the bracing system must be shown on the falsework plans. Bracing must not be attached to concrete traffic
38 barrier, guardrail posts, or guardrail. Any damaged bracing, such as frayed and kinked guying systems must be replaced. Wire
39 rope must avoid making sharp angles or right-angle bends and a means of preventing accidental loss of tension must be
40 provided. The following information must be submitted to the Engineer for approval:

- 41 1. Cable diameter, rod, or tension member size, and allowable working load.
- 42 2. Location and method of attaching the cable, rod, or tension member to the falsework. The connecting device must be
43 designed to transfer both horizontal and vertical forces to the cable without overstressing any falsework component.
- 44 3. The type of cable connectors or fastening devices (such as U-bolt clips or plate clamps) to be used and the efficiency
45 factor for each type. If cables are to be spliced, the splicing method must be shown.
- 46 4. Method of tightening cables, rods, or tension members after installation if tightening is necessary to ensure their
47 effectiveness. Method of preventing accidental loosening.
- 48 5. Anchorage details, including the size and mass of concrete anchor blocks, the assumed coefficient of friction for
49 surface anchorages, and the assumed lateral soil bearing capacity for buried anchorages.
- 50 6. Method of prestretching or preloading cable or tension members.
- 51 7. Determination of the potential stretch or elongation of the tension member under the design load and if the resulting
52 lateral deflection will cause excessive secondary stresses in the falsework.

53 Copies of manufacturer's catalog or brochure showing technical data pertaining to the type of cable to be used must be
54 furnished with the falsework plans. Technical data must include the cable diameter, the number of strands and the number of
55 wires per strand, ultimate breaking strength or recommended safe working strength, and any other information to identify the
56 cable.

57 Absent sufficient technical data to identify the cable, or if it is old and worn, the Contractor must perform cable breaking
58 tests to establish the safe working load for each reel of cable furnished. For static guy cable the minimum factor of safety must
59 be 3:1. The Contractor must provide the Engineer an opportunity to witness these tests.

1 When cable bracing is used to prevent the overturning of heavy-duty shoring, attention must be given to the connections
2 by which forces are transferred from the shoring to the cables. Cable restraint must be designed to act through the cap system
3 to prevent the inadvertent application of forces which the shoring is not designed to withstand. Cables must be attached to any
4 tower component.

5 Do not use cable splices made by lapping and clipping with Crosby type clamps. Other splicing methods may be used;
6 however, at each location where the cable is spliced, cable strength must be verified by a load test.

7 When cables are used as external bracing to resist overturning of a falsework system, the horizontal load to be carried by
8 the cables must be calculated as follows:

- 9 a. When used with heavy-duty shoring systems, cables must be designed to resist the difference between 1.25 times
10 the total overturning moment and the resistance to overturning provided by the individual falsework towers.
- 11 b. When used with pipe-frame shoring systems where supplemental bracing is required, cables must be designed to
12 resist the difference between 1.25 times the total overturning moment and the resistance to overturning provided by
13 the shoring system as a whole.
- 14 c. When used as external bracing to prevent overturning of all other types of falsework, including temporary support
15 during erection and removal of falsework at traffic openings, cables must be designed to resist 1.25 times the total
16 overturning moment.

17 Determine the maximum allowable cable design load using these criteria:

- 18 1) If the cable is new, or is in uniformly good condition, and if it can be identified by reference to a manufacturer's
19 catalog or other technical publication, the allowable load must be the ultimate strength of the cable as specified by the
20 manufacturer, multiplied by the efficiency of the cable connector, and divided by a safety factor of 3, i.e. safe working
21 load = breaking strength x connector efficiency/safety factor.
- 22 2) If the cable is used but still in serviceable condition, or is new or nearly new but cannot be found in a manufacturer's
23 catalog, the Contractor must perform load breaking tests. The cable design load must not exceed the breaking
24 strength, as determined by the load test, multiplied by the connector efficiency factor, and divided by a safety factor of
25 3.
- 26 3) If the cable is used and still in serviceable condition, or is a new or nearly new cable which cannot be identified, and if
27 load breaking tests are not performed, the cable design load must not exceed the safe working load described in the
28 wire rope capacities table multiplied by the cable connector efficiency.

29 Cable connectors must be designed using criteria described in the following table Efficiency of Wire Rope Connections
30 and in Section 6-02.3(17)F2. Cable safe working loads are provided in the table Wire Rope Capacities.

31
32 **Efficiency of Wire Rope Connections**

| Type of Connection | Connector Efficiency |
|--|----------------------|
| Wire Rope | 100% |
| Sockets — Zink Type | 100% |
| Wedge Sockets | 70% |
| Clips — Crosby Type With Thimble | 80% |
| Knot and Clip (Contractors Knot) | 50% |
| Plate Clamp — 3 Bolt Type With Thimble | 80% |
| Spliced Eye and Thimble: | — |
| 1/4" and smaller | 100% |
| 3/8" to 3/4" | 95% |
| 7/8" to 1" | 88% |
| 1 1/8" to 1-1/2" | 82% |
| 1 5/8" to 2" | 75% |
| 2 1/8" and larger | 70% |

33 NOTE: Efficiencies of wire rope connections are as compared to safe loads on wire rope.

34
35 **Wire Rope Capacities**

| Diameter Inches | Weight Lbs/Ft | Safe Load Lbs |
|-----------------|---------------|---------------|
| 1/4 | 0.10 | 1,050 |
| 5/16 | 0.16 | 1,500 |
| 3/8 | 0.23 | 2,250 |
| 7/16 | 0.31 | 3,070 |

| Diameter Inches | Weight Lbs/Ft | Safe Load Lbs |
|-----------------|---------------|---------------|
| 1/2 | 0.40 | 4,030 |
| 9/16 | 0.51 | 4,840 |
| 5/8 | 0.63 | 6,330 |
| 3/4 | 0.95 | 7,930 |
| 7/8 | 1.29 | 10,730 |
| 1 | 1.60 | 15,000 |
| 1 1/8 | 2.03 | 18,600 |
| 1 1/4 | 2.50 | 23,000 |
| 1 3/8 | 3.03 | 25,900 |
| 1 1/2 | 3.60 | 30,700 |
| 1 5/8 | 4.23 | 35,700 |
| 1 3/4 | 4.90 | 41,300 |

NOTE; Wire rope capacity safe loads are in pounds for new plow steel hoisting rope, 6 strands of 19 wires, hemp center (safety factor of 6).

6-02.3(17)F2 APPLYING WIRE ROPE CLIPS

The only correct method of attaching U-bolt wire rope clips to rope ends is to place the base (saddle) of the clip against the live end of the rope, while the "U" of the bolt presses against the dead end.

The clips are usually spaced about 6 rope diameters apart to give adequate holding power. Use a wire-rope thimble in the loop eye to prevent kinking when wire rope clips are used. The correct number of clips for safe application, and spacing distances, are shown below:

Number of Clips and Spacing for Safe Application

| Improved Plow Steel Rope Diameter Inches | Number of Clips | | Minimum Spacing (Inches) |
|--|-----------------|----------------|--------------------------|
| | Drop Forged | Other Material | |
| 3/8 | 2 | 3 | 3 |
| 1/2 | 3 | 4 | 3 1/2 |
| 5/8 | 3 | 4 | 4 |
| 3/4 | 4 | 5 | 4 1/2 |
| 7/8 | 4 | 5 | 5 1/4 |
| 1 | 5 | 6 | 6 |
| 1 1/8 | 6 | 6 | 6 3/4 |
| 1 1/4 | 6 | 7 | 7 1/2 |
| 1 3/8 | 7 | 7 | 8 1/4 |
| 1 1/2 | 7 | 8 | 9 |

6-02.3(17)F3 ANCHOR BLOCKS

Concrete anchor blocks and connections used to resist forces from external bracing must be shown in the falsework plans. Concrete anchor blocks must be proportioned to resist both sliding and overturning. When designing anchor block stability, the mass of the anchor block must be reduced by the vertical component of the cable or brace tension to obtain the net or effective mass to be used in the anchorage computations. The coefficient of friction assumed in the design must not exceed the following:

| Surface | Friction Coefficient |
|------------------------------|----------------------|
| Anchor block set on sand | 0.40 |
| Anchor block set on clay | 0.50 |
| Anchor block set on gravel | 0.60 |
| Anchor block set on pavement | 0.60 |

1 NOTE: Multiply the friction coefficient by 0.67 if it is likely the supporting material is wet or will become wet during the
2 construction period.

3
4 The method of connecting the cable or brace to the anchor block is part of the anchor block design. The connection must
5 be designed to resist both horizontal and vertical forces.

6 **6-02.3(17)F4 TEMPORARY BRACING FOR BRIDGE GIRDERS DURING ERECTION**

7 Steel girders must be braced as specified in Section 6-03.3(7)A.

8 Prestressed concrete girders must be braced sequentially during girder erection. The bracing must be designed and
9 detailed by the Contractor and must be shown in the falsework/formwork plans submitted to the Engineer for approval. The
10 Contractor must furnish, install, and remove the bracing at no additional cost to the Owner.

11 At a minimum, the Contractor must brace girders at each end and at midspan to prevent lateral movement or rotation.
12 This bracing must be placed before the release of each girder from the erection equipment. If the bridge is constructed with
13 cast-in-place concrete diaphragms, the bracing may be removed once the concrete in the diaphragms has been placed and
14 cured for a minimum of 24 hours.

15 **6-02.3(17)F5 TEMPORARY BRACING FOR BRIDGE GIRDERS DURING DIAPHRAGM AND BRIDGE DECK** 16 **CONCRETE PLACEMENT**

17 Prestressed concrete girders must be braced to resist forces that would cause rotation or torsion in the girders caused by
18 the placing of precast concrete deck panels and concrete for the bridge deck.

19 Bracing must be designed and detailed by the Contractor and must be shown in the falsework/formwork plans submitted
20 to the Engineer for approval. These braces must be furnished, installed, and removed by the Contractor at no additional cost
21 to the Owner. The Contractor may consider the bracing effects of the diaphragms in developing the falsework/formwork plans.
22 The Contractor must account for the added load from concrete finishing machines and other construction loadings in the
23 design of the bracing.

24 Falsework support brackets and braces must not be welded to structural steel bridge members or to steel reinforcing
25 bars.

26 **6-02.3(17)G TESTING FALSEWORK DEVICES**

27 The Contractor must establish the load capacity and deflection or settlement of all friction collars and clamps, brackets,
28 hangers, saddles, sand jacks, and similar devices using a recognized independent testing Laboratory approved by the
29 Engineer. Laboratory tests must use the same materials and design that will be used on the project. Test loads must be
30 applied to the device in the same manner that the device will experience loading on the project. Any bolts or threaded rods
31 used with the device must be identified as to diameter, length, type, grade, and torque. Any wedges, blocks, or shims used
32 with the device on the project must also be tested with the device. Any adjustable jack system used as a part of a device must
33 be tested with the device and must have its maximum safe working extended height identified. Devices must not be tested in
34 contact with the permanent Structure. Use independent members with the same properties as the permanent Structure to test
35 device connections.

36 At least 14 Days before the test, the Contractor must submit a test procedure and scale drawing for the Engineer's
37 approval showing how the device will be tested and how data will be collected. The Contractor must provide the Engineer an
38 opportunity to witness these tests.

39 The approved independent testing Laboratory must provide a certified test report which must be signed and dated. The
40 test report must clearly identify the device tested including trademarks and model numbers; identify all parts and materials
41 used, including grade of steel, or lumber, member section dimensions; location, size, and the maximum tested extended
42 height of any adjustable jacks; indicate condition of materials used in the device; indicate the size, length and location of all
43 welds; indicate how much torque was used with all bolts and threaded rods. The report must describe how the device was
44 tested, report the results of the test, provide a scale drawing of the device showing the location of where deflections or
45 settlements were measured, and show where load was applied. Deflections or settlements must be measured at load
46 increments and the results must be clearly graphed and labeled. Before installation of falsework devices named in this
47 Section, the Contractor must submit the certified test reports to the Engineer for review and approval.

48 The safe working load for shop manufactured devices named in this Section must be derived by dividing the ultimate
49 strength by a safety factor of 2.0. Determine the safe working load for field produced or field modified devices, including using
50 timber blocks or wedges with the device, by dividing the ultimate strength by a safety factor of 3.0. Working load must include
51 masses of all successive concrete placements, falsework, forms, all load transfer that takes place during post-tensioning, and
52 any live loads; such as workers, roadway finishing machines, and concrete delivery systems. The maximum allowable free end
53 deflection of deck overhang brackets with combined dead and live working loads applied is 3/16 inch even though deflection
54 may be compensated for by precambering or setting the elevations high. The Contractor must comply with all manufacturer's
55 Specifications; including those relating to bolt torque, cleaning and oiling of parts, and the reuse of material. Devices which are
56 deteriorated, bent, warped or have poorly fitted connections or welds, must not be installed.

6-02.3(17)H FORMWORK ACCESSORIES

Formwork accessories such as form ties, form anchors, form hangers, anchoring inserts, and similar hardware must be specifically identified in the formwork plans including the name and size of the hardware, manufacturer, safe working load, and factor of safety. The grade of steel must also be indicated for threaded rods, coil rods, and similar hardware. Do not use wire form ties.

Welding or clamping formwork accessories to Contract Plan reinforcing steel is not allowed. Do not use driven types of anchorages for fastening forms or form supports to concrete, or Contractor manufactured J hooks. Field drilling of holes in prestressed girders is not allowed.

Taper ties may be used provided the following conditions are met:

1. The structure is not designed to resist water pressure, such as pontoons, floating dolphins, or detention vaults.
2. After the taper tie is removed, plugs designed and intended for plugging taper tie holes must be installed at each face of concrete. The plug must be installed a minimum of 1-1/2" clear from the face of concrete.
3. After the plug is installed, the hole must be cleaned of all grease, contamination and foreign matter.
4. Holes on the exposed faces of concrete must be patched and finished to match the surrounding concrete

The following table from ACI 347R-88 provides minimum safety factors for formwork accessories. The hardware proposed must comply with these minimum ultimate strength requirements or the manufacturer's minimum requirements, whichever provides the greater factor of safety. The Contractor must attach copies of the manufacturer's catalog cuts and/or test data of hardware proposed, to the formwork plans and submit the falsework and formwork plans and calculations for review and approval per Section 6-02.3(16). Where catalog cuts and/or test data are not available, testing must be performed as specified in Section 6-02.3(17)G.

Minimum Safety Factors of Formwork Accessories¹

| Accessory | Safety Factor | Type of Construction |
|-------------------|---------------|---|
| Form Tie | 2.0 | All applications. |
| Form Anchor | 2.0 | Formwork supporting form mass and concrete pressures only. |
| Form Anchor | 3.0 | Formwork supporting masses of forms, concrete, construction live loads, and impact. |
| Form Hangers | 2.0 | All applications. |
| Anchoring Inserts | 2.0 | Placed in previous opposing concrete placement to act as an anchor for form tie. |

NOTE:

1. Safety factors are based on ultimate strength of the formwork accessory.

The bearing area of external holding devices must be adequate to prevent excessive bearing stress on form lumber. Form ties and form hangers must be arranged symmetrically on the supporting members to minimize twisting or rotation of the members. Form tie elongation must not exceed the allowable deflection of the wale or member it supports. Inserts, bolts, coil rods, and other fasteners must be analyzed and designed for appropriately combined bending, shear, torsion, and tension stresses. The formwork must not be attached to Contract Plan rebar or rebar cages. However, the Contractor may install additional reinforcing steel for formwork anchorage.

Frictional resistance is not considered as contributing to the stability of any connection or connecting device, except those designed as friction connectors such as U-bolt friction-type connectors.

Form anchors and anchoring inserts must be designed considering concrete strength at time of loading, available embedment, location in the member, and any other factors affecting their working strength, and must be installed in concrete per the manufacturer's published requirements. Form anchors and anchoring inserts embedded in previous concrete placements must not be loaded until the concrete has reached the required design strength. The required design strength of concrete for loading of an anchor must be shown on the formwork drawing if it is assumed that the anchor will be loaded before the concrete has reached its 28-Day strength.

Installation of permanent concrete inserts, such as form ties hangers, or embedded anchor assemblies, must allow removal of all metal to at least 1/2 inch below the concrete surface. Holes must be patched as specified in Section 6-02.3(14). During removal of the outer unit, the bond between the concrete and the inner unit or rod must not be broken.

6-02.3(17)I TIMBER CONNECTIONS

Timber connections must be designed per the methods, stresses, and loads allowed in the Timber Construction Manual, Current Edition by the American Institute of Timber Construction (AITC). Timber falsework and formwork connections must be designed using wet condition stresses for all installations West of the Cascade Range crest line and by criteria provided in the following Sections. Frictional resistance is not considered as contributing to the stability of any timber connection.

6-02.3(17)I1 BOLTED CONNECTIONS

Tabulated values in the AITC Timber Construction Manual, Current Edition are based on square posts. For a round post or pile, the main member thickness must be the side of a square post having the same cross-sectional area as the round post used.

The AITC Table 6.20 for Douglas Fir-Larch bolt Group 3 and for Hem-Fir bolt Group 8 show design values for bolts to be used when the load is applied either parallel or perpendicular to the direction of the wood grain. When the load is applied at an angle to the grain, as is the case with falsework bracing, the design value for the main member must be obtained from the Hankinson formula described in the AITC manual.

Design values in the AITC Table 6.20 apply only to 3 member joints (bolt in double-shear) in which the side members are each 1/2 the thickness of the main member. This joint configuration is not typical of bridge falsework where side members are usually much smaller than main members. For 2 member joints (single shear bolt condition), the AITC Table 6.20 values must be adjusted by a single shear load factor as follows:

1. 0.75 for installations East of the Cascade Range crest line, except as described in item 3 below;
2. 0.50 for installations West of the Cascade Range crest line; and
3. 0.50 for load acting at an angle to the bolt axis, as is the case with longitudinal bracing when falsework bents are skewed.

Except for connections in falsework adjacent to or over railroads or roadways, threaded rods and coil rods may be used in place of bolts of the same diameter with no reduction in the tabulated values. At openings for roadways and railroads, all connections must be bolted using 5/8-inch diameter or larger through bolts.

Bolt holes must be a minimum 1/32 inch to a maximum 1/8 inch larger than the bolt diameter. A washer not less than a standard cut washer must be installed between the wood and the bolt head and between the wood and the nut to distribute the bearing stress under the bolt head and nut and to avoid crushing the fibers. Instead of standard cut washers, metal plates or straps with dimensions at least equal to that of a standard cut washer may be substituted.

When steel bars or shapes are used as diagonal bracing, the tabulated design values described in AITC Table 6.20 for the main members loaded parallel to grain (P value) are increased 75 percent for joints made with bolts 1/2-inch or less in diameter, 25 percent for joints made with bolts 1-1/2-inch in diameter, and proportionally for intermediate diameters. No increase in the tabulated values is allowed for perpendicular-to-grain loading (Q value).

Clearance requirements for end, edge, and bolt spacing distance must be as shown below. All distances are measured from the end or side of the wood member to the center of the bolt hole. For members subject to load reversals, use the larger controlling distances for design. For parallel-to-grain loading, use the minimum distances for full design load:

- a. In tension, minimum end distance must be 7 times the bolt diameter;
- b. In compression, minimum end distance must be 4 times the bolt diameter; and
- c. In tension or compression, the minimum edge distance must be 1.5 times the bolt diameter.

For perpendicular-to-grain loading, the minimum distance for full design load:

- 1) Minimum end distance must be 4 times the bolt diameter;
- 2) Edge distance toward which the load is acting must be at least 4 times the bolt diameter; and
- 3) Distance on the opposite edge must be at least 1.5 bolt diameters.

Minimum clearance (spacing) between adjacent bolts in a row must be 4 times the bolt diameter, measured center-to-center of the bolt holes.

When more than 2 bolts are used in a line parallel to the axis of the side member, additional requirements must be followed as described in the AITC manual.

6-02.3(17)I2 LAG SCREW CONNECTIONS

Design values for lag screws subject to withdrawal loading are found in AITC Table 6.27. Values for wood having a specific gravity of 0.51 for Douglas Fir-Larch or 0.42 for Hem-Fir must be assumed when using the table. The withdrawal values are in pounds per inch of penetration of the threaded part of the lag screw into the side grain of the member holding the point, with the axis of the screw perpendicular to that member. The maximum load on a screw must not exceed the allowable tensile strength of the screw at the root section.

AITC recommends against subjecting lag screws to end-grain withdrawal loading. However, if this condition cannot be avoided, the design value must be 75 percent of the corresponding value for withdrawal from the side grain.

Use values in the Group II wood species column must for Douglas Fir-Larch and the Group III wood species column must for Hem-Fir. When the load is applied at an angle to the grain, as is the case with falsework bracing, the design value must be obtained from the Hankinson formula described in the AITC manual.

When lag screws are subjected to a combined lateral and withdrawal loading, as would be the case with longitudinal bracing when the falsework bents are skewed, the effect of the lateral and withdrawal forces are determined separately. The withdrawal component of the applied load must not exceed the allowable value in withdrawal. The lateral component of the applied load must not exceed the allowable lateral load value.

Lag screws must be inserted in lead holes as follows:

- 1 1. The clearance hole for the shank must have the same diameter as the shank, and the same depth of penetration as
2 the length of unthreaded shank.
- 3 2. The lead hole for the threaded portion must have a diameter equal to 60 to 75 percent of the shank diameter and a
4 length equal to at least the length of the threaded portion. The larger percentile figure in each range must apply to
5 screws of the greater diameters used in Group II wood species.
- 6 3. The threaded portion of the screw must be inserted in its lead hole by turning with a wrench, not by driving with a
7 hammer.
- 8 4. To facilitate insertion, use soap or other lubricant on the screws or in the lead hole.

9 **6-02.3(17)I3 DRIFT PIN AND DRIFT BOLT CONNECTIONS**

10 When drift pins or drift bolts are used, determine the required length and penetration using the following criteria. The
11 lateral load-carrying capacity of drift pins and drift bolts driven into the side grain of a wood member must be limited to 75
12 percent of the design values for a common bolt of the same diameter and length in the main member. For drift pin
13 connections, the pin penetration into the connected members must be increased to compensate for the absence of a bolt head
14 and nut. For drift bolts or pins driven into the end grain of a member, the lateral load-carrying capacity must be limited to 60
15 percent of the allowable side grain load (perpendicular to grain value) for an equal diameter bolt with nut. To develop this
16 allowable load the drift bolt or pin must penetrate at least 12 diameters into the end grain. To fully develop the allowable load
17 of the drift bolts or pins, they must be driven into predrilled holes, 1/16 inch less in diameter than the drift pin or bolt diameter.

18 The criteria described in the AITC Timber Construction Manual, Current Edition must apply to drift bolt or pin connection
19 allowable loads for the following conditions:

- 20 1. Withdrawal resistance; and
- 21 2. When there are more than 2 drift bolts or pins in a joint, allowable loads must be further reduced by applying
22 applicable modification factors described in the AITC Table 6.3.

23 **6-02.3(17)I4 NAILED AND SPIKED JOINTS**

24 Joints using nails or spikes must conform to AITC. For side grain withdrawal, use the values in AITC Table 6.35 for wood
25 having a specific gravity of 0.51 for Douglas Fir-Larch and a specific gravity of 0.42 for Hem-Fir. Do not use end grain
26 withdrawal. For lateral loading, use the values in AITC Table 6.36 for wood species Group II for Douglas Fir-Larch and wood
27 species Group III for Hem-Fir. Diameters listed in the tables apply to fasteners before application of any protective coating.

28 When more than 1 nail or spike is used in a joint, the total design value for the joint in withdrawal or lateral resistance
29 must be the sum of the design values for the individual nails or spikes.

30 The tabulated design values for lateral loads are valid only when the nail penetrates into the main member at least 11
31 diameters for Douglas Fir-Larch and 13 diameters for Hem-Fir. Note the values are maximum values for the type and size of
32 fastener shown. The tabulated values must not be increased even if the actual penetration is exceeded.

33 When main member penetration is less than 11 diameters for Douglas Fir-Larch and 13 diameters for Hem-Fir,
34 determine the design value by straight-line interpolation between 0 and the tabulated load, except that penetration must not be
35 less than 1/3 of that specified.

36 Double-headed or duplex nails used in falsework and formwork construction are shorter than common wire nails or box
37 nails of the same size designation. They have less penetration into the main member and therefore their load-carrying capacity
38 must be adjusted accordingly.

39 Nail and spike minimum spacing in timber connections must be as follows:

- 40 1. The average center-to-center distance between adjacent nails, measured in any direction, must not be less than the
41 required penetration into the main member for the size of nail being used.
- 42 2. The minimum end distance in the side member, and the minimum edge distance in both the side member and the
43 main member, must not be less than 1/2 of the required penetration.

44 Allowable values for withdrawal and lateral load resistance are reduced when using toe nails, as follows:

- 45 a. For withdrawal loading, the design load must not exceed 2/3 of the value described in the applicable design table;
46 and
- 47 b. For lateral loading, the design load must not exceed 5/6 of the value described in the applicable design table.

48 Toe nails are recommended to be driven at an approximate angle of 30 degrees with the piece and started approximately
49 1/3 of the length of the nail from the end or side of the piece.

50 **6-02.3(17)I5 TIMBER CONNECTION ADJUSTMENT FOR DURATION OF LOAD**

51 Tabulated values for timber fasteners are for normal duration of load and may be increased for short duration loading,
52 except for connections used in falsework and formwork for post tensioned Structures and staged construction sequences.
53 Duration of load adjustment for timber connections is not allowed for all post tensioned Structures and for staged construction
54 sequences where delayed and/or staged loading occurs for any type of concrete Structure. The adjustment for duration of load
55 as described in this Section applies only to design values for timber connectors, such as nails, bolts, and lag screws. Allowable
56 stresses for timber and structural steel components used in the connection, as described in Section 6-02.3(17)B, are
57 maximums and must not be increased.

1 Tabulated values for nails, bolts, and lag screws may be adjusted by the following duration-of-load factors:

- 2 1. 1.25 for falsework design governed by the minimum design horizontal load or greater (3 percent or greater of the
- 3 dead load).
- 4 2. 1.33 for falsework design governed by wind load.
- 5 3. 2.00 for falsework design governed by impact loading.

6 **6-02.3(17)J FACE LUMBER, STUDS, WALES, AND METAL FORMS**

7 Elements of this Section must be designed for the loads, allowable stresses, deflections, and conditions described in the
8 entirety of Section 6-02.3(17).

9 Forms battered or inclined above the concrete will tend to lift up as concrete is placed and must have positive anchorage
10 or counterweights designed to resist uplift and must be shown on the formwork plans. Where the concrete pouring sequence
11 causes fresh concrete to be significantly higher along one side of tied forms than the opposite side, a positive form anchorage
12 system must be designed capable of resisting the imbalance of horizontal thrust, and prevent the dislocation and sliding of the
13 entire form unit.

14 Wooden forms must be faced with smooth sanded, exterior plywood. This plywood must comply with the requirements of
15 the National Bureau of Standards, U.S. Product Standard PS 1, and the Design Specification of the American Plywood
16 Association (APA). Each full sheet must bear the APA stamp. The Contractor must list in the form plans the grade and class of
17 plywood. If the Engineer approves the manufacturer's certification of structural properties, the Contractor may use plywood
18 that does not carry the APA stamp. Do not use plywood panels stamped shop or shop cutting.

19 Plyform is an APA plywood specifically designed and manufactured for concrete forming. Plyform differs from
20 conventional exterior plywood grades in strength and the exterior face panels are sanded smooth and factory oiled. Likewise,
21 there is a significant difference between grades designated Class 1, Class 2, and Structural I Plyform.

22 The grades of plywood for various form applications must be as follows:

- 23 1. Traffic and Pedestrian Barriers that will not receive an architectural surface treatment: must use APA grade High
24 Density Overlaid (HDO) Plyform Class I. But if the Contractor coats the form to prevent it from leaving joint and grain
25 marks on the surface, plywood that meets or exceeds APA grades B-B Plyform Class I or B-C (Group I species) may
26 be used. Under this option, the Contractor must provide for the Engineer's approval a 4-foot square, test panel of
27 concrete formed with the same plywood and coating as proposed in the form plans. This panel must include 1 form
28 joint along its centerline. The Contractor must apply coating material, according to the manufacturer's instructions,
29 before applying chemical release agents.
- 30 2. Other Exposed Surfaces all but those on traffic and pedestrian barriers: Use plywood that complies with or exceed
31 the requirements of APA grades B-B Plyform Class I or B-C (Group I series). If 1 face is less than B quality, the B, or
32 better, face must contact the concrete.
- 33 3. Unexposed Surfaces, such as the undersides of bridge decks between girders, or the interiors of box girders, and
34 traffic and pedestrian barriers where surfaces will receive an architectural treatment: May use APA grade CDX,
35 provided the Contractor complies with stress and deflection requirements stated elsewhere in these Specifications.

36 Form joints on an exposed surface must be in a horizontal or vertical plane. But in wingwalls and box girders, side form
37 joints must be placed at right angles and parallel to the roadway grade. Joints parallel to studs or joists must be backed by a
38 stud or joist. Joints at right angles to studs and joists must be backed by a stud or other backing the Engineer approves.
39 Perpendicular backing is not required if studs or joists are spaced:

- 40 a. 9 inches or less on center and covered with 1/2-inch plywood, or
- 41 b. 12 inches or less on center and covered with 3/4-inch plywood.

42 The face grain of plywood must run perpendicular to studs or joists unless shown otherwise on the Contractor's formwork
43 plans and approved by the Engineer. Proposals to deviate from the perpendicular orientation must be accompanied by
44 supporting calculations of the stresses and deflections.

45 Forming for all exposed curved surfaces must comply with the shape of the curve shown on the Drawings and must not
46 be chorded except as follows. On any retaining wall that follows a horizontal circular curve, the wall stems may be a series of
47 short chords if:

- 48 1) The chords within the panel are the same length, unless otherwise approved by the Engineer.
- 49 2) The chords do not vary from a true curve by more than 1/2 inch at any point.
- 50 3) All panel points are on the true curve.

51 Where architectural treatment is required, the angle point for chords in wall stems must fall at vertical rustication joints.

52 For exposed surfaces of abutments, wingwalls, piers, retaining walls, and columns, the Contractor must build forms of
53 plywood at least 3/4 inch thick with studs no more than 12 inches on center. The Engineer may approve exceptions, but
54 deflection of the plywood, studs, or wales must never exceed 1/360 of the span, or 1/270 of the span for unexposed surfaces,
55 including the bottom of the deck slab between girders.

56 All form plywood must be at least 1/2 inch thick. On sharply curved surfaces the Contractor may use 1/4 inch plywood if it
57 is backed firmly with heavier material.

1 Round columns or rounded pier shafts must be formed with a self-supporting metal shell form or form tube that leaves a
2 smooth, non-spiraling surface. Wood forms are not permitted.

3 Metal forms must not be used elsewhere unless the Engineer is satisfied with the surface and approves in writing. The
4 Engineer may withdraw approval for metal forms at any time. If permitted to use a combination of wood and metal in forms, the
5 Contractor must coat the forms so the texture produced by the wood matches that of the metal. Do not use aluminum for metal
6 forms.

7 For design, the Contractor must assume that on vertical surfaces concrete exerts 150 pounds per sq. ft., per foot of
8 depth. However, when the depth is reached where the rate of placement controls the pressure, the following table applies:
9

| Rate of Placing Feet per Hour | Pressure, Pounds per Square Foot for Temperature of Concrete as Shown | |
|----------------------------------|---|-----------------|
| | 60 °F | 70 °F and above |
| 2 | 470 | 375 |
| 3 | 640 | 565 |
| 4 | 725 | 625 |
| 5 | 815 | 690 |
| 6 | 900 | 750 |
| 7 | 990 | 815 |
| 8 | 1,075 | 875 |
| 9 | 1,165 | 935 |
| 10 | 1,250 | 1,000 |
| 15 | 1,670 | 1,300 |

10 The pressures in the above table have been increased to provide an allowance for the vibration and impact.

11 All corners must be beveled 3/4 inch. However, footings, footing pedestals, and seals need not be beveled unless
12 required in the Drawings.

13 All forms must be as mortar-tight as possible with no water standing in them as the concrete is placed.

14 The Contractor must apply a parting compound on forms for exposed concrete surfaces. This compound must be a
15 chemical release agent that permits the forms to separate cleanly from the concrete. The compound must not penetrate or
16 stain the surface, or must not attract dirt or other foreign matter. After the forms are removed, the concrete surface must be
17 dust-free and have a uniform appearance. The Contractor must apply the compound at the manufacturer's recommended rate
18 to produce a surface free of dusting action and yet provide easy removal of the forms.
19

20 If an exposed concrete surface will be sealed, the release agent must not contain silicone resin. Before applying the
21 agent, the Contractor must provide the Engineer a written statement from the manufacturer stating whether the resin in the
22 base material is silicone or non-silicone.

23 The Contractor must select a parting compound from the current Qualified Products List, or submit to the Engineer a
24 sample of the parting compound at least 10 Working Days before its use. Approval or disapproval must be based on
25 Laboratory test results.

26 The Engineer may reject any forms that will not produce a satisfactory surface.

27 **6-02.3(17)K CONCRETE FORMS ON STEEL SPANS**

28 Concrete forms on all steel Structures must be removable and must not remain in place. Where needed, the forms must
29 have openings for truss or girder members. Each opening must be large enough to leave at least 1-1/2 inches between the
30 concrete and steel on all sides of the steel member after the forms have been removed. Unit Contract prices cover all costs
31 related to these openings.

32 The Contractor must not weld any part of the form to any steel member.

33 The compression member or bottom connection of cantilever formwork support brackets must bear either within 6 inches
34 maximum vertically of the bottom flange or within 6 inches maximum horizontally of a vertical web stiffener. The Contractor's
35 bridge deck form system must be designed to prevent rotation of the steel girder. This can be achieved by temporary struts
36 and ties or other methods the Contractor shows to be effective. Do not use partial depth cantilever formwork support brackets
37 that do not conform to the above requirements, unless the Contractor submits details showing the additional formwork struts
38 and ties used to brace the steel girder against web distortion caused by the partial depth bracket, and receives the Engineer's
39 approval of the submittal.

40 If the Engineer permits bolt holes in the web to support form brackets, the holes must be shop drilled unless otherwise
41 approved by the Engineer. The Contractor must fill the holes with fully torqued AASHTO M 164 bolts per Section 6-03.3(33).
42 Each bolt head must be placed on the exterior side of the web. Do not make holes in the flanges.

1 6-02.3(17)L FINISHING MACHINE SUPPORT SYSTEM

2 Before using any finishing machine, the Contractor must obtain the Engineer's approval of detailed drawings that show
3 the system proposed to support it. The Contractor must not attach this or any other equipment support system to the sides or
4 suspend it from any girder unless the Engineer permits. The Engineer will not allow such a method if it will unduly change
5 stress patterns or create too much stress in the girder.

6 6-02.3(17)M RESTRICTED OVERHEAD CLEARANCE SIGN

7 The Contractor must notify the Engineer not less than 15 Working Days before the anticipated start of each falsework
8 and girder erection operation whenever such falsework or girders will reduce clearances available to traffic. Falsework
9 openings must not be more restrictive to traffic than shown on the Drawings.

10 Where the height of vehicular openings through falsework is less than 15 feet, a W 12-2 "Low Clearance Symbol Sign"
11 must be erected on the shoulder in advance of the falsework and 2 or more W 12-301 and/or W 12-302 signs must be
12 attached to the falsework to provide accurate usable clearance information over the entire falsework opening. The posted low
13 clearance must include an allowance for anticipated falsework girder deflection, rounded-up to the next whole inch, due to
14 design dead load, including all successive concrete pours. Use W 12-302 signs to designate prominent clearance restrictions
15 and limits of usable clearance. Where the clearance is less than the legal height limit (14'-0"), a W 12-2 sign must be erected
16 in advance of the nearest intersecting road or wide point in the road at which a vehicle can detour or turn around. A W 13-501
17 sign indicating the distance to the low clearance must be installed below the advance sign. The Engineer will furnish the above
18 noted signs and the Contractor must erect and maintain them, all as specified in Section 1-10.3(3).

19 When erecting falsework that restricts overhead clearance above a railroad track, the Contractor must place restricted
20 overhead clearance signs as soon as the restriction occurs. Sign details are shown on the Standard Drawings. Unit Contract
21 prices cover all costs relating to these signs.

22 6-02.3(17)N REMOVAL OF FALSEWORK AND FORMS

23 If the Engineer does not specify otherwise, the Contractor may remove forms based on an applicable row of criteria in the
24 table below. Both compressive strength and minimum time criteria must be met if both are listed in the applicable row. The
25 minimum time must be from the time of the last concrete placement in the forms. In no case must the Contractor remove forms
26 or falsework without the Engineer's approval.

27

| Concrete Placed In | Percent of Specified Minimum Compressive Strength ¹ | Minimum Compressive Strength ¹ | Minimum Time |
|--|--|---|--------------|
| Side forms not supporting the concrete weight, including columns, walls, crossbeams, nonsloping box girder webs, abutments, and traffic and pedestrian barriers. | | | 3 days |
| | or | | |
| | | 1,400 psi | 18 hours |
| Side forms of footings, pile caps, and shaft caps. ² | — | — | 18 hours |
| Crossbeams, sloping box girder webs, struts, inclined columns, inclined walls and other forms that support the concrete weight. | 80 | — | 5 days |
| Bridge decks supported on wood or steel stringers or on steel or prestressed concrete girders. ³ | 80 | — | 10 days |
| Box girders, T-beam girders, and flat-slab superstructure. ³ | 80 | — | 14 days |
| Arches. ³ | 80 | — | 21 days |

28 NOTE:

- 29 1. Strength must be proved by test cylinders made from the last concrete placed into the form. The cylinders must be
30 cured according to AASHTO T 23.
- 31 2. Curing compound must be immediately applied to the sides when forms are removed.

- 1 3. Where continuous spans are involved, the time for all spans will be determined by the last concrete placed affecting
2 any span.
3

4 Before releasing supports from beneath beams and girders, the Contractor must remove forms from columns to enable
5 the Engineer to inspect the column concrete.

6 Curing must comply with Section 6-02.3(11). The concrete surface must not become dry during form removal if removed
7 during the cure period.

8 Before placing forms for traffic and pedestrian barriers, the Contractor must completely release all falsework under
9 spans.

10 Before releasing forms under concrete subjected to temperatures colder than 50 °F, the Contractor must first prove that
11 the concrete meets desired strength — regardless of the time that has elapsed.

12 The Engineer may approve leaving in place forms for footings in cofferdams or cribs. This decision will be based on
13 whether removing them would harm the cofferdam or crib and whether the forms will show in the finished Structure.

14 All cells of a box girder Structure which have permanent access must have all forms completely removed, including the
15 bridge deck forms. All debris and all projections into the cells must be removed. Unless otherwise shown on the Drawings, the
16 bridge deck interior forms in all other cells where no permanent access is available, may be left in place.

17 Falsework and forms supporting sloping exterior webs must not be released until the bridge deck and deck overhang
18 concrete has obtained its removal strength and number of days criteria in the table above. Stem reshoring must not be used.

19 Open joints shown on the Drawings must have all forms completely removed, including Styrofoam products and form
20 anchors, allowing the completed Structure to move freely.

21 If the Contractor intends to support or suspend falsework and formwork from the bridge Structure while the falsework and
22 formwork is being removed, the Contractor must submit a falsework and formwork removal plan and calculations for review
23 and approval. The falsework and formwork removal plan must include the following:

- 24 1. The location and size of any cast-in-place falsework lowering holes and how the holes are to be filled.
- 25 2. The location, capacity, and size of any attachments, beams, cables, and other hardware used to attach to the
- 26 Structure or support the falsework and formwork.
- 27 3. The type, capacity and factor of safety, weight, and spacing of points of reaction of lowering equipment.
- 28 4. The weight at each support point of the falsework and formwork being lowered.

29 All other forms must be removed whether above or below the level of the ground or water. Sections 6-02.3(7) and 6-
30 02.3(8) govern form removal for concrete exposed to sea water or to alkaline water or soil. The forms inside of hollow piers,
31 girders, or abutments must be removed through openings shown on the Drawings or approved by the Engineer.

32 **6-02.3(17)O EARLY CONCRETE TEST CYLINDER BREAKS**

33 The Contractor is responsible for fabrication, curing, and testing of the early cylinders. Early cylinders are defined as all
34 cylinders tested in advance of the design age of 28 days whose purpose is to determine the in-place strength of concrete in a
35 Structure before applying loads or stresses. The Contractor must retain a testing laboratory to perform this Work. Testing
36 laboratories' equipment must be calibrated within 1 year before testing and testers must be ACI certified or qualified per
37 AASHTO R 18.

38 The concrete cylinders must be molded per AASHTO T 23 from concrete last placed in the forms and representative of
39 the quality of concrete placed in that pour.

40 The cylinders must be cured per AASHTO T 23.

41 The concrete cylinders must be tested for compressive strength per AASHTO T 22. The number of early cylinder breaks
42 is per the Contractor's need and as approved by the Engineer.

43 The Contractor must furnish the Engineer with all test results, proof of equipment calibration, and tester's certification.
44 The test results will be reviewed and accepted before any forms are removed. The Contractor must not remove forms without
45 the approval of the Engineer.

46 All costs in connection with furnishing cylinder molds, fabrication, curing, and testing of early cylinders must be in the unit
47 Contract prices for the Bid Items of Work involved.

48 **6-02.3(18) PLACING ANCHOR BOLTS**

49 The Contractor must comply with the following requirements in setting anchor bolts in piers, abutments, or pedestals:

- 50 1. If set in the wet concrete, the bolts must be accurately placed before the concrete is placed.
- 51 2. If the bolts are set in drilled holes, hole diameter must exceed bolt diameter by at least 1 inch. Grouting must comply
52 with Section 6-02.3(20).
- 53 3. If the bolts are set in pipe, grouting must comply with Section 6-02.3(20).
- 54 4. If freezing weather occurs before bolts can be grouted into sleeves or holes, they must be filled with an approved
55 non-evaporating, antifreeze solution.

1 6-02.3(19) BRIDGE BEARINGS**2 6-02.3(19)A BRIDGE BEARING ASSEMBLIES**

3 For all fixed, sliding, or rolling bearings, the Contractor must:

- 4 1. Machine all sliding and rolling surfaces true, smooth, and parallel to the movement of the bearing.
 - 5 2. Polish all sliding surfaces.
 - 6 3. Anchor expansion bearings securely, setting them true to line and grade.
 - 7 4. Avoid placing concrete in such a way that it might interfere with the free action of any sliding or rolling surface.
- 8 Grout placement under steel bearings must comply with Section 6-02.3(20).

9 6-02.3(20) GROUT FOR ANCHOR BOLTS AND BRIDGE BEARINGS

10 Grout must conform to Section 9-20.3(2)

11 Grout must be a workable mix with viscosity suitable for the intended application.

12 If the Contractor elects to use a prepackaged grout, it must conform to Section 9-20.3(2) for bearing assemblies with
13 bearing plates, and must conform to Section 9-20.3(3) for elastomeric bearing pads and fabric pad bearings without bearing
14 plates, and a material sample and laboratory test data from an independent testing laboratory must be submitted to the
15 Engineer for approval with the request for approval of material sources.

16 If the Contractor elects to use a neat cement grout it must conform to Section 9-20.3(4), and the mix proportions and
17 laboratory test data from an independent test laboratory must be submitted to the Engineer for approval with the request for
18 approval of material sources.

19 The Contractor must receive approval from the Engineer before using the grout.

20 Field grout cubes must be made per WSDOT Test Method 813 for either prepackaged grout or a Contractor provided mix
21 when requested by the Engineer, but not less than 1 per bridge pier or 1 per day.

22 Before placing grout, the concrete on which it is to be placed must be thoroughly cleaned, roughened, and wetted with
23 water to ensure proper bonding. The grout pad must be cured as recommended by the manufacturer or kept continuously wet
24 with water for 3 days. The grout pad may be loaded when a minimum of 4000 psi compressive strength is attained.

25 Before placing grout into anchor bolt sleeves or holes, the cavity must be thoroughly cleaned and wetted to ensure
26 proper bonding.

27 To grout bridge bearing masonry plates, the Contractor must:

- 28 1. Build a form approximately 4 inches high with sides 4 inches outside the base of each masonry plate.
- 29 2. Fill each form to the top with grout.
- 30 3. Work grout under all parts of each masonry plate.
- 31 4. Remove each form after the grout has hardened.
- 32 5. Remove the grout outside each masonry plate to the base of the masonry plate.
- 33 6. Bevel off the grout neatly to the top of the masonry.
- 34 7. Place no additional load on the masonry plate until the grout has set at least 72 hours.

35 After all grout under the masonry plate and in the anchor bolt cavities has attained a minimum strength of 4,000 psi, the
36 anchor bolt nuts must be tightened to snug-tight. "Snug-tight" means either the tightness reached by a few blows from an
37 impact wrench, or the full effort of a person using a spud wrench. Once the nut is snug-tight, the anchor bolt threads must be
38 burred just enough to prevent loosening of the nut.

39 6-02.3(21) DRAINAGE OF BOX GIRDER CELLS

40 To drain box girder cells, the Contractor must provide and install, according to details in the Drawings, short lengths of
41 nonmetallic pipe in the bottom slab at the low point of each cell. The pipe must have a minimum inside diameter of 4 inches. If
42 the difference in plan elevation is 2 inches or less, the Contractor must install pipe in each end of the box girder cell. All
43 drainage holes must be screened per the Drawings.

44 6-02.3(22) DRAINAGE OF SUBSTRUCTURE

45 The Contractor must use weep holes and gravel backfill that complies with Section 9-03.10(2) to drain fill material behind
46 retaining walls, abutments, tunnels, and wingwalls. To maintain thorough drainage, weep holes must be placed as low as
47 possible. Weep holes must be covered with geotextile meeting the requirements of Section 9-37.2, Table 2 Class C before
48 backfilling. Geotextile screening must be bonded to the concrete with an approved adhesive. Gravel backfill must be placed
49 and compacted as required in Section 2-10. If the Drawings require tiling; French or rock drains, or other drainage devices
50 must be installed.

51 If underdrains are not installed behind the wall or abutment, all backfill within 18 inches of weep holes must comply with
52 Section 9-03.10(4). Unless the Drawings require otherwise, all other backfill behind the wall or abutment must be gravel
53 backfill for walls.

6-02.3(23) OPENING TO TRAFFIC

Bridges with a bridge deck made of Portland cement concrete must remain closed to all traffic, including construction equipment, until the concrete has reached the 28 day specified compressive strength. Determine this strength by testing cylinders made of the same concrete as the deck slab and cured under the same conditions. A concrete deck bridge must never be opened to traffic earlier than 10 days after the deck concrete was placed and never without the written approval of the Engineer.

For load restrictions on bridges under construction, refer to Section 6-01.5.

6-02.3(24) REINFORCEMENT

Although the Drawings may include a bar list and bending diagram, these are used at the Contractor's risk. Determine reinforcement fabrication details from the information provided in the Drawings. Before delivery of the reinforcing bars, the Contractor must submit to the Engineer 2 informational copies of the supplemental bending diagrams.

6-02.3(24)A FIELD BENDING

If the Drawings call for field bending of steel reinforcing bars, the Contractor must bend them in keeping with the Structure configuration and the Drawings and Specifications. Bending steel reinforcing bars partly embedded in concrete per these requirements:

Field bending must not be done:

1. On bars size No. 14 or No. 18.
2. When air temperature is lower than 45 °F.
3. With hammer blows or pipe sleeves.
4. While bar temperature is 400 °F to 700 °F.

In field-bending steel reinforcing bars, the Contractor must:

- a. Make the bend gradually.
- b. Apply heat as described in Tables 2 and 3 for bending bar sizes No. 6 through No. 11 and for bending bar sizes No. 5 and smaller when the bars have been previously bent. Previously unbent bars of sizes No. 5 and smaller may be bent without heating.
- c. Use a bending tool equipped with a bending diameter as listed in Table 1.
- d. Limit any bend to a maximum of 135 degrees for bars smaller than size No. 9, and 90 degrees for bars size No. 9 and No. 11.
- e. Straighten by moving a hickey bar, if used, progressively around the bend.

In applying heat for field-bending steel reinforcing bars, the Contractor must:

- 1) Use a method that will avoid damages to the concrete.
- 2) Insulate any concrete within 6 inches of the heated bar area.
- 3) Ensure, by using temperature-indicating crayons or other suitable means, that steel temperature never exceeds the maximum temperatures described in Table 2 below.
- 4) Maintain the steel temperature within the required range described in Table 2 below during the entire bending process.
- 5) Apply 2 heat tips simultaneously at opposite sides of bars larger than size No. 6 to assure a uniform temperature throughout the thickness of the bar. For size No. 6 and smaller bars, apply 2 heat tips, if necessary.
- 6) Apply the heat for a long enough time that within the bend area the entire thickness of the bar, including its center, reaches the required temperature.
- 7) Bend immediately after the required temperature has been reached.
- 8) Heat at least as much of the bar as Table 3 below requires.
- 9) Locate the heated section of the bar to include the entire bending length. and
- 10) Never cool bars artificially with water, forced air, or other means.

Bending Diameters for Field-Bending Reinforcing Bars

| Bar Size | Bend Diameter/Bar Diameter Ratio | |
|---------------------|----------------------------------|--------------|
| | Heat Not Applied | Heat Applied |
| No. 4, No. 5 | 8 | 8 |
| No. 6 through No. 9 | Not Permitted | 8 |
| No. 10, No. 11 | Not Permitted | 10 |

The minimum bending diameters for stirrups and ties for No. 4 and No. 5 bars when heat is not applied is specified in Section 9-07.

Preheating Temperatures for Field-Bending Reinforcing Bars Temperature (F)

| Bar Size | Minimum | Maximum |
|---------------------|---------|---------|
| No. 4 | 1,200 | 1,250 |
| No. 5, No. 6 | 1,350 | 1,400 |
| No. 7 through No. 9 | 1,400 | 1,450 |
| No. 10, No. 11 | 1,450 | 1,500 |

Minimum Bar Length to be Heated (d = nominal diameter of bar)

| Bar Size | Bend Angle | | |
|---------------------|------------|------------|---------------|
| | 45 degrees | 90 degrees | 135 degrees |
| No. 4 through No. 8 | 8d | 12d | 15d |
| No. 9 | 8d | 12d | Not Permitted |
| No. 10, No. 11 | 9d | 14d | Not Permitted |

6-02.3(24)B PROTECTION OF MATERIALS

The Contractor must protect reinforcing steel from all damage. When placed into the Structure, the steel must be free from dirt, loose rust or mill scale, paint, oil, and other foreign matter.

When transporting, storing, or constructing in close proximity to bodies of salt water, plain and epoxy-coated steel reinforcing bar must be kept in enclosures that provide protection from the elements.

If plain or epoxy-coated steel reinforcing bar is exposed to mist, spray, or fog that may contain salt, it must be flushed with fresh water before concrete placement.

When the Engineer requires protection for reinforcing steel that will remain exposed for a length of time, the Contractor must protect the reinforcing steel:

1. By cleaning and applying a coat of paint conforming to Section 9-08.2 Item 3, Formula A-9-73 over all exposed surfaces of steel, or
2. By cleaning and painting paint conforming to Section 9-08.2 Item 3, Formula A-9-73 on the first 6 inches of the steel bars protruding from the concrete and covering the bars with polyethylene sleeves.

The paint must have a minimum dry film thickness of 1-mil.

6-02.3(24)C PLACING AND FASTENING

The Contractor must position reinforcing steel as the Drawings require and must ensure that the steel does not move as the concrete is placed.

When spacing between bars is 1 foot or more, they must be tied at all intersections. When spacing is less than 1 foot, every other intersection must be tied. If the Drawings require bundled bars, they must be tied together with wires at least every 6 feet. All epoxy-coated bars in the top mat of the bridge deck must be tied at all intersections. Other epoxy-coated bars must also be tied at all intersections, but must be tied at alternate intersections when spacing is less than 1 foot in each direction. Wire used for tying epoxy-coated reinforcing steel must be plastic coated. Tack welding is not permitted on reinforcing steel.

Abrupt bends in the steel are permitted only when one steel member bends around another. Vertical stirrups must pass around main reinforcement or be firmly attached to it.

For slip formed concrete, the reinforcing steel bars must be tied at all intersections and cross braced to keep the cage from moving during concrete placement. Cross bracing must be with additional reinforcing steel. Cross bracing must be placed both longitudinally and transversely.

After reinforcing steel bars are placed in a traffic or pedestrian barrier and before slip form concrete placement, the Contractor must check clearances and reinforcing steel bar placement. This check must be accomplished by using a template or by operating the slip form machine over the entire length of the traffic or pedestrian barrier. All clearance and reinforcing steel bar placement deficiencies must be corrected by the Contractor before slip form concrete placement.

Use mortar blocks, or other approved devices, to maintain the concrete coverage required by the Drawings. The Mortar blocks must:

1. Have a bearing surface measuring not greater than 2 inches in either dimension.
2. Have a compressive strength equal to that of the concrete in which they are embedded.

1 In slabs, each mortar cube must have either: a grooved top that will hold the reinforcing bar in place, or an embedded
 2 wire that protrudes and is tied to the reinforcing steel. If this wire is used around epoxy-coated bars, it must be coated with
 3 plastic.

4 Mortar blocks may be accepted based on a manufacturer's certificate of compliance.

5 Instead of mortar blocks, the Contractor may use metal or plastic chair supports to hold uncoated bars. Any surface of a
 6 metal chair support not covered by at least 1/2 inch of concrete must be one of the following:

- 7 a. Hot-dip galvanized after fabrication in keeping with AASHTO M 232 Class D.
- 8 b. Coated with plastic firmly bonded to the metal. This plastic must be at least 3/32 inch thick where it touches the form
 9 and must not react chemically with the concrete when tested in the SPU's Materials Laboratory. The plastic must not
 10 shatter or crack at or above -5 °F, or deform enough to expose the metal at or below 200 °F.
- 11 c. Stainless steel that comply with the requirements of ASTM A 493, Type 302. Stainless steel chair supports are not
 12 required to be galvanized or plastic coated.

13 Instead of mortar blocks, epoxy-coated reinforcing bars may be supported by one of the following:

- 14 1) Metal chair supports coated entirely with a dielectric material such as epoxy or plastic.
- 15 2) Other epoxy-coated reinforcing bars.
- 16 3) Plastic chair supports.

17 Plastic chair supports must be lightweight, non-porous, and chemically inert in concrete. Plastic chair supports must have
 18 rounded seatings, must not deform under load during normal temperatures, and must not shatter or crack under impact
 19 loading in cold weather. Plastic chair supports must be placed at spacings greater than 1 foot along the bar and must have at
 20 least 25 percent of their gross place area perforated to compensate for the difference in the coefficient of thermal expansion
 21 between plastic and concrete. The shape and configuration of plastic supports must allow complete concrete consolidation in
 22 and around the support.

23 In bridge decks, roadway and sidewalk slabs, the Contractor must place reinforcing steel mats carefully to provide the
 24 required concrete cover. A "mat" is 2 layers of steel. Top and bottom mats must be supported enough to hold both in their
 25 proper positions. If No. 4 bars make up the lower layer of steel in a mat, it must be blocked at not more than 3-foot intervals (or
 26 4-foot intervals for bars No. 5 and larger). Wire ties to girder stirrups is not considered as blocking. To provide a rigid mat, the
 27 Contractor must add other supports and tie wires to the top mat as needed.

28 If a bar will interfere with a bridge drain, it must be bent in the field to bypass the drain.

29 Clearances must be at least as follows:

| Clearance | Materials |
|----------------------|---|
| 4 inches between | Bars and the surface of any concrete masonry exposed to the action of salt or alkaline water. |
| 3 inches between | Bars and the surface of any concrete deposited against earth without intervening forms. |
| 2-1/2 inches between | Adjacent bars in a layer. Bridge deck bars and the top of the bridge deck. |
| 2 inches between | Adjacent layers. Bars and the surface of concrete exposed to earth. Reinforcing bars and the faces of forms for exposed aggregate finish. |
| 1-1/2 inches between | Bars and the surface of concrete when not specified otherwise in this Section or in the Plans. Barrier and curb bars and the surface of concrete. |
| 1 inch between | Bridge deck bars and the bottom of the bridge deck. Slab bars and the top surface of the bottom slab of a cast-in-place concrete box girder. |

31
 32 Cover to ties and stirrups may be 1/2 inch less than the values specified for main bars but must not be less than 1 inch.
 33 Reinforcing steel bars must not vary more than the following tolerances from their position shown on the Drawings.

| Material | Allowable Variance |
|--|--------------------|
| Members 10 inches or less in thickness | ± 1/4 in |
| Members more than 10 inches in thickness | ± 3/8 in |
| Drilled Shafts top of rebar cage elevation | + 6-in/-3 in |
| Except: | |
| The distance between the nearest reinforcing steel bar surface and the top surface of the bridge deck slab | + 1/4 in |
| Longitudinal spacing of bends and ends of bars | ± 1 in |

| Material | Allowable Variance |
|---|--------------------|
| Length of bar laps | -1-1/2 in |
| Embedded length | |
| No. 3 through No. 11 | -1 in |
| No. 14 through No. 18 | -2 in |
| When reinforcing steel bars are to be placed at equal spacing within a plane: | |
| Stirrups and ties | ±1 in |
| All other reinforcement | ±1 bar diameter |

1

2

Before placing any concrete, the Contractor must:

3

a) Clean all mortar from reinforcement.

4

b) Obtain the Engineer's permission to place concrete after the Engineer has inspected the placement of the reinforcing steel. Any concrete placed without the Engineer's permission will be rejected and removed.

5

6

6-02.3(24)D SPLICING

7

The Contractor must supply steel reinforcing bars in the full lengths the Drawings require. Unless the Engineer approves in writing, the Contractor must not change the number, type, or location of splices.

8

9

The Engineer may allow the Contractor to use thermal or mechanical splices in place of the method shown on the Drawings if they are of an approved design. Use of a new design may be granted if:

10

11

1. The Contractor provides technical data and proof from the manufacturer that the design will perform satisfactorily.

12

2. Sample splices and materials from the manufacturer pass the Engineer's tests.

13

After a design has been approved, any changes in detail or material requires new approval.

14

When splicing, the Contractor must:

15

a. Not lap-splice reinforcing bars 14 or 18.

16

b. Not allow any welded or mechanical splice to deviate in alignment more than 1/4 inch per 3-1/2 feet of bar.

17

c. Distribute splices evenly, grouping them together only at points of low tensile stress.

18

d. Ensure at least 2 inches clearance between any splice and the nearest bar or the surface of the concrete, or 1-1/2 inch for the length of the sleeve on mechanical splices.

19

20

e. Rigidly clamp or wire all splices in a way the Engineer approves.

21

f. Place lap-spliced bars in contact for the length of the splice and tie them together near each end.

22

g. Securely fasten the ends and edges of welded-wire-fabric reinforcement, overlapping them enough to maintain even strength.

23

24

6-02.3(24)E WELDING REINFORCING STEEL

25

Welding of steel reinforcing bars must conform to the requirements of ANSI/AWS D1.4 Structural Welding Code - Reinforcing Steel, latest edition, except where superseded by the Contract, Drawings, and these Specifications.

26

27

Before any welding starts, the Contractor must obtain the Engineer's approval of a written welding procedure for each type of welded splice to be used, including the weld procedure Specifications and joint details. The weld procedure specifications must be written on a form taken from AWS D1.4 Annex A, or equivalent. Test results of tensile strength, macroetch, and visual examination must be included. The form must be signed and dated.

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31

Welders must be qualified per AWS D1.4. The Contractor must be responsible for the testing and qualification of welders, and must submit welder qualification and retention records to the Engineer for approval. The weld joint and welding position a welder is qualified in are per AWS D1.4. The welder qualifications must remain in effect indefinitely unless, the welder is not engaged in a process of welding for which the welder is qualified for a period exceeding 6 months, or there is some specific reason to question a welder's ability.

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Filler metals used for welding reinforcing bars are per AWS D1.4 Table 5.1. All filler metals must be low-hydrogen and

37

handled in compliance with low-hydrogen practices specified in the AWS code.

38

All welding must be protected from air currents, drafts, and precipitation to prevent loss of heat or loss of arc shielding.

39

Short circuiting transfer with gas metal arc welding is not allowed. Slugging of welds is not allowed.

40

The minimum preheat and interpass temperature for welding is per AWS D1.4 Table 5.2 and mill certification of carbon equivalence, per lot of reinforcing. Preheating must be applied to the reinforcing bars and other splice members within 6

41

42

inches of the weld, unless limited by the available lengths of the bars or splice member.

43

Generally, post heating of welded splices is only required for direct butt welded splices of AASHTO M 31 Grade 60 bars size No. 9 or larger and must be done immediately after welding before the splice has cooled to 700 °F. Post heating must not be less than 800 °F nor more than 1,000 °F and held at this temperature for not less than 10 minutes before allowing the splice to cool naturally to ambient temperature.

44

45

46

1 For compatibility with AWS D1.4, welded lap splices for spiral or hoop reinforcing are considered Flare-V groove welds,
2 indirect butt joints.

3 The Contractor is responsible for using a welding sequence that will limit the alignment distortion of the bars due to the
4 effects of welding. The maximum out-of-line permitted will be 1/4 inch from a 3.5-foot straight-edge centered on the weld and
5 in line with the bar.

6 The following procedure for welding steel reinforcing bars is recommended:

7 Sheared bar ends must be burned or sawed off a minimum of 1/2 inch to completely remove the ruptured portion of the
8 steel shear area before welding butt splices. Surfaces to be welded must be smooth, uniform, and free from fins, tears, cracks,
9 and other defects. Surfaces to be welded and surfaces adjacent to a weld must also be free from loose or thick scale, slag,
10 rust, moisture, grease, paint, epoxy covering, or other foreign materials. All tack welds must be within the area of the final
11 weld. No other tack weld will be permitted. Double bevel groove welds require chipping, grinding, or gouging to sound metal at
12 the root of the weld before welding the other side. Progression of vertical welding must be upward. The ground wire from the
13 welding machine must be clamped to the bar being welded.

14 Should the Contractor elect to use a procedure which differs in any way from the procedure recommended, the
15 Contractor must submit the changes, in writing, to the Engineer for approval. Approved weld procedures must be strictly
16 followed.

17 **6-02.3(24)F MECHANICAL SPLICES**

18 The Contractor must form mechanical splices with an Engineer-approved system using sleeve filler metal, threaded
19 coupling, or another method that complies with this Section.

20 If necessary to maintain required clearances after the splices are in place, the Contractor must adjust, relocate, or add
21 stirrups, ties, and bars.

22 Before splicing, the Contractor must provide the Engineer with the following information for each shipment of splice
23 material:

- 24 a. The type or series identification, and heat treatment lot number for threaded-sleeve splices.
- 25 b. The grade and size of bars to be spliced.
- 26 c. A manufacturer's catalog with complete data on material and procedures.
- 27 d. A written statement from the manufacturer that the material is identical to that used earlier by the Engineer in testing
28 and approving the system design.
- 29 e. A written statement from the Contractor that the system and materials will be used according to the manufacturer's
30 instructions and all requirements of this Section.

31 All splices must comply with these criteria:

- 32 1. Mechanical splices must develop at least 125 percent of the specified yield strength of the un-spliced bar. The
33 ultimate tensile strength of the mechanical splice must exceed that of the un-spliced bar.
- 34 2. The total slip of the bar within the spliced sleeve of the connector after loading in tension to 30.0 ksi and relaxing to
35 3.0 ksi must not exceed the following measured displacements between gage points clear of the splice sleeve:
36 a. 0.01 inches for bar sizes up to No. 14
37 b. 0.03 inches for No. 18 bars
- 38 3. The maximum allowable bar size for mechanical laps splices must be No. 6.

39 The Engineer will visually inspect the splices and accept all that appear to conform with the test samples. For sleeve-filler
40 splices, the Engineer will allow voids within the limits on file in the design approval. If the Engineer considers any splice
41 defective, it must be removed and replaced at the Contractor's expense.

42 In preparing sleeve-filler metal splices, the Contractor must:

- 43 a) Clean the bar surfaces by oxyacetylene torch followed by power wire brushing, or abrasive blasting.
- 44 b) Remove all slag, mill scale, rust, and other foreign matter from all surfaces within and 2 inches beyond the sleeve.
- 45 c) Grind down any projection on the bar that would prevent placing the sleeve.
- 46 d) Prepare the ends of the bars as the splice manufacturer recommends and as the approved procedure requires.
- 47 e) Preheat, just before adding the filler, the entire sleeve and bar ends to 300 °F, ± 50 °F. If a gas torch is used, the
48 flame must not be directed into the sleeve.

49 When a metallic, sleeve-filler splice is used, or any other system requiring special equipment, both the system and the
50 operator must qualify in the following way under the supervision of the Owner's Materials and Fabrication inspector. The
51 operator must prepare 6 test splices (3 vertical, 3 horizontal) using bars having the same AASHTO Designation and size
52 (maximum) as those to be used in the Work. Each test sample must be 42 inches long, made up of 2 21-inch bars joined end-
53 to-end by the splice. The bar alignment must not deviate more than 1/8 inch from a straight line over the whole length of the
54 sample. All 6 samples must comply with the tensile strength and slip criteria specified in this Section.

55 The Contractor must provide labor, materials, and equipment for making these test samples at no expense to the Owner.
56 The Owner will test the samples at no cost to the Contractor.

1 6-02.3(24)G JOB CONTROL TESTS

2 As the Work progresses, the Engineer may require the Contractor to provide a sample of thermal or mechanical splice to
3 be used in a project control test. The operator must create this sample on the Job Site with the Engineer present using bars of
4 the same size as those being spliced in the Work. The sample must comply with all requirements of these Specifications, and
5 is in addition to all other sample splices required for qualification. The Engineer will require no more than 2 samples on any
6 project with fewer than 200 splices and no more than 1 sample per 100 splices on any project with more than 200 splices.

7 6-02.3(24)H EPOXY-COATED STEEL REINFORCING BAR

8 This Work is furnishing, fabricating, coating, and placing epoxy-coated steel reinforcing bars as the Drawings, these
9 Specifications, and the Contract require. Coating material must be applied electrostatically, by spraying, or by the fluidized-bed
10 method.

11 All epoxy-coated bars must comply with the requirements of Section 9-07. Fabrication may occur before or after coating.

12 The Contractor must protect epoxy-coated bars from damage using padded or nonmetallic slings and straps free from
13 dirt or grit. To prevent abrasion from bending or sagging, the Contractor must lift bundled bars with a strong-back, multiple
14 supports, or a platform bridge. Bundled bars must not be dropped or dragged. During shop or field storage, bars must rest on
15 wooden or padded cribbing. The Contractor may substitute other methods for protecting the bars if the Engineer approves. If
16 the Engineer believes the coated bars have been badly damaged, they will be rejected.

17 Metal chairs and supports must be coated with epoxy, or another inert coating, if the Engineer approves. The Contractor
18 may use other support devices with the Engineer's approval. Use plastic coated tie wire, approved by the Engineer, to protect
19 the coated bars from being damaged during placement.

20 The bars must be placed as the Drawings require and held firmly in place during placing and setting of the concrete. All
21 bars must be placed and fastened as specified in Section 6-02.3(24)C.

22 In the interval between installing coated bars and concreting the deck, the Contractor must protect the coating from
23 damage that might result from other construction Work.

24 The Engineer will inspect the coated bars after they are placed and before the deck concrete is placed. The Contractor
25 must patch any areas that show significant damage as defined below.

26 Significant damage means any opening in the coating that exposes the steel in an area that exceeds:

- 27 1. 0.05 square inches (approximately 1/4-inch square or 1/4 inch in diameter or the equivalent).
- 28 2. 0.012 square inches (approximately 1/8-inch square or 1/8 inch in diameter) when the opening is within 1/4 inch of
29 another opening of equal or larger size.
- 30 3. 6 inches long, any width.
- 31 4. 0.50 square inch aggregate area in any 1-foot length of bar.

32 The Contractor must patch significantly damaged areas with Engineer-approved patching material obtained from the
33 epoxy resin manufacturer. This material must be compatible with the coating and inert in concrete. Areas to be patched must
34 be clean and free of surface contaminants. Patching must be done before oxidation occurs and according to the resin
35 manufacturer's instructions.

36 6-02.3(25) PRESTRESSED CONCRETE GIRDERS

37 The Contractor must perform quality control inspection. The manufacturing plant of prestressed concrete girders must be
38 certified by the Precast/Prestressed Concrete Institute's Plant Certification Program for the type of prestressed member to be
39 produced.

40 Before the start of production of girders, the Contractor must advise the Engineer of the production schedule. The
41 Contractor must give the inspector safe and free access to the Work. If the inspector observes any Work not in conformance
42 with the Specifications or unacceptable quality control practices, the inspector will advise the plant manager. If the corrective
43 action is not acceptable to the Engineer, the girder will be subject to rejection by the Engineer.

44 The Owner intends to perform Quality Assurance Inspection. By its inspection, the Owner intends only to facilitate the
45 Work and verify the quality of that Work. This inspection does not relieve the Contractor of any responsibility for identifying and
46 replacing defective material and workmanship.

47 The various types of girders are:

- 48 1. Prestressed Concrete Girder: Refers to prestressed concrete girders of all types, including prestressed concrete I
49 girders, prestressed concrete wide flange I girders, bulb tee girders, deck bulb tee girders, thin flange deck bulb tee
50 girders, precast prestressed members, spliced prestressed concrete girders, and prestressed concrete tub girders.
- 51 2. Prestressed Concrete I Girder: Refers to a prestressed concrete girder with a flanged I shaped cross-section,
52 requiring a cast-in-place concrete deck to support traffic loads. Standard girders in this category include Series
53 W42G, W50G, W58G, and W74G.
- 54 3. Prestressed Concrete Wide Flange I Girder: Refers to a prestressed concrete girder with an I-shaped cross-section
55 with wide top and bottom flanges, requiring a cast-in-place concrete deck to support traffic loads. Standard girders in
56 this category include Series WF36G, WF42G, WF50G, WF58G, WF66G, WF74G, WF83G, WF95G and WF100G.

- 1 4. Bulb Tee Girder: Refers to a prestressed concrete girder, with a wide top flange requiring a cast-in-place concrete
2 deck to support traffic loads. Standard girders in this category include Series W32BTG, W38BTG, and W62BTG.
- 3 5. Deck Bulb Tee Girder: Refers to a bulb tee girder with a top flange designed to support traffic loads, and designed to
4 be mechanically connected at the flange edges to adjacent girders at the Job Site. Unless otherwise specified, deck
5 bulb tee girders must conform to all requirements specified for bulb tee girders. Standard girders in this category
6 include Series W35DG, W41DG, W53DG, and W65DG.
- 7 6. Thin Flange Deck Bulb Tee Girder: Refers to a bulb tee girder with a top flange width equal to the girder spacing and
8 requiring a cast-in-place concrete deck to support traffic loads. Unless otherwise specified, thin flange deck bulb tee
9 girders must conform to all requirements specified for bulb tee girders. Standard girders in this category include
10 Series W32TFG, W38TFG, W50TFG, and W62TFG.
- 11 7. Precast Prestressed Member (PCPS Member) – Refers to a precast prestressed slab, precast prestressed ribbed
12 section, or a deck double tee girder. PCPS members are designed to be mechanically connected at the flange or
13 member edges to adjacent PCPS members at the Job Site. Unless otherwise specified, PCPS members must
14 conform to all requirements specified for deck bulb tee girders.
- 15 8. Spliced Prestressed Concrete Girder – Refers to prestressed concrete girders initially manufactured in segments to
16 be longitudinally spliced together with cast-in-place concrete closures at the Job Site. Unless otherwise specified,
17 spliced prestressed concrete girders must conform to all requirements specified for prestressed concrete girders.
18 Anchorages must conform to Sections 6-02.3(26)B, 6-02.3(26)C, and 6-02.3(26)D. Ducts must conform to the
19 Section 6-02.3(26)E requirements for internal embedded installation, except that ducts for I girders may be 24-gage,
20 semi-rigid, galvanized, corrugated, ferrous metal. Ducts must be round, unless the Engineer approves use of elliptical
21 shaped ducts. Duct-wedge plate transitions must conform to Section 6-02.3(26)E. Prestressing reinforcement must
22 conform to Section 6-02.3(26)F. Standard girders in this category include Series WF74PTG, WF83PTG, WF95PTG
23 and WF100PTG.
- 24 9. Prestressed Concrete Tub Girder – Refers to prestressed concrete trapezoidal box or bathtub girders including those
25 manufactured in segments to be spliced together with cast-in-place concrete closures at the Job Site. Unless
26 otherwise specified, prestressed concrete tub girders must conform to all requirements specified for prestressed
27 concrete girders and spliced prestressed concrete girders. Standard girders in this category include Series U**G* or
28 Series UF**G*, where U specifies webs without flanges, UF specifies webs with flanges, ** specifies the girder height
29 in inches, and * specifies the bottom flange width in feet.

30 6-02.3(25)A SHOP DRAWINGS

31 The Drawings show design conditions and details for prestressed girders. Deviations are not permitted, except as
32 allowed by these Specifications, the Shop Drawings as approved by the Engineer, or by manufacturing processes approved by
33 the annual plant approval process.

34 Shop Drawings must show the size and location of all cast-in holes for installation of deck formwork hangers and/or
35 temporary bracing. Holes for formwork hangers must match approved deck formwork plans designed as specified in Section 6-
36 02.3(16). There must be no field-drilled holes in prestressed concrete girders. Post-tensioning ducts in spliced prestressed
37 concrete girders must be located so their center of gravity is per the Drawings.

38 The Contractor may change prestressed concrete girder dimensions from that shown on the Drawings provided:

- 39 1. The girder has the same or higher load carrying capacity using the current AASHTO LRFD Design Specifications and
40 WSDOT Bridge Design Manual LRFD, as demonstrated by design calculations submitted to the Engineer for
41 approval as specified in Section 1-05.3, and accompanying the Shop Drawing submittal.
- 42 2. The Contractor receives the Engineer's approval of the Shop Drawing and design calculation submittal for the
43 modified girder section before starting fabrication of the girder.
- 44 3. The Contractor adjusts substructures to yield the same top of roadway elevation shown on the Drawings.
- 45 4. The depth of the girder is not increased by more than 2 inches and is not decreased, except that in no case must an
46 increase in the girder depth reduce the minimum vertical clearance of the bridge and girder over a traveled way to
47 less than 16-1/2 feet, or to less than the minimum vertical clearance specified in the Drawings if the Drawings already
48 specify a minimum vertical clearance of less than 16-1/2 feet.

49 The Contractor must provide Shop Drawings to the Engineer for approval as specified in Section 1-05.3. Shop Drawings
50 for spliced prestressed concrete girders must conform to Section 6-02.3(26)A. The Shop Drawings for spliced prestressed
51 concrete girders must include all details related to the post-tensioning operations in the field, including details of hardware
52 required, tendon geometry, blockout details, and details of additional or modified steel reinforcing bars required in cast-in-place
53 closures.

54 6-02.3(25)B CASTING

55 Before casting girders, the Contractor must have possession of an approved set of Shop Drawings. Side forms must be
56 steel except that cast-in-place concrete closure forms for spliced prestressed concrete girders, interior forms of prestressed
57 concrete tub girders, and end bulkhead forms of prestressed concrete girders may be wood. Interior voids for precast
58 prestressed slabs with voids must be formed by either wax soaked cardboard or expanded polystyrene forms. The interior void

1 forms must be secured in the position as shown on the Shop Drawings as approved by the Engineer, and must remain in
2 place.

3 All concrete mixes to be used must comply with the requirements of Section 9-19.1. The temperature of the concrete
4 when placed must be between 50 °F and 90 °F.

5 Slump must not exceed 4 inches for normal concrete nor 7 inches with the use of a high range water reducing admixture,
6 nor 9 inches when both a high range water reducing admixture is used and the water-cement ratio is less than or equal to
7 0.35. The high range water reducer must comply with the requirements of Sections 9-23.4.

8 Air-entrainment is not required in the concrete placed into prestressed precast concrete girders, including cast-in-place
9 concrete closures for spliced prestressed concrete girders.

10 No welds will be permitted on steel within prestressed girders. Once the prestressing steel has been installed, no welds
11 or grounds for welders must be made on the forms or the steel in the girder, except as specified.

12 The Contractor may form circular block-outs in the girder top flanges to receive falsework hanger rods. These block-outs
13 must:

- 14 1. Not exceed 1 inch in diameter.
- 15 2. Be spaced no more than 72 inches apart longitudinally on the girder.
- 16 3. Be located 3 inches or more from the outside edge of the top flange on Series W42G, W50G, W58G, girders, and all
17 prestressed concrete tub girders with webs with flanges, and 6 inches or more for all other prestressed concrete
18 girders with flanges.

19 The Contractor may form circular block-outs in the girder webs to support brackets for bridge deck falsework. These
20 block-outs must:

- 21 a. Not exceed 1 inch in diameter.
- 22 b. Be spaced no more than 72 inches apart longitudinally on the girder.
- 23 c. Be positioned to clear the girder reinforcing and prestressing steel.

24 **6-02.3(25)C PRESTRESSING**

25 Each stressing system must have a pressure gauge or load cell that will measure jacking force. Any gauge must display
26 pressure accurately and readably with a dial at least 6 inches in diameter or with a digital display. Each jack and its gauge
27 must be calibrated as a unit and must be accompanied by a certified calibration chart. The Contractor must provide 1 copy of
28 this chart to the Engineer. The cylinder extension during calibration must be in approximately the position it will occupy at final
29 jacking force.

30 Jacks and gauges must be recalibrated and recertified:

- 31 1. Annually.
- 32 2. After any repair or adjustment.
- 33 3. Anytime there are indications that the jack calibration is in error.

34 The Engineer may use load cells to check jacks, gauges, and calibration charts before and during tensioning.

35 All load cells must be calibrated and must have an indicator that shows prestressing force in the strand. The range of this
36 cell must be broad enough that the lowest 10 percent of the manufacturer's rated capacity is not used to measure jacking
37 force.

38 From manufacture to encasement in concrete, prestressing strand must be protected against dirt, oil, grease, damage,
39 and all corrosives. Strand must be stored in a dry, covered area and must be kept in the manufacturer's original packaging
40 until placement in the forms. If prestressing strand has been damaged or pitted, it will be rejected. Prestressing strand with rust
41 must be spot-cleaned with a nonmetallic pad to inspect for any sign of pitting or section loss.

42 Post-tensioning of spliced prestressed concrete girders must conform to Section 6-02.3(26)G, and the following
43 requirements:

- 44 a. Before tensioning, the Contractor must remove all side forms from the cast-in-place concrete closures. From this
45 point until 48 hours after grouting the tendons, the Contractor must keep all construction and other live loads off the
46 superstructure and must keep the falsework supporting the superstructure in place.
- 47 b. No welds or welding grounds must be attached to metal forms, structural steel, or steel reinforcing bars of the
48 structural member.
- 49 c. The Contractor must not tension the post-tensioning reinforcement until the concrete in the cast-in-place closures
50 reaches the minimum compressive strength specified in the Drawings (or 5,000 psi if the concrete strength is not
51 specified in the Drawings). This strength must be measured with concrete cylinders made of the same concrete and
52 cured under the same conditions as the cast-in-place closures.
- 53 d. All post-tensioning must be completed before placing the sidewalks and barriers on the superstructure.

54 **6-02.3(25)D CURING**

55 During curing, the Contractor must keep the girder in a saturated curing atmosphere until the girder concrete has
56 reached the required release strength. If the Engineer approves, the Contractor may shorten curing time by heating the

1 outside of impervious forms. Heat may be radiant, convection, conducted steam, or hot air. With steam, the arrangement must
2 envelop the entire surface with saturated steam. The Engineer will not allow hot air curing until after approving the Contractor's
3 proposed method to envelop and maintain the girder in a saturated atmosphere. Saturated atmosphere means a relative
4 humidity of at least 90 percent. The Contractor must never allow dry heat to touch the girder surface at any point.

5 Under heat curing methods, the Contractor must:

- 6 1. Keep all unformed girder surfaces in a saturated atmosphere throughout the curing time.
- 7 2. Embed a thermocouple (linked with a thermometer accurate to ± 5 °F) 6 to 8 inches from the top or bottom of the
8 girder on its centerline and near its midpoint.
- 9 3. Monitor with a recording sensor (accurate to ± 5 °F) arranged and calibrated to continuously record, date, and identify
10 concrete temperature throughout the heating cycle.
- 11 4. Make this temperature record available for the Engineer to inspect.
- 12 5. Heat concrete to no more than 100 °F during the first 2 hours after placing the concrete, and then increase 25 °F per
13 hour to a maximum of 175 °F.
- 14 6. Cool concrete, after curing is complete, no more than 25 °F per hour, to 100 °F. and
- 15 7. Keep the temperature of the concrete above 60 °F until the girder reaches release strength.

16 The Contractor may strip side forms from prestressed concrete girders once the concrete has reached a minimum
17 compressive strength of 3,000 psi. All damage from stripping is the Contractor's responsibility.

18 Curing of cast-in-place concrete closures for spliced prestressed concrete girders must conform to Section 6-02.3(11).

19 **6-02.3(25)E CONTRACTORS CONTROL STRENGTH**

20 Concrete strength must be measured on test cylinders cast from the same concrete as that in the girder. These cylinders
21 must be cured under time-temperature relationships and conditions that simulate those of the girder. If the forms are heated by
22 steam or hot air, test cylinders will remain in the coolest zone throughout curing. If forms are heated another way, the
23 Contractor must provide a record of the curing time-temperature relationship for the cylinders for each girder to the Engineer.
24 When 2 or more girders are cast in a continuous line and in a continuous pour, a single set of test cylinders may represent all
25 girders provided the Contractor demonstrates uniformity of casting and curing to the satisfaction of the Engineer.

26 The Contractor must mold, cure, and test enough of these cylinders to satisfy Specification requirements for measuring
27 concrete strength. The Contractor may use 4" x 8" or 6" x 12" cylinders. If heat is used to shorten curing time, the Contractor
28 must let cylinders cool for at least 1/2 hour before testing.

29 Test cylinders may be cured in a moist room or water tank per AASHTO T-23 after the girder concrete has obtained the
30 required release strength. If, however, the Contractor intends to ship the girder before the standard 28 day strength test,
31 determine the design strength for shipping from cylinders placed with the girder and cured under the same conditions as the
32 girder. These cylinders may be placed in a non-insulated, moisture-proof envelope.

33 To measure concrete strength in the girder, the Contractor must randomly select 2 test cylinders and average their
34 compressive strengths. The compressive strength in either cylinder must not fall more than 5 percent below the specified
35 strength. If these 2 cylinders do not pass the test, 2 other cylinders must be selected and tested.

36 If too few cylinders were molded to carry out all required tests on the girder, the Contractor must remove and test cores
37 from the girder under the surveillance of the Engineer. If the Contractor casts cylinders to represent more than 1 girder, all
38 girders in that line must be cored and tested.

39 For precast prestressed members, a test must consist of 4 cores measuring 3 inches in diameter by 6 inches in height,
40 for slabs, and by the thickness of the web, for ribbed sections. 2 cores must be taken from each side of the member and on
41 each side of the member's span midpoint, at locations approved by the Engineer. The core locations for precast prestressed
42 slabs must be near mid-depth of the slab, within the middle third of the span length, and must avoid all prestressing strands
43 and steel reinforcing bars. The core locations for precast prestressed ribbed sections must be immediately beneath the top
44 flange, within the middle third of the span length, and must avoid all prestressing strands and steel reinforcing bars.

45 For prestressed concrete tub girders, a test must consist of 4 cores measuring 3 inches in diameter by the thickness of
46 the web, taken from each web approximately 3 feet to the left and to the right of the center of the girder span. The cores must
47 avoid all prestressing strands and steel reinforcing bars.

48 For all other prestressed concrete girders, a test must consist of 3 cores measuring 3 inches in diameter by the
49 thickness of the web and must be removed from just below the top flange: 1 at the midpoint of the girder's length and the other
50 2 approximately 3 feet to the left and approximately 3 feet to the right.

51 The cores must be taken per AASHTO T 24 and must be tested per AASHTO T 22. The Engineer may accept the girder
52 if the average compressive strength of the 4 cores from the precast prestressed member, or prestressed concrete tub girder,
53 or of the 3 cores from any other prestressed concrete girder, is at least 85 percent of the specified compressive strength with
54 no one core less than 75 percent of specified compressive strength.

55 If the girder is cored to determine the release strength, the required patching and curing of the patch must be done
56 before shipment. If there are more than 3 holes or if they are not in a neutral location, the prestress steel must not be released
57 until the holes are patched and the patch material has attained a minimum compressive strength equal to the required release
58 compressive strength or 4,000 psi, whichever is larger.

1 The Contractor must coat cored holes with an epoxy bonding agent and patch the holes using the same type concrete as
2 that in the girder, or a mix approved during the annual plant review and approval. The epoxy bonding agent must comply with
3 the requirements of Section 9-26.1 for Type II, Grade 2 epoxy. The girder must not be shipped until tests show the patch
4 material has attained a minimum compressive strength of 4,000 psi

5 **6-02.3(25)F PRESTRESS RELEASE**

6 Side and flange forms that restrain deflection must be removed before release of the prestressing reinforcement.

7 All harped and straight strands must be released in a way that will produce the least possible tension in the concrete.
8 This release must not occur until tests show each girder has reached the minimum compressive strength required by the
9 Drawings.

10 The Contractor may request permission to release the prestressing reinforcement at a minimum concrete compressive
11 strength less than specified in the Drawings. This request must be submitted to the Engineer for approval as specified in
12 Section 1-05.3 and must be accompanied with calculations showing the adequacy of the proposed release concrete
13 compressive strength. The release strength must not be less than 3,500 psi, except that the release strength for spliced
14 prestressed concrete girders must not be less than 4,000 psi. The calculated release strength must comply with the
15 requirements outlined in the Washington State Department of Transportation (WSDOT) Bridge Design Manual for tension and
16 compression at release. The proposed minimum concrete compressive strength at release will be evaluated by the Owner.
17 Fabrication of girders using the revised release strength must not start until the Owner has provided written approval of the
18 revised release compressive strength. If a reduction of the minimum concrete compressive strength at release is allowed, the
19 Contractor must bear any added cost that results from the change.

20 **6-02.3(25)G PROTECTION OF EXPOSED REINFORCEMENT**

21 When a girder is removed from its casting bed, all bars and strands projecting from the girder must be cleaned and
22 painted with a minimum dry film thickness of 1 mil of paint conforming to Section 9-08.2 Item 3, Formula A-9-73. All steel
23 reinforcing bars, including welded wire fabric, projecting from the girder must be protected as specified in Section 6-02.3(24)B.
24 During handling and shipping, projecting reinforcement must be protected from bending or breaking. Just before placing
25 concrete around the painted projecting bars or strands, the Contractor must remove from them all spattered concrete
26 remaining from girder casting, dirt, oil, and other foreign matter.

27 Grouting of post-tensioning ducts for spliced prestressed concrete girders must conform to Section 6-02.3(26)H.

28 **6-02.3(25)H FINISHING**

29 The Contractor must apply a Class 1 finish, as defined in Section 6-02.3(14), to:

- 30 1. The exterior surfaces of the outside girders.
- 31 2. The bottoms, sides, and tops of the lower flanges on all girders.

32 All other girder surfaces must receive a Class 2 finish.

33 The interface on I-girders and other girders that contact the cast-in-place deck must have a finish of dense, screeded
34 concrete without a smooth sheen or laitance on the surface. After vibrating and screeding, and just before the concrete
35 reaches initial set, the Contractor must texture the interface. This texture must be applied with a steel brooming tool that
36 etches the surface transversely leaving grooves 1/8 inch to 1/4 inch wide, between 1/8 inch and 1/4 inch deep, and spaced 1/4
37 inch to 1/2 inch apart.

38 On the deck bulb tee girder section and all precast prestressed members, the Contractor must test the bridge deck
39 surface portion for flatness. This test must occur after floating but while the concrete remains plastic. Testing must be done
40 with a 10-foot straight edge parallel to the girder centerline and with a flange width straight edge at right angles to the girder
41 centerline. The Contractor must fill depressions, cut down high spots, and refinish to correct any deviation of more than 1/4
42 inch within the straight edge length. This section of the bridge deck surface must be finished to comply with the requirements
43 for finishing bridge decks, as defined in Section 6-02.3(10) except that, if approved by the Engineer, a coarse stiff broom may
44 be used to provide the finish instead of a metal tined comb.

45 The Contractor may repair rock pockets and other defects in the girder provided the repair is covered in the annual plant
46 approval package. All other repairs and repair procedures must be documented and approved by the Engineer before
47 acceptance of the girder.

48 **6-02.3(25)I FABRICATION TOLERANCES**

49 The girders must be produced as shown on the Shop Drawings as approved by the Engineer, and must comply with the
50 dimensional tolerances listed below. Construction tolerances of cast-in-place closures for spliced prestressed concrete girders
51 must conform to the tolerances specified for spliced prestressed concrete girders. Actual acceptance or rejection will depend
52 on how the Engineer believes a defect outside these tolerances will affect the Structure's strength or appearance:

- 53 1. Prestressed Concrete Girder Length (overall): $\pm 1/4$ inch per 25 feet of beam length, up to a maximum of $\pm 1-1/2$ inch.
- 54 2. Precast Prestressed Member Length (overall): ± 1 inch.
- 55 3. Width (flanges): + 3/8 inch, - 1/4 inch.
- 56 4. Width (narrow web section): + 3/8 inch, - 1/4 inch.

- 1 5. Width (Precast Prestressed Member): $\pm 1/4$ inch.
- 2 6. Girder Depth (overall): $\pm 1/4$ inch.
- 3 7. Flange Depth:
 - 4 a. For I and Wide Flange I girders: $\pm 1/4$ inch
 - 5 b. For bulb tee and deck bulb tee girders: $+ 1/4$ inch, $- 1/8$ inch
 - 6 c. For PCPS members: $+ 1/4$ inch, $- 1/8$ inch
- 7 8. Strand Position in Prestressed Concrete Girder:
 - 8 a. $\pm 1/4$ inch from the center of gravity of an individual strand.
 - 9 b. $\pm 1/2$ inch from the center of gravity of a bundled strand group.
 - 10 c. ± 1 inch from the center of gravity of the harped strands at the girder ends.
- 11 9. Strand Position in Precast Prestressed Member: $\pm 1/4$ inch from the center of gravity of a bundled strand group and
- 12 of an individual strand.
- 13 10. Longitudinal Position of the Harping Point:
 - 14 a. Single harping point: ± 18 inches
 - 15 b. Multiple bundled strand groups
 - 16 1) First bundled strand group: ± 6 inches
 - 17 2) Second bundled strand group: ± 18 inches
 - 18 3) Third bundled strand group: ± 30 inches
- 19 11. Position of an interior void, vertically and horizontally (Precast Prestressed Slab with voids): $\pm 1/2$ inch.
- 20 12. Bearing Recess (center recess to beam end): $\pm 1/4$ inch.
- 21 13. Beam Ends (deviation from square or designated skew):
 - 22 a. Horizontal: $\pm 1/2$ inch from web centerline to girder flange
 - 23 b. Vertical: $\pm 1/8$ inch per foot of beam depth
- 24 14. Precast Prestressed Member Ends (deviation from square or designated skew): $\pm 1/2$ inch.
- 25 15. Bearing Area Deviation from Plane (in length or width of bearing): $1/16$ inch.
- 26 16. Stirrup Reinforcing Spacing: ± 1 inch.
- 27 17. Stirrup Projection from Top of Beam: $\pm 3/4$ inch.
- 28 18. Mild Steel Concrete Cover: $- 1/8$ inch, $+ 3/8$ inch.
- 29 19. Offset at Form Joints (deviation from a straight line extending 5 feet on each side of joint): $\pm 1/4$ inch.
- 30 20. Deviation from Design Camber (Precast Prestressed Member): $\pm 1/4$ inch per 10 feet of member length measured at
- 31 midspan, but not greater than $\pm 3/4$ inch total.
- 32 21. Differential Camber Between Girders in a Span (measured in place at the Job Site):
 - 33 a. For I, Wide Flange I, bulb tee, and spliced prestressed concrete girders: $1/8$ inch per 10 feet of beam length.
 - 34 b. For deck bulb tee girders: Cambers must be equalized by an approved method when the differences in cambers
 - 35 between adjacent girders or stages measured at mid-span exceeds $1/4$ inch.
 - 36 c. For PCPS members: $\pm 1/4$ inch per 10 feet of member length measured at midspan, but not greater than $\pm 1/2$
 - 37 inch total.
 - 38 d. For prestressed concrete tub girders: $\pm 1/4$ inch per 10 feet of member length measured at midspan, but not
 - 39 greater than $\pm 1/2$ inch total.
- 40 22. Position of Inserts for Structural Connections: ± 1 inch.
- 41 23. Position of Lifting Loops: ± 3 inches longitudinal, $\pm 1/4$ inch transverse.
- 42 24. Weld plates for bulb tee girders must be placed: $\pm 1/2$ inch longitudinal and $\pm 1/8$ inch vertical.
- 43 25. Position of post-tensioning ducts at girder and CIP closure ends: $\pm 1/4$ inch.
- 44 26. Position of post tensioning ducts along segments of segmental prestressed concrete girders: $\pm 1/4$ inch.
- 45 27. Deviation from a smooth curve for post-tensioning ducts at closures based on the sum total of duct placement and
- 46 alignment tolerances: $\pm 3/8$ inch.

47 6-02.3(25)J HORIZONTAL ALIGNMENT

48 The Contractor must check and record the horizontal alignment of the top and bottom flanges of each girder at the

49 following times:

- 50 1. Initial: Upon removal of the girder from the casting bed.
- 51 2. Final: Within 2 weeks, but not less than 3 days before shipment.
- 52 3. Storage: Between 115 to 125 days after casting, if the girder remains in storage for a period exceeding 120 days.

1 Each check must be made by measuring the distance between each flange and a chord that extends the full length of the
2 girder. The Contractor must perform and record each check at a time when the alignment of the girder is not influenced by
3 temporary differences in surface temperature. Records for the initial check must be included in the Contractor's prestressed
4 concrete certificate of compliance. Records for the final and storage checks must be provided to the Engineer for approval.

5 Immediately after the girder is removed from the casting bed, neither flange must be offset more than 1/8 inch for each
6 10 feet of girder length. During storage and before shipping, the offset, with girder ends plumb and upright and with no external
7 force, must not exceed 1/4 inch per 10 feet of girder length. Any girder within this tolerance may be shipped, but must be
8 corrected at the Job Site to the 1/8 inch maximum offset per 10 feet of girder length before concrete is placed into the
9 diaphragms.

10 The Engineer may allow using external force to correct girder alignment at the plant or Job Site if the Contractor provides
11 stress calculations and a proposed procedure. If external force is permitted, it must not be released until after the bridge deck
12 has been placed and cured 10 days.

13 The maximum deviation of the side of the precast prestressed slab, or the edge of the bridge deck slab of the deck
14 double tee girder or the precast prestressed ribbed section, measured from a chord that extends end to end of the member,
15 must be $\pm 1/8$ inch per 10 feet of member length, but not greater than 1/2 inch total.

16 All precast prestressed members which exceed the specified horizontal alignment tolerance may be subject to rejection.

17 **6-02.3(25)K GIRDER DEFLECTION**

18 The Contractor must check and record the vertical deflection (camber) of each girder at the following times:

- 19 1. Initial: Upon removal of the girder from the casting bed.
- 20 2. Storage: Within 2 weeks, but not less than 3 days before shipment, if the girder remains in storage for a period
21 exceeding 120 days.

22 The Contractor must perform and record each check at a time when the alignment of the girder is not influenced by
23 temporary differences in surface temperature. These records must be available for the Engineer's inspection, and in girders
24 older than 120 days, must be transmitted to the Engineer as soon as possible for evaluation of the effect of long-term storage
25 on the "D" dimension. Records for the Initial check must be in the Contractor's Prestressed Concrete certificate of compliance.
26 Records for the Storage check must be provided to the Engineer for approval.

27 The "D" dimensions shown on the Drawings are computed girder deflections at midspan based on a time lapse of 40 and
28 120 days after release of the prestressing strands, and are intended to advise the Contractor as to the expected range of
29 girder deflection when deck forming. A positive (+) "D" dimension indicates upward deflection.

30 The Contractor must control the deflection of prestressed concrete girders to receive a cast-in-place slab by scheduling
31 fabrication between 40 and 120 days of slab placement on the erected girders.

32 If it is anticipated that the girders will be older than 120 Days at the time of erection, the Contractor must submit
33 calculations to the Engineer showing the estimated girder deflection at midspan at the age anticipated for erection. This
34 submittal must also include the Contractor's proposal for accommodating any excess camber in the construction. The
35 Contractor must not proceed with girder fabrication until this submittal is accepted by the Engineer. The actual girder deflection
36 at the midspan may vary from the maximum estimated "D" dimension when slab forming by a maximum of plus 1/2 inch for
37 girder lengths up to 80 feet, and plus 1 inch for girder lengths over 80 feet, but less than or equal to 140 feet, and plus 1-1/2
38 inches for girder lengths over 140 feet.

39 All costs, including bridge deck form adjustments required to maintain specified steel reinforcing bar clearances and deck
40 profiles, and any additional Owner engineering expenses, for accommodating excess girder deflection must be at the
41 Contractor's expense.

42 **6-02.3(25)L HANDLING AND STORAGE**

43 During handling and storage, each girder must always be kept plumb and upright, and each precast prestressed member
44 and prestressed concrete tub girder must always be kept in the horizontal orientation as shown on the Drawings.

45 It must be lifted only by the lifting embedments, strand lift loops or high-strength threaded steel bars, at either end. For
46 strand lift loops, use only 1/2-inch diameter or 0.6-inch diameter strand conforming to Section 9-07.10, and a minimum 2-inch
47 diameter straight pin of a shackle through the loops. Multiple loops must be held level in the girder during casting to allow each
48 loop to carry its share of the load during lifting. The minimum distance from the end of the girder to the strand lift loops must be
49 3'-0". The loops must project a minimum of 1 foot 6 inches from the top of the girder, and must extend to within 3 inches clear
50 of the bottom of the girder, terminating with a 9-inch long 90 degree hook. Loads on individual loops must be limited to 12 kips,
51 and all girders must be picked up at a minimum angle of 60 degrees from the top of the girder. For high-strength threaded
52 steel bars, use a minimum of 2, 1-1/3-inch diameter bars conforming to Section 9-07.11 must at each end of the girder. The
53 lifting hardware that connects to the bars must be designed, detailed, and furnished by the Contractor. The minimum distance
54 from the end of the girder to the centroid of the lifting bars must be 3'-0". Lifting bars must extend to within 3 inches clear of the
55 bottom of the girder and must be anchored in the bottom flange with steel plates and nuts. The minimum size of embedded
56 plates for lifting bars must be 1/2" thick x 3" square. Lifting forces on the lifting bars must not exceed 58 kips on an individual
57 bar, and must be within 10 degrees of perpendicular to the top of the girder.

58 For some girders, straight temporary top flange strands may be specified in the Drawings. The lifting locations and
59 concrete release strengths in the girder schedule in the Drawings assume that these temporary strands are pre-tensioned.

1 Alternatively, these temporary strands may be post-tensioned, provided the same lifting locations described in the girder
2 schedule are used and the strands are tensioned before lifting the girder from the form. These temporary strands must be of
3 the same diameter, and must be tensioned to the same force, as the permanent strands. The inside diameter of the debonding
4 sleeves must be large enough such that the temporary strands fully retract upon cutting. When temporary top strands are
5 specified for spliced prestressed concrete girders, the temporary top strands must be post-tensioned before lifting the
6 assembled girder. When the post-tensioned alternative is used, the Contractor is responsible for properly sizing the anchorage
7 plates, and the reinforcement adjacent to the anchorage plates, to prevent bursting or splitting of the concrete in the top flange.
8 Temporary strands must be cut or released as specified in Section 6-02.3(25)N.

9 The Contractor may request permission to use lifting embedments, lifting embedment locations, lifting angles, concrete
10 release strengths, or temporary top strand configurations except as specified in the Drawings. The number of temporary top
11 strands may be increased from the number shown on the Drawings but must not be decreased. When temporary top strands
12 are not needed for lifting but are required for shipping, they must be post-tensioned on the same day that the permanent
13 prestress is released into the girder. The request, including calculations showing the adequacy of the proposed lifting method,
14 must be submitted to the Engineer for approval as specified in Section 1-05.3 and 6-01.8. The Contractor's analysis must
15 conform to Article 5.4.1 of the PCI Design Handbook, Precast and Prestressed Concrete, Sixth Edition, or other approved
16 methods. The Contractor's calculations must verify that the concrete stresses in the prestressed girder do not exceed those
17 listed in Section 6-02.3(25)M. The Contractor must not start girder lifting operations under the lifting method submittal until
18 receiving the Engineer's written approval of the submittal, and must perform the girder lifting operations at no additional
19 expense to the Owner.

20 If girders are to be stored, the Contractor must place them on a stable foundation that will keep them in a vertical
21 position. Stored girders must be supported at the bearing recesses or, if there are no recesses, approximately 18 inches from
22 the girder ends. Precast prestressed members must be supported at points between 1'-0" and 2'-0" from the member ends.
23 After post-tensioning, segmental prestressed concrete girders must be supported at points between 2'-0" and 5'-0" from the
24 girder ends, unless otherwise shown on the Drawings. For long-term storage of girders with initial horizontal curvature, the
25 Contractor may wedge one side of the bottom flange, tilting the girders to control curvature. If the Contractor elects to set
26 girders out of plumb during storage, the Contractor must have the proposed method analyzed by the Contractor's engineer to
27 ensure against damaging the girder.

28 **6-02.3(25)M SHIPPING**

29 After the girder has reached its 28 day design strength, and the fabricator believes it to comply with the Specification, the
30 girder and a completed Certification of Compliance, signed by a Precast/Prestressed Concrete Institute Certified Technician or
31 a Professional Engineer, acceptable to the Owner, must be submitted to the Engineer for inspection. If the Engineer finds the
32 certification and the girder to be acceptable, the Engineer will stamp the girder "Approved for Shipment."

33 No double tee girder, deck double tee girder, precast prestressed slab or precast prestressed ribbed section must be
34 shipped for at least 3 days after concrete placement. No deck bulb tee girder or prestressed concrete tub girder must be
35 shipped for at least 7 days after concrete placement, except that deck bulb tee girders or prestressed concrete tub girders may
36 be shipped 3 days after concrete placement when $L/(bd)$ is less than or equal to 5.0, where L equals the shipping length of the
37 girder, b equals the girder top flange width (for deck bulb tee girders) or the bottom flange width (for prestressed concrete tub
38 girders), and d equals the girder depth, all in feet. No other girder must be shipped for at least 10 days after concrete
39 placement.

40 Girder support during shipping must be located as shown on the Drawings and must be no closer than the girder depth to
41 the ends of the girder at the girder center line. Support locations have been determined per the criteria specified in the
42 WSDOT Bridge Design Manual LRFD Section 5.6.3.D. The Contractor must verify the applicability of these criteria to the
43 trucking configuration intended for transport of the girders. If the trucking configuration differs from these criteria, the
44 Contractor must submit a girder shipping plan, with supporting calculations, to the Engineer for approval as specified in
45 Sections 1-05.3 and 6-01.8.

46 The Contractor may request permission to use support locations except those specified. The Contractor must submit the
47 support location modification proposal, with supporting calculations, to the Engineer for approval as specified in Sections 1-
48 05.3 and 6-01.8. If the support locations are moved closer to the longitudinal ends of the girders, the calculations must
49 demonstrate adequate control of bending during shipping. The calculations must also show that concrete stresses in the
50 girders will not exceed those listed below.

51 If the Contractor elects to assemble spliced prestressed concrete girders into components of 2 or more segments before
52 shipment, the Contractor must submit shipment support location working drawings with supporting calculations to the Engineer
53 as specified in Sections 1-05.3 and 6-01.8. The calculations must show that concrete stresses in the assembled girders will
54 not exceed those listed below.

55 Lateral bracing for shipping is not required for prestressed concrete tub girders and precast prestressed members as
56 defined in Section 6-02.3(25).

57 For all prestressed concrete girders, except prestressed concrete tub girders and precast prestressed members, the
58 Contractor must provide bracing to control lateral bending during shipping, unless the Contractor furnishes calculations as
59 specified in Section 1-05.3 demonstrating that bracing is unnecessary. External bracing must be attached securely to the top
60 flange of the girder. The Contractor is cautioned that more conservation guidelines for lateral bracing may be required for
61 some delivery routes. The Contractor must submit a bracing plan, with supporting calculations, to the Engineer for approval as

1 specified in Section 1-05.3. The Contractor must not start shipping the girders until receiving the Engineer's approval of the
2 bracing plan, and must perform all bracing operations at no additional cost to the Owner.

3 Criteria for Checking Girder Stresses at the time of Lifting or Transporting and Erecting.

4 Stresses at both the support and harping points must be satisfied based on these criteria:

5 1. Allowable compression stress, $f_c = 0.60f'_{cm}$

6 a. f'_{cm} = compressive strength at time of lifting or transporting verified by test, must not to exceed design
7 compressive strength (f'_{c}) at 28 days in psi + 1,000 psi

8 2. Allowable tension stress, ksi

9 a. With no bonded reinforcement = 3 times square root (f'_{cm}) \leq 0.20 ksi

10 b. With bonded reinforcement to resist total tension force in the concrete computed on the basis of an uncracked
11 section = 6.0 times square root (f'_{cm}). The allowable tensile stress in the reinforcement is 30 ksi

12 3. Prestress losses

13 a. For lifting from casting beds = computed losses at 1 day

14 b. For transportation = computed losses at 10 days

15 c. Impact on dead load

16 d. Lifting from casting beds = 0 percent

17 e. Transporting and erecting = 20 percent

18 **6-02.3(25)N PRESTRESSED CONCRETE GIRDER ERECTION**

19 Before erecting any prestressed concrete girders, the Contractor must submit to the Engineer for review and must have
20 received approval for the erection plan and procedure describing the methods the Contractor intends to use. The erection plan
21 and procedure must provide complete details of the erection process including but not limited to:

22 1. Temporary falsework support, bracing, guys, deadmen, and attachments to other Structure components or objects.

23 2. Procedure and sequence of operation.

24 3. Girder stresses during progressive stages of erection.

25 4. Girder weights, lift points, lifting embedments and devices, spreaders, and angle of lifting cables as specified in
26 Section 6-02.3(25)L.

27 5. Crane make and model, mass, geometry, lift capacity, outrigger size and reactions.

28 6. Girder launcher or trolley details and capacity (if intended for use).

29 7. Locations of cranes, barges, trucks delivering girders, and the location of cranes and outriggers relative to other
30 Structures, including retaining walls and wing walls.

31 The erection plan must include drawings, notes, catalog cuts, and calculations clearly showing the above listed details,
32 assumptions, and dimensions. Material properties and Specifications, structural analysis, and any other data used must also
33 be included. The plan must be prepared by, or under the direct supervision of, a Professional Engineer, licensed under Title 18
34 RCW, State of Washington, in the branch of Civil or Structural, and must carry the engineer's seal and signature, as specified
35 in Section 6-02.3(16).

36 The Contractor must submit the erection plans, calculations, and procedure to the Engineer as specified in Sections 1-
37 05.3 and 6-02.3(16). After the plan is accepted and returned to the Contractor, all changes that the Contractor proposes must
38 be submitted to the Engineer for review and approval.

39 When prestressed girders arrive on the project, the Engineer will confirm they are stamped "Approved for Shipment," that
40 the final horizontal alignment and deflection (camber) check records have been approved, and that they have not been
41 damaged in shipment before accepting them.

42 The concrete in piers and crossbeams must reach at least 80 percent of design strength before girders are placed on
43 them. The Contractor must hoist girders only by the lifting embedments at the ends, always keeping the girders plumb and
44 upright. Once erected, the girders must be braced as specified in Sections 6-02.3(17)F4 and 6-02.3(17)F5. When temporary
45 strands in the top flange are used, they must be cut after the girders are braced and before the intermediate diaphragms are
46 cast. The Contractor must place the cast-in-place deck on the girders within 30 Calendar Days of cutting the temporary
47 strands, except as otherwise approved by the Engineer.

48 For situations where the Contractor proposes to delay placing the cast-in-place deck on the girders beyond 30 Calendar
49 Days after cutting the temporary strands, the Contractor must submit supporting girder camber calculations to the Engineer for
50 approval as specified in Section 1-05.3. The Contractor must cut the temporary strands until receiving the Engineer's approval
51 of the girder camber calculations.

52 Instead of the oak block wedges shown on the Drawings, the Contractor may use Douglas fir blocks if the grain is
53 vertical. The aspect ratio (height/width) of oak block wedges at the girder centerline must not exceed 1.0.

54 The Contractor must check the horizontal alignment of both the top and bottom flanges of each girder after girder
55 erection but before placing concrete in the bridge diaphragms as described in Section 6-02.3(25)J.

1 The Contractor must fill all block-out holes and patch any damaged area caused by the Contractor's operation, with an
2 approved mix, to the satisfaction of the Engineer.

3 For precast prestressed concrete slabs, the Contractor must place the 1-1/4-inch diameter vertical dowel bars at the top
4 of the pier walls as shown on the Drawings. The Contractor must either form the hole or core drill the hole following the
5 alternatives shown on the Drawings. The portion of the dowel bar in the top of the pier walls must be set with either grout that
6 complies with Section 9-26.3 or type II epoxy bonding agent conforming to Section 9-26.1 following placement of each precast
7 prestressed slab.

8 **6-02.3(25)O DECK BULB TEE GIRDER FLANGE CONNECTION**

9 The Contractor must submit a method of equalizing deck bulb tee girder, and precast prestressed member, deflections to
10 the Engineer for approval as specified in Section 1-05.3, and that submittal must be included with the deck bulb tee girder
11 fabrication Shop Drawing submittal specified in Section 6-02.3(25)A. Deflection equalizing methods approved for previous
12 Owner Contracts will be acceptable providing the bridge configuration is similar and the previous method was satisfactory. A
13 listing of the previous Owner Contract numbers for which the method was used must be included with the submittal. The weld-
14 ties may be used as a component of the equalizing system provided the Contractor's procedure outlines how the weld-ties are
15 to be used, and that the Contractor's submittal includes a list and description of previous bridge projects where the Contractor
16 has successfully used weld-ties as a component of the equalizing system.

17 The concrete diaphragms for deck bulb tee girders must attain a minimum compressive strength of 2,500 psi before any
18 camber equalizing equipment is removed.

19 On deck bulb tee girders, girder deflection must be equalized using the approved method before girders are weld-tied
20 and before keyways are filled. Keyways between tee girders must be filled flush with the surrounding surfaces with non-shrink
21 grout conforming to Section 9-20.3(2), except that keyways for deck bulb tee girders receiving a cast-in-place concrete deck
22 slab need not be filled with grout. This nonshrink grout must have a compressive strength of 5,000 psi before the equalizing
23 equipment is removed. Determine compressive strength by fabricating and testing cubes per WSDOT Test Method 813 and
24 testing per AASHTO T-106.

25 Welding ground must be attached directly to the steel plates being welded when welding the weld-ties on bulb tee
26 girders.

27 No construction equipment must be placed on the Structure, except equalizing equipment, until the girders have been
28 weld-tied and the keyway grout has attained a compressive strength of 5,000 psi.

29 **6-02.3(26) CAST-IN-PLACE PRESTRESSED CONCRETE**

30 Unless otherwise shown on the Drawings, concrete for cast-in-place prestressed bridge members must be Class 4000D
31 in the bridge deck, and Class 4000 at all other locations. Air entrainment must conform to Sections 6-02.3(2)A and 6-02.3(3).

32 The Contractor must construct supporting falsework to leave the superstructure free to contract and lift off the falsework
33 during post-tensioning. Forms that will remain inside box girders to support the bridge deck must, by design, resist girder
34 contraction as little as possible.

35 Before tensioning, the Contractor must remove all side forms from girders. From this point until 48 hours after grouting
36 the tendons, the Contractor must keep all construction and other live loads off the superstructure and must keep the falsework
37 supporting the superstructure in place.

38 Once the prestressing steel is installed, no welds or welding grounds must be attached to metal forms, structural steel, or
39 reinforcing bars of the structural member.

40 The Contractor must not stress the strands until all concrete has reached a compressive strength of at least 4,000 psi, or
41 the strength shown on the Drawings. This strength must be measured on concrete test cylinders made of the same concrete
42 cured under the same conditions as the cast-in-place unit.

43 All post-tensioning must be completed before sidewalks and barriers are placed.

44 **6-02.3(26)A SHOP DRAWINGS**

45 Before casting the structural elements, the Contractor must submit Shop Drawings as specified in Section 1-05.3.

46 These Shop Drawings must show complete details of the methods, materials, and equipment the Contractor proposes to
47 use in prestressing Work. The Shop Drawings must comply with the design conditions shown on the Drawings unless the
48 Engineer permits equally effective variations.

49 In addition, the Shop Drawings must show:

- 50 1. The method and sequence of stressing.
- 51 2. Technical data on tendons and steel reinforcement, anchorage devices, anchorage device efficiency and acceptance
52 test results and records, anchoring stresses, types of tendon conduit, and all other data on prestressing operations.
- 53 3. Stress and elongation calculations. Separate stress and elongation calculations must be submitted for each tendon if
54 the difference in tendon elongations exceeds 2 percent.
- 55 4. That tendons in the bridge will be arranged to locate their center of gravity as the Drawings require.
- 56 5. Details of additional or modified reinforcing steel required by the stressing system.

1 6. Procedures and lift-off forces at both ends of the tendon for performing a force verification lift-off if discrepancies
2 occurs between measured and calculated elongations.

3 Couplings or splices are not permitted in prestressing strands. Couplings or splices in bar tendons are subject to the
4 Engineer's approval.

5 Friction losses used to calculate forces of the post-tensioning steel must be based on the assumed values used for the
6 design. The assumed anchor set, friction coefficient "μ," and friction wobble coefficient "k" values for design are shown on the
7 Drawings. The post-tensioning Supplier may change the assumed anchor set value provided all stress and force limits listed in
8 Section 6-02.3(26)G are met.

9 The Contractor must determine all points of interference between the mild steel reinforcement and the paths of the post-
10 tensioning tendons. Details to resolve interferences must be submitted with the Shop Drawings for approval. Where reinforcing
11 bar placement conflicts with post-tensioning tendon placement, the tendon profile shown on the Drawings must be maintained.
12 Mild steel reinforcement for post-tensioning anchorage zones must not be produced until after the post-tensioning Shop
13 Drawings have been accepted by the Engineer.

14 Approval of these Shop Drawings will mean only that the Engineer considers them to show a reasonable approach in
15 enough detail. Approval will not indicate a check on dimensions.

16 The Contractor may deviate from the approved Shop Drawings only after obtaining the Engineer's approval of a written
17 request that describes the proposed changes. Approval of a change in method, material, or equipment does not relieve the
18 Contractor of any responsibility for completing the Work.

19 Before physical completion of the project, the Contractor must provide the Engineer with reproducible originals of the
20 Shop Drawings (and any approved changes). These must be clear, suitable for microfilming, and on permanent sheets that
21 measure no smaller than 11" x 17". Alternatively, the Shop Drawings may be provided in an electronic format with the approval
22 of the Bridge and Structures Engineer.

23 **6-02.3(26)B GENERAL REQUIREMENTS FOR ANCHORAGES**

24 Post-tensioning reinforcement must be secured at each end with an approved anchorage device, which must not kink,
25 neck down, or otherwise damage the post-tensioning reinforcement. The anchorage assembly must be grouted to the
26 Engineer's satisfaction.

27 The Structure must be reinforced with steel reinforcing bars in the anchorage zone in the vicinity of the anchorage
28 device. This reinforcement must be categorized into 2 zones. The first or local zone must be the concrete surrounding and
29 immediately ahead of the anchorage device. The second or general zone must be the overall anchorage zone, including the
30 local zone.

31 The steel reinforcing bars required for concrete confinement in the local zone is determined by the post-tensioning
32 system Supplier and must be shown on the Shop Drawings. The calculations must be submitted with the Shop Drawings. The
33 local zone steel reinforcing bars must be furnished and installed by the Contractor, at no additional cost to the Owner, in
34 addition to the structural reinforcement required by the Drawings. The steel reinforcing bars required in the general zone must
35 be as shown on the Drawings and are included in the appropriate Bid Items.

36 The Contractor must submit details, certified test reports, and/or supporting calculations, as specified below, which verify
37 the structural adequacy of the anchorage devices for approval by the Engineer. This requirement does not apply where the
38 anchorage devices have been previously approved by the Owner for the same Structure configuration. The Contractor must
39 also submit any necessary changes to the Drawings. The test report must specify all pertinent test data.

40 Dead ended anchorages are not permitted. Dead ended anchorages are defined as anchorages that cannot be accessed
41 during the stressing operations.

42 Materials and workmanship must conform to the applicable requirements of Section 6-03 and Section 9-06.

43 Before installing the anchorage device, the Contractor must submit to the Engineer a manufacturer's certificate of
44 compliance as specified in Section 1-06.3.

45 Anchorage devices must comply with the requirements listed in either Sections 6-02.3(26)C or 6-02.3(26)D.

46 All anchorages must develop at least 96 percent of the actual ultimate strength of the prestressing steel, when tested in
47 an unbounded state, without exceeding anticipated set. This anchor efficiency test must be performed, or inspected and
48 certified, by an independent testing agency approved by the Engineer.

49 **6-02.3(26)C NORMAL ANCHORAGE DEVICES**

50 Normal anchorage devices, defined as post-tensioning anchorage assemblies conforming to the factored bearing
51 resistance requirements specified in this Section, must provide a factored bearing resistance greater than or equal to 1.2 times
52 the maximum jacking force. The Contractor must submit calculations showing that the factored bearing resistances of the
53 anchorage devices are not exceeded.

54 The factored bearing resistance of the anchorages must be taken as:

$$55 \quad Pr = \phi f_n A_b$$

56 For which f_n is the lesser of:

$$57 \quad f_n = 0.7f'_{ci}(A / A_g)^{1/2}$$

$$f_n = 2.25f_{ci}$$

Where:

ϕ = Resistance factor of 0.70

A = Maximum area of the portion of the supporting surface that is similar to the load area and concentric with it and does not overlap similar areas for adjacent anchorage devices (square inches)

A_b = Effective net area of the bearing plate calculated as the area A_g , minus the area of openings in the bearing plate (square inches)

A_g = Gross bearing area of the bearing plate calculated as specified below (square inches)

f_{ci} = Nominal compressive strength of concrete at the time of application of the tendon force (ksi)

The full bearing plate area may be used for A_g and the calculation of A_b if the plate material does not yield at the factored tendon force and the slenderness of the bearing plate, n/t , conforms to:

$$(n / t) \leq 0.08(E_b / f_b)^{0.33}$$

Where:

E_b = Modulus of elasticity of the bearing plate material (ksi)

f_b = Stress in the anchor plate at a section taken at the edge of the wedge hole or holes (ksi)

n = Projection of the base plate beyond the wedge hole or wedge plate, as appropriate (inches)

t = average thickness of the bearing plate (inches)

For anchorages with separate wedge plates, n may be taken as the largest distance from the outer edge of the bearing plate. For rectangular bearing plates, this distance must be measured parallel to the edge of the bearing plate. If the anchorage has no separate wedge plate, n may be taken as the projection beyond the outer perimeter of the group of holes in the direction under consideration.

For bearing plates that do not comply with the slenderness requirement specified above, the effective gross bearing area, A_g , must be taken as follows:

For anchorages with separate wedge plates, the area geometrically similar to the wedge plate, with dimensions increased by twice the bearing plate thickness.

For anchorages without separate wedge plates, the area geometrically similar to the outer perimeter of the wedge holes, with dimensions increased by twice the bearing plate thickness.

6-02.3(26)D SPECIAL ANCHORAGE DEVICES

Special anchorage devices, defined as post-tensioning anchorage assemblies that do not conform to the factored bearing pressure requirements specified in Section 6-02.3(26)C, must conform to the acceptance test requirements below. Acceptance testing must be performed, or inspected and certified, by an independent testing agency approved by the Engineer. Results of the special anchorage device acceptance testing must be recorded and submitted to the Engineer for approval as specified in Sections 1-05.3 and 6-01.8.

6-02.3(26)D1 TEST BLOCK REQUIREMENTS

The test block must be a rectangular prism of sufficient size to contain all special anchorage components that will also be embedded in the concrete of the Structure being post-tensioned. The arrangement of the special anchorage device components must conform to practical application to the project and the special anchorage device manufacturer's recommendations. The test block must contain an empty duct of the size appropriate for the maximum tendon size that can be accommodated by the special anchorage device.

6-02.3(26)D2 TEST BLOCK DIMENSIONS

The dimensions of the test block perpendicular to the tendon in each direction must be the smaller of the minimum edge distance or the minimum spacing specified by the special anchorage device manufacturer, with the stipulation that the concrete cover over any confining reinforcing steel or supplementary skin reinforcement must be appropriate for the project-specific application and circumstances. The length of the block along the axis of the tendon must be at least 2 times the larger of the cross-section dimensions.

6-02.3(26)D3 LOCAL ZONE REINFORCEMENT FOR CONFINEMENT

The confining reinforcement steel in the local zone of the test block must be the same as that recommended by the special anchorage device manufacturer.

6-02.3(26)D4 SUPPLEMENTARY SKIN REINFORCEMENT

In addition to the special anchorage device and the associated zone reinforcement for confinement, supplementary skin reinforcement may be provided throughout the test block. Such supplementary skin reinforcement must be as specified by the special anchorage device manufacturer, but must not exceed a volumetric ratio of 0.01.

1 The Contractor must furnish and install supplementary skin reinforcement in the anchorage zone of the Structure similar
2 in configuration and equivalent in volumetric ratio to the supplementary skin reinforcement used in the test block at no
3 additional cost to the Owner. The steel reinforcing bars shown on the Drawings in corresponding portions of the general zone
4 may be counted toward this reinforcement requirement.

5 **6-02.3(26)D5 TEST BLOCK CONCRETE STRENGTH**

6 The compressive strength of the test block when acceptance testing must not exceed the compressive strength of
7 Structure being post-tensioned when post-tensioning.

8 **6-02.3(26)D6 SPECIAL ANCHORAGE DEVICE ACCEPTANCE TESTING**

9 Special anchorage device acceptance testing must be conducted using one of the following test methods:

- 10 1. Cyclic load test.
- 11 2. Sustained load test.
- 12 3. Monotonic load test.

13 The loads specified for the tests are specified in fractions of the ultimate load F_{pu} of the largest tendon that the special
14 anchorage device is designed to accommodate. The specimen must be loaded per conventional usage of the device in post-
15 tensioning applications, except that the load may be applied directly to the wedge plate or equivalent area.

16 **6-02.3(26)D7 CYCLIC LOADING TEST**

17 A load of $.8F_{pu}$ must be applied. The load must be cycled between $0.1F_{pu}$ and $0.8F_{pu}$ until crack widths stabilize, but for
18 no less than 10 cycles. Crack widths are considered stabilized if they do not change more than 0.001 inches over the last 3
19 readings. Upon completion of the cyclic loading portion of the test, the specimen must be loaded to failure, or, if limited by the
20 capacity of the loading equipment, to at least $1.1F_{pu}$.

21 Crack widths and patterns must be recorded at the initial load of $0.8F_{pu}$, at least at the last 3 consecutive peak loadings
22 before termination of the cyclic loading portion of the test, and at $0.9F_{pu}$. The maximum load must also be reported.

23 **6-02.3(26)D8 SUSTAINED LOADING TEST**

24 A load of $0.8F_{pu}$ must be applied and held constant until crack widths stabilize, but not less than 48 hours. Crack widths
25 are considered stabilized if they do not change by more than 0.001 inches over the last 3 readings. Upon completion of the
26 sustained loading portion of the test, the specimen must be loaded to failure, or, if limited by the capacity of the loading
27 equipment, to at least $1.1F_{pu}$. Crack widths and crack patterns must be recorded at the initial load of $0.8F_{pu}$, at least 3 times at
28 intervals of no less than 4 hours during the last 12 hours of the sustained loading time period, and at $0.9F_{pu}$. The maximum
29 load must also be reported.

30 **6-02.3(26)D9 MONOTONIC LOADING TEST**

31 A load of $0.9F_{pu}$ must be applied and held constant for 1 hour. Upon completion of the 1 hour load hold period, the
32 specimen must be loaded to failure, or, if limited by the capacity of the loading equipment, to at least $1.2F_{pu}$.

33 Crack width and crack patterns must be recorded at $0.9F_{pu}$, at the conclusion of the 1 hour load hold period, and at
34 $1.0F_{pu}$. The maximum load must be reported.

35 **6-02.3(26)D10 SPECIAL ANCHORAGE DEVICE TEST PERFORMANCE REQUIREMENTS**

36 The test block must conform to the following load requirements under test load:

- 37 1. The maximum test load for cyclic loading and sustained loading tests must be $1.1F_{pu}$ minimum.
- 38 2. The maximum test load for monotonic load testing must be $1.2F_{pu}$ minimum.

39 The test block must conform to the following crack width requirements under test load:

- 40 a. Cracks must not exceed 0.010 inches in width at $0.8F_{pu}$ at completion of the cyclic loading test or sustained loading
41 test, or at $0.9F_{pu}$ after the 1 hour load hold period of the monotonic loading test.
- 42 b. Cracks must not exceed 0.016 inches at $0.9F_{pu}$ for the cyclic loading test or the sustained loading test, or at $1.0F_{pu}$ for
43 the monotonic loading test.

44 **6-02.3(26)D11 TEST SERIES REQUIREMENTS**

45 A test series must consist of 3 test specimens. Each one of the test specimens must conform to the acceptance criteria
46 specified above. If 1 of the 3 specimens fails to pass the test, a supplementary test series of 3 additional specimens must be
47 conducted. The 3 additional test specimens must conform to the specified acceptance criteria.

48 **6-02.3(26)D12 SPECIAL ANCHORAGE DEVICE ACCEPTANCE TESTING RESULTS REPORT**

49 The special anchorage device acceptance testing results report includes:

- 50 1. Dimensions of the test specimen.
- 51 2. Working drawings with details and dimensions of the special anchorage device, including all confining reinforcing
52 steel.

- 1 3. Quantity and arrangement of supplementary skin reinforcement.
- 2 4. Type and yield strength of the reinforcing steel.
- 3 5. Type and compressive strength of the concrete when testing.
- 4 6. Type of testing procedure and all measurements specified for each specimen under the test.

5 The special anchorage device manufacturer must specify auxiliary and confining reinforcement, minimum edge distance,
6 minimum anchor spacing, and minimum concrete strength when stressing required for proper performance of the local zone

7 **6-02.3(26)E DUCTS**

8 Ducts for transverse post-tensioning of bridge deck slabs may be rectangular. All other ducts must be round. Ducts must
9 conform to the following requirements for internal embedded installation and external exposed installation. Elliptical shaped
10 duct may be used if approved by the Engineer.

11 **6-02.3(26)E1 DUCTS FOR INTERNAL EMBEDDED INSTALLATION**

12 Ducts, including their splices, must be semi-rigid, air and mortar tight, corrugated plastic ducts of virgin polyethylene or
13 polypropylene materials, free of water-soluble chlorides or other chemicals reactive with concrete or post-tensioning
14 reinforcement. Ducts, including their splices, must either have a white coating on the outside or must be of a white material
15 with ultraviolet stabilizers added. Ducts, including their splices, must be capable of withstanding concrete pressures without
16 deforming or permitting the intrusion of cement paste during placement of concrete. All fasteners must be appropriate for use
17 with plastic ducts, and all clamps must be of an approved plastic material.

18 Polyethylene ducts must conform to ASTM D 3350 with a cell classification of 345464A. Polypropylene ducts must
19 conform to ASTM D 4101 with a cell classification range of PP0340B14541 to PP0340B67884. Resins used for duct
20 fabrication must have a minimum oxidation induction time of 20 minutes, per ASTM D 3895, based on tests performed by the
21 duct fabricator on samples taken from the lot of finished product. The duct thickness is specified in Section 10.8.3 of the
22 AASHTO LRFD Bridge Construction Specifications, latest edition and current interims.

23 All duct splices, joints, couplings, and connections to anchorages must be made with devices or methods (mechanical
24 couplers, plastic sleeves, shrink sleeves) that are approved by the duct manufacturer and produce a smooth interior alignment
25 with no lips or kinks. All connections and fittings must be air and mortar tight. Taping is not acceptable for connections and
26 fittings.

27 Each duct must maintain the required profile within a placement tolerance of $\pm 1/4$ inch for longitudinal tendons and $\pm 1/8$
28 inch for transverse slab tendons during all phases of the work. The minimum acceptable radius of curvature must be as
29 recommended by the duct manufacturer and as supported by documented industry standard testing. The ducts must be
30 completely sealed to keep out all mortar.

31 Each duct must be located to place the tendon at the center of gravity alignment shown on the Drawings. To keep friction
32 losses to a minimum, the Contractor must install ducts to the exact lines and grades shown on the Drawings. Once in place,
33 the ducts must be tied firmly in position before they are covered with concrete. During concrete placement, the Contractor
34 must not displace or damage the ducts.

35 The ends of the ducts must:

- 36 1. Permit free movement of anchorage devices.
- 37 2. Remain covered after installation in the forms to keep out all water or debris.

38 Immediately after any concrete placement, the Contractor must force blasts of oil-free, compressed air through the ducts
39 to break up and remove any mortar inside before it hardens. Before deck concrete is placed, the Contractor must satisfy the
40 Engineer ducts are unobstructed and contain nothing that could interfere with tendon installation, tensioning, or grouting. If the
41 tendons are in place, the Contractor must show they are free in the duct.

42 Ducts must be capped and sealed at all times until completing grouting to prevent the intrusion of water.

43 Strand tendon duct must have an inside cross-sectional area large enough to accomplish strand installation and grouting.
44 The area of the duct must be at least 2.5 times the net area of prestressing steel in the duct. The maximum duct diameter
45 must be 4 1/2 inches.

46 The inside diameter of bar tendon duct must at least be 1/4 inch larger than the bar diameter. At coupler locations the
47 duct diameter must at least be 1/4 inch larger than the coupler diameter.

48 Ducts installed and cast into concrete before prestressing steel installation, must be capable of withstanding at least 10
49 feet of concrete fluid pressure.

50 Ducts must have adequate longitudinal bending stiffness for smooth, wobble free placement. A minimum of 3 successful
51 duct qualification tests are required for each diameter and type of duct as follows:

- 52 a. Ducts with diameters 2 inches and smaller must not deflect more than 3 inches under its own weight, when a 10-foot
53 duct segment is supported at its ends.
- 54 b. Ducts larger than 2 inches in diameter must not deflect more than 3 inches under its own weight, when a 20-foot duct
55 segment is supported at its ends.
- 56 c. Duct must not dent more than 1/8 inch under a concentrated load of 100 pounds applied between corrugations by a
57 #4 steel reinforcing bar.

When the duct must be curved in a tight radius, more flexible duct may be used, subject to the Engineer's approval.

6-02.3(26)E2 DUCTS FOR EXTERNAL EXPOSED INSTALLATION

Duct must be high-density polyethylene (HDPE) conforming to ASTM D 3350. The cell classification for each property listed in the table below:

| Property | Cell Classification |
|----------|---------------------|
| 1 | 3 or 4 |
| 2 | 2, 3, or 4 |
| 3 | 4 or 5 |
| 4 | 4 or 5 |
| 5 | 2 or 3 |
| 6 | 2, 3, or 4 |

The color code must be C.

Duct for external tendons, including their splices, must be water tight, seamless or welded, and be capable of resisting at least 150 psi grout pressure.

Transition couplers between ducts must conform to either the standard pressure ratings of ASTM D 3505 or the hydrostatic design stresses of ASTM F 714 at 73 °F. The inside diameter through the coupled length must not be less than that produced by the dimensional tolerances specified in ASTM D 3505.

Workers performing HDPE pipe welding must have satisfactorily completed a certified HDPE pipe welding course and must have a minimum of 5 years experience in welding HDPE pipe.

The Contractor must submit the name and HDPE pipe welding work experience of each HDPE pipe welder proposed to perform this Work in the project. The experience submittal for each HDPE pipe welder must include:

The Engineer may require the HDPE pipe welder to demonstrate test HDPE pipe welding before receiving final approval.

1. The name of the pipe welder.
2. The name, date, and location of the certified HDPE pipe welding course, with the course completion certificate.
3. A list of at least 3 projects in the last 5 years where the pipe welder performed HDPE pipe welding, including:
 - a. The project name and location, and date of construction.
 - b. The Governmental Agency/Owner.
 - c. The name, address, and phone number of the Governmental Agency/Owner's representative.

The Contractor must not start HDPE pipe welding operations until receiving the Engineer's approval of the work experience submittal for each HDPE pipe welder performing HDPE pipe welding in the project. The Engineer may require the HDPE pipe welder to demonstrate test HDPE pipe welding before receiving final approval.

6-02.3(26)E3 TRANSITIONS

Transitions between ducts and wedge plates must have adequate length to reduce the angle change effect on the performance of strand-wedge connection, friction loss at the anchorage, and fatigue strength of the post-tensioning reinforcement.

6-02.3(26)E4 VENTS, GROUT INJECTION PORTS, DRAINS, AND CAPS

The Contractor must install vents at high points and drains at low points of the tendon profile, and at other places if the Drawings require. Vents at high points must consist of a set of 3 vents: one to be installed at the high point of the duct, and flanking vents to be installed on either side of the high-point vent at locations where the duct profile is 8 to 12 inches below the elevation of the high-point vent. Vents must include grout injection ports.

Vents and drains must have a minimum inside diameter of 3/4 inches, and must be of either stainless steel, nylon, or polyolefin materials, free of water-soluble chlorides or other chemicals reactive with concrete or post-tensioning reinforcement. Stainless steel vents and drains must conform to ASTM A 240 Type 316. Nylon vents and drains must conform to cell classification S-PA0141 (weather-resistant). Polyolefin vents and drains must contain an antioxidant with a minimum oxidation induction time of 20 minutes per ASTM D 3895. Polyolefin vents and drains must also have a stress crack resistance of 3 hours minimum when tested at an applied stress of 350 psi per ASTM F 2136.

All fasteners must be appropriate for use with plastic ducts, and all clamps must be of an approved plastic material. Taping of connections is not allowed. Valves must be positive mechanical shut-off valves. Valves, and associated caps, must have a minimum pressure rating of 100 psi.

Vents must point upward and remain closed until grouting starts. Drains must point downward and remain open until grouting starts. Ends of stainless steel vents and drains must be removed 1 inch inside the concrete surface after grouting has been completed. Ends of nylon or polyolefin vents and drains may be left flush to the surface unless otherwise specified by the

1 Engineer. Vents, except for grout injection, are not required for transverse post-tensioning ducts in the bridge deck unless
2 specified in the Drawings.

3 Caps must be made of either stainless steel or fiber reinforced polymer (FRP). Stainless steel caps must conform to
4 ASTM A 240 Type 316L. The resin for FRP caps must be either nylon, polyester, or acrylonitrile butadiene styrene (ABS).
5 Nylon must conform to cell classification S-PA0141 (weather-resistant). Caps must be sealed with "O" ring seals or precision-
6 fitted flat gaskets placed against the bearing plate. Caps must be fastened to the anchorage with stainless steel bolts
7 conforming to ASTM A 240 Type 316L.

8 **6-02.3(26)E5 LEAK TIGHTNESS TESTING**

9 The Contractor must test each completed duct assembly for leak tightness after placing concrete but before placing post
10 tensioning reinforcement. The Contractor must submit the equipment used to conduct the leak tightness testing and to monitor
11 and record the pressure maintained in and lost from the closed assembly, and the process to be followed in conducting the
12 leak-tightness testing, to the Engineer for approval with the post-tensioning system Shop Drawings as specified in Section 6-
13 02.3(26)A.

14 Before testing, all grout caps must be installed and all vents, grout injection ports, and drains must either be capped or
15 have their shut-off valves closed. The Contractor must pressurize the completed duct assembly to an initial air pressure of 50
16 psi. This pressure must be held for 5 minutes to allow for internal adjustments within the assembly. After 5 minutes, the air
17 supply valve must be closed. The Contractor must monitor and measure the pressure maintained within the closed assembly,
18 and any subsequent loss of pressure, over a period of 1 minute following the closure of the air supply valve. The maximum
19 pressure loss for duct assemblies equal to or less than 150 feet in length must be 25 psig. The maximum pressure loss for
20 duct assemblies greater than 150 feet in length must be 15 psig. If the pressure loss exceeds the allowable, locations of
21 leakage must be identified, repaired or reconstructed using methods approved by the Engineer. The repaired system must
22 then be retested. The cycle of testing, repair and retesting of each completed duct assembly must continue until the completed
23 duct assembly completes a test with pressure loss within the specified quantity.

24 All duct splices, joints, couplings and connections to anchorages must be made with devices or methods, such as
25 mechanical couplers, plastic sleeves, or shrink sleeve, approved by the duct manufacturer and produce a smooth interior
26 alignment with no lips or kinks. All connections and fittings must be air and mortar tight. Taping is not acceptable for
27 connections and fittings

28 **6-02.3(26)F PRESTRESSING REINFORCEMENT**

29 All prestressing reinforcement strand must comply with Section 9-07.10. They must not be coupled or spliced. Tendon
30 locations shown on the Drawings indicate final positions after stressing. No tendon made of 7-wire strands must contain more
31 than 37 strands of 1/2-inch diameter, or more than 27 strands of 0.6-inch diameter.

32 All prestressing reinforcement bar must conform to Section 9-07.11. They must not be coupled or spliced except as
33 otherwise specified in the Drawings or Contract.

34 Prestressing reinforcement not conforming to either Section 9-07.10 or 9-07.11 is not allowed except as otherwise noted.
35 Such reinforcement may be used provided it is specifically allowed by the Drawings or Contract, it satisfies all material and
36 performance criteria specified in the Drawings or Contract, and receives the Engineer's approval.

37 From manufacture to encasement in concrete or grout, prestressing strand must be protected against dirt, oil, grease,
38 damage, and all corrosives. Strand must be stored in a dry, covered area and must be kept in the manufacturer's original
39 packaging. If prestressing strand has been damaged or pitted, it will be rejected. Prestressing strand with rust must be spot-
40 cleaned with a nonmetallic pad to inspect for any sign of pitting or section loss. If the prestressing reinforcement will not be
41 stressed and grouted for more than 7 Calendar Days after it is placed in the ducts, the Contractor must place an approved
42 corrosion inhibitor conforming to Federal Specification MIL-P-3420F-87 in the ducts.

43 The feeding ends of the strand tendons must be equipped with a bullet nosing or similar apparatus to facilitate strand
44 tendon installation.

45 Strand tendons may be installed by pulling or pushing. Any equipment capable to performing the task may be used,
46 provided it does not damage the strands and conforms to the following:

- 47 1. Pulling lines must have a capacity of at least 2.5 times the dead weight of the tendons when used for horizontal
48 tendon installation.
- 49 2. Metal pushing wheels must not be used.
- 50 3. Bullets for checking duct clearance before concreting must be rigid and be 1/8 inch smaller than the inside diameter
51 of the duct. Bullets for checking duct after concreting must be less than 1/4 inch smaller than the inside diameter of
52 the duct.

53 **6-02.3(26)G TENSIONING**

54 Equipment for tensioning post-tensioning reinforcement must comply with the following requirements:

- 55 1. Stressing equipment must be capable of producing a jacking force of at least 81 percent of the specified tensile
56 strength of the post-tensioning reinforcement.
- 57 2. Jacking force test capacity must be at least 95 percent of the specified tensile strength of the post-tensioning
58 reinforcement.

- 1 3. Wedge seating methods must assure uniform seating of wedge segments and uniform wedge seating losses on all
- 2 strand tendons.
- 3 4. Accumulation of differential seating losses during tensioning cycling must be prevented by proper devices.
- 4 5. Jacks used for stressing tendons less than 20 feet long must have wedge power seating capability.

5 The Contractor must not start to tension the tendons until:

- 6 a. All concrete has reached a compressive strength of at least 4,000 psi or the strength specified in the Drawings
- 7 (demonstrated on test cylinders made of the same concrete cured under the same conditions as that in the bridge),
- 8 and
- 9 b. The Engineer is satisfied that all strands are free in the ducts.

10 Tendons must be tensioned to the values shown on the Drawings (or approved Shop Drawings) with hydraulic jacks.

11 When stressing from both ends of a tendon is specified, it need not be simultaneous unless otherwise specified in the

12 Drawings. The jacking sequence must comply with the approved Shop Drawings.

13 Each jack must have a pressure gauge that will determine the load applied to the tendon. The gauge must display

14 pressure accurately and readably with a dial at least 6 inches in diameter or with a digital display. Each jack and its gauge

15 must be calibrated as a unit and must be accompanied by a certified calibration chart. The Contractor must provide 1 copy of

16 this chart to the Engineer for monitoring. The cylinder extension during calibration must be in approximately the position it will

17 occupy at final jacking force.

18 All jacks and gauges must be recalibrated and recertified: (1) at least every 180 days, and (2) after any repair or

19 adjustment. The Engineer may use pressure cells to check jacks, gauges, and calibration charts before and during tensioning.

20 These stress limits apply to all tendons (unless the Drawings set other limits):

- 21 1) During jacking before seating: 90 percent of the yield strength of the steel.
- 22 2) At anchorages after seating: 70 percent of the specified tensile strength of the steel.
- 23 3) At service limit state after losses: 80 percent of the yield strength of the steel.

24 Tendons must be anchored at initial stresses that will ultimately maintain service loads at least as great as the Drawings

25 require.

26 As stated in Section 6-02.3(26)A, use the assumed design friction coefficient " μ " and wobble coefficient " k " shown on the

27 Drawings to calculate the stressing elongation. These coefficients may be revised by the post-tensioning Supplier by the

28 following method provided it is approved by the Engineer:

- 29 a) Early in the project, the post-tensioning Supplier must test, in place, 2 representative tendons of each size and type
- 30 shown on the Drawings, for accurately determining the friction loss in a strand and/or bar tendon.
- 31 b) The test procedure must consist of stressing the tendon at an anchor assembly with load cells at the dead end and
- 32 jacking end. The test specimen must be tensioned to 80 percent of the specified tensile strength in 10 increments.
- 33 For each increment, the gauge pressure, elongation, and load cell force must be recorded and the data furnished to
- 34 the Engineer. The theoretical elongations and post-tensioning forces shown on the post-tensioning Shop Drawings
- 35 must be re-evaluated by the post-tensioning Supplier using the results of the tests and corrected as necessary.
- 36 Revisions to the theoretical elongations must be submitted to the Engineer for evaluation and approval. The
- 37 apparatus and methods used to perform the tests must be proposed by the post-tensioning Supplier and be subject
- 38 to the approval of the Engineer.

39 All costs associated with testing and evaluating test data must be in the unit Contract prices for the applicable items of

40 Work involved.

41 As tensioning proceeds, the Engineer will be recording the applied load, tendon elongation, and anchorage seating

42 values.

43 Elongation measurements must be made at each stressing location to verify that the tendon force has been properly

44 achieved. If proper anchor set has been achieved and the measured elongation of each strand tendon is within ± 7 percent of

45 the approved calculated elongation, the stressed tendon represented by the elongation measurements is acceptable to the

46 Owner.

47 If discrepancies greater than 7 percent exist between the measured and calculated elongations, the jack calibration must

48 be checked and stressing records reviewed for any evidence of wire or strand breakage. If the jack is properly calibrated and

49 there is no evidence of wire or strand breakage, a force verification lift off must be performed to verify the force in the tendon.

50 The post-tensioning Supplier force verification lift off procedure must provide access for visual verification of anchor plate lift

51 off. The jacking equipment must be capable of bridging and lifting off the anchor plate. The tendon is acceptable if the

52 verification lift off force is not less than 99 percent of the approved calculated force nor more than 70 percent of the specified

53 tensile strength of the prestressing steel or as approved by the Engineer.

54 Elongation measurements must be recorded for bar tendons to verify proper tensioning only. Acceptance will be by force

55 verification lift off. The bar tendon is acceptable if the verification lift off force is not less than 95 percent nor more than 105

56 percent of the approved calculated force or as approved by the Engineer.

57 When removing the jacks, the Contractor must relieve stresses gradually before cutting the prestressing reinforcement.

58 The prestressing strands must be cut a minimum of 1 inch from the face of the anchorage device.

6-02.3(26)H GROUTING

Grout for post-tensioning reinforcement must conform to Section 9-20.3(1). Use prepackaged components of the grout mix within 6 months or less from date of manufacture to date of usage. Grout for post-tensioning reinforcement will be accepted based on manufacturer's certificate of compliance as specified in Section 1-06.3, except that the water-cementitious material ratio of 0.45 maximum must be field verified.

All grout produced for any single Structure must be furnished by 1 Supplier.

All grouting operations must be conducted by ASBI-certified grout technicians.

The Contractor must submit a Grouting Operation Plan to the Engineer for approval as specified in Section 1-05.3. The grouting operation Plan must include, but is not limited to;

1. Names of the grout technicians, accompanied by documentation of their ASBI certification.
2. Type, quantity, and brand of materials used in the grouting operations, including all manufacturer's certificates of compliance.
3. Type of equipment to be used, including meters and measuring devices used to positively measure the quantity of materials used to mix the post-tensioning grout, the equipment capacity in relation to demand and working conditions, and all back-up equipment and spare parts.
4. General grouting procedure.
5. Duct leak tightness testing and repair procedures as specified in Section 6-02.3(26)E.
6. Methods used to control the rate of grout flow within the ducts.
7. Theoretical grout volume calculations, and target flow rates recommended by the grout manufacturer as a function of the mixer equipment and the expected range of ambient temperatures.
8. Grout mixing and pumping procedures.
9. Direction of grouting.
10. Sequence of use of the grout injection ports, vents, and drains.
11. Procedures for handling blockages.
12. Procedures for post grouting repairs.

The Contractor must not start grouting operations until receiving the Engineer's approval of the grouting operation Plan.

Post-tensioning grout must be mixed per the prepackaged grout manufacturer's recommendations using high-shear colloidal mixers. Mechanical paddle mixers are not allowed. The grout produced for filling post-tensioning ducts must be free of lumps and undispersed cement. All equipment used to mix each batch of post-tensioning grout must be equipped with appropriate meters and measuring devices to positively measure all quantities of all materials used to produce the mixed grout. The field test for water-cementitious materials ratio must be performed before starting the grout injection process. Grouting must not start until the material properties of each batch of grout have been confirmed as acceptable.

After tensioning the tendons, the Contractor must again blow oil-free, compressed air through each duct. All drains must then be closed and the vents opened. Grout caps must be installed at tendon ends before grouting. After completely filling the duct with grout, the Contractor must pump the grout from the low end at a pressure of not more than 250 psig, except for transverse tendons in deck slabs the grout pressure must not exceed 100 psig. Grout must be continuously wasted through each vent until no more air or water pockets show. At this point, all vents must be closed and grouting pressure at the injector held between 100 and 200 psig for at least 10 seconds, except for transverse tendons in deck slabs the grouting pressure must be held between 50 and 75 psig for at least 10 seconds. The Contractor must leave all plugs, caps, and valves in place and closed for at least 24 hours after grouting.

Grouting equipment must:

- a. Include a pressure gauge with an upper end readout of between 275 and 325 psig;
- b. Screen the grout before it enters the pump with an easily reached screen that has clear openings of no more than 0.125 inches;
- c. Be gravity fed from an attached, overhead hopper kept partly full during pumping; and
- d. Be able to complete the largest tendon on the project in no more than 20 minutes of continuous grouting.

In addition, the Contractor must have standby equipment (with a separate power source) available for flushing the grout when the regular equipment cannot maintain a 1 way flow of grout. This standby equipment must be able to pump at 250 psig.

The grout ejected from the end vent must have a minimum flow of 11 seconds.

The grout mix must be injected within 30 minutes after the water is added to the cement. Temperature of the surrounding concrete must be at least 35 °F from the time the grout injecting starts until 2-inch cubes of the grout have a compressive strength of 800 psi. Cubes must be made per WSDOT Test Method T 813 and stored per AASHTO T 23. If ambient conditions are such that the surrounding concrete temperature may fall below 35 °F, the Contractor must provide a heat source and protective covering for the Structure to keep the temperature of the surrounding concrete above 35 °F. Grout temperature must not exceed 90 °F during mixing and pumping. If conditions are such that the temperature of the grout mix may exceed 90 °F, the Contractor will make necessary provisions, such as cooling the mix water and/or dry ingredients, to ensure that the temperature of the grout mix does not exceed 90 °F.

1 6-02.3(27) CONCRETE FOR PRECAST UNITS

2 Precast units must not be removed from forms until the concrete has attained a minimum compressive strength of 70
3 percent of the specified design strength as verified by rebound number determined per ASTM C 805. Type III Portland cement
4 is permitted to be used in precast concrete units.

5 Precast units must not be shipped until the concrete has reached the specified design strength as determined by testing
6 cylinders made from the same concrete as the precast units. The cylinders must be made, handled, and stored per AASHTO T
7 23 and compression tested per AASHTO Test Method T 22 and AASHTO Test Method T 231.

8 6-02.3(27)A OF SELF-CONSOLIDATING CONCRETE FOR PRECAST UNITS

9 Self-Consolidating Concrete (SCC) is concrete that is able to flow under its own weight and completely fill the formwork,
10 without the need for any vibration, while maintaining homogeneity, even in the presence of dense reinforcement. SCC must be
11 capable of flowing through the steel reinforcing bar cage without segregation or buildup of differential head inside or outside of
12 the steel reinforcing bar cage.

13 SCC may be used for the following precast concrete structure elements:

- 14 1. Precast roof, wall, and floor panels and retaining wall panels as specified in Section 6-02.3(28).
- 15 2. Precast reinforced concrete 3-sided structures as specified in Section 6-02.3(28) as supplemented in the Special
16 Provisions.
- 17 3. Precast concrete barrier as specified in Section 6-10.3(1).
- 18 4. Precast concrete wall stem panels as specified in Section 6-11.3(3).

19 6-02.3(27)B SUBMITTALS FOR SELF-CONSOLIDATING CONCRETE FOR PRECAST UNITS

20 With the exception of items 3, 7, and 8 in Section 6-02.3(27)A, the Contractor must submit the mix design for SCC to
21 the Engineer for annual approval as specified in Section 6-02.3(28)B. The mix design submittal must include items specified in
22 Section 6-02.3(2)A, and results of the following tests conducted on concrete that has slump flow within the slump flow range
23 defined below:

- 24 1. Slump Flow.
 - 25 a. The mix design must specify the target slump flow in inches, per WSDOT FOP for ASTM C 1611. The slump flow
26 range is defined as the target slump flow \pm 2 inches.
 - 27 b. The visual stability index (VSI) must be less than or equal to 1 per ASTM C 1611, Appendix X1, using Filling
28 Procedure B.
 - 29 c. The T_{50} flow rate results must be less than 6 seconds per ASTM C 1611, Appendix X1, using Filling Procedure B.
- 30 2. Column Segregation.
 - 31 a. The maximum static segregation must be 10 percent per ASTM C 1610.
 - 32 b. The Maximum Hardened Visual Stability Index (HVSI) must be per AASHTO PP 58.
- 33 3. J ring test results for passing ability must be less than or equal to 1-1/2 inches per the WSDOT FOP for ASTM C
34 1621.
- 35 4. Air content must be tested per WSDOT Test Method T 818 and must conform to Section 6-02.3(2)A.
- 36 5. Concrete unit weight results in pounds per cubic foot must be recorded per AASHTO T 121, except that the concrete
37 must not be consolidated in the test mold.
- 38 6. The temperature of all concrete laboratory test samples must be tested per AASHTO T 309 and must conform to the
39 placement limits specified in Section 6-02.3(4)D.
- 40 7. The modulus of elasticity in pounds per square inch at 28 days must be recorded per ASTM C 469.

41 Use of Type III cement is permitted.

42 Placement for construction may include consolidation using light vibration, but the requirements of Section 6-02.3(4)C for
43 consistency will not apply.

44 Items 3, 7, and 8 in Section 6-02.3(27)A require the precast plant to cast 1 representative structure acceptable to the
45 Engineer and have the structure sawn in half for examination by the Owner to determine that segregation has not occurred.
46 The Owner's approval of the sawn structure will constitute approval of the precast plant to use SCC, and a concrete mix
47 design submittal is not required.

48 6-02.3(27)C ACCEPTANCE TESTING OF SELF-CONSOLIDATING CONCRETE FOR PRECAST UNITS

49 Acceptance testing must be performed by the Contractor and test results must be submitted to the Engineer. Placement
50 of SCC for concrete testing such as cylinder preparation is per WSDOT Test Method T 819.

51 SCC for items 1, 2, 4, 5, and 6 in Section 6-02.3(27)A will be accepted as specified in Section 6-02.3(5) procedures and
52 based on conformance to the requirements specified above and in Section 6-02.3(2)A for the following:

- 53 1. Temperature.
- 54 2. Air content.

- 1 3. Compressive strength at 28 days.
- 2 4. Slump flow within the target slump flow range.
- 3 5. J ring passing ability less than or equal to 1-1/2 inches.
- 4 6. VSI less than or equal to 1.
- 5 SCC for concrete barrier will be accepted based on temperature, air, and compressive strength testing listed above.
- 6 SCC for precast junction boxes, cable vaults, and pull boxes will be accepted based on the temperature and
- 7 compressive strength testing listed above.
- 8 SCC for precast drainage structure elements will be accepted per the requirements of AASHTO M 199.

9 **6-02.3(28) PRECAST CONCRETE PANELS**

10 The Contractor must perform quality control inspection. The manufacturing plant for precast concrete units must be
11 certified by the Precast/Prestressed Concrete Institute's Plant Certification Program for the type of precast member to be
12 produced, or the National Precast Concrete Association's Plant Certification Program or be an International Congress Building
13 Officials or International Code Council Evaluation Services recognized fabricator of structural precast concrete products, and
14 must be approved by WSDOT as a Certified Precast Concrete Fabricator before the start of production. WSDOT Certification
15 must be granted at, and renewed during, the annual precast plant review and approval process. Products that must conform to
16 this requirement include noise barrier panels, wall panels, floor and roof panels, marine pier deck panels, retaining walls, pier
17 caps, and bridge deck panels. Precast concrete panels that are prestressed must comply with all requirements of Section 6-
18 02.3(25).

19 Before the start of production of the precast concrete units, the Contractor must advise the Engineer of the production
20 schedule. The Contractor must give the inspector safe and free access to the Work. If the inspector observes any Work not in
21 compliance with the Specifications or unacceptable quality control practices, the inspector will advise the plant manager. If
22 the corrective action is not acceptable to the Engineer, the panel will be rejected.

23 **6-02.3(28)A SHOP DRAWINGS**

24 Before casting the structural elements, the Contractor must submit Shop Drawings as specified in Section 1-05.3.

25 These Shop Drawings must show complete details of the methods, materials, and equipment the Contractor proposes to
26 use in prestressing/precasting Work. The Shop Drawings must comply with the design conditions shown on the Drawings
27 unless the Engineer approves equally effective variations.

28 The Shop Drawings must contain as a minimum:

- 29 1. Panel shapes (elevations and sections) and dimensions.
- 30 2. Finishes and method of constructing the finish (i.e. forming and rolling).
- 31 3. Reinforcing, joint, and connection details.
- 32 4. Lifting, bracing, and erection inserts.
- 33 5. Locations and details of hardware attached to the Structure.
- 34 6. Relationship to adjacent material.

35 Approval of these Shop Drawings does not relieve the Contractor of responsibility for accuracy of the drawings or
36 conformity with the Contract. Approval will not indicate a check on dimensions.

37 The Contractor may deviate from the approved Shop Drawings only after obtaining the Engineer's approval of a written
38 request that describes the proposed changes. Approval of a change in method, material, or equipment does not relieve the
39 Contractor of any responsibility for completing the Work.

40 Before completion of the Contract, the Contractor must provide the Engineer with reproducible originals of the Shop
41 Drawings (and any approved changes). These must be clear, suitable for microfilming, and on permanent sheets that conform
42 with the size requirements of Section 1-05.3.

43 **6-02.3(28)B CASTING**

44 Before casting precast concrete units, the Contractor and Fabrication inspector must have possession of an approved set
45 of Shop Drawings.

46 Concrete must comply with requirements of Section 6-02.3(25)B for annual pre-approval of the concrete mix design, and
47 slump. If SCC is used, the concrete must conform to Sections 6-02.3(27)B and 6-02.3(27)C.

48 Precast units must not be removed from forms until the concrete has attained a minimum compressive strength of 70
49 percent of the specified design strength. A minimum compressive strength at other than 70 percent may be used for specific
50 precast units if the fabricator requests and receives approval as part of the WSDOT plant certification process.

51 Forms may be steel or plywood faced, providing they impart the required finish to the concrete.

52 **6-02.3(28)C CURING**

53 Concrete in the precast units must be cured by either moist or accelerated curing methods. The methods to be used
54 must be preapproved in the WSDOT plant certification process.

- 1 1. For moist curing, the surface of the concrete must be kept covered or moist until the compressive strength of the
2 concrete reaches the strength specified for stripping. Exposed surfaces must be kept continually moist by fogging,
3 spraying, or covering with moist burlap or cotton mats. Moist curing must start as soon as possible following
4 completion of surface finishing.
- 5 2. For accelerated curing, heat must be applied at a controlled rate following the initial set of concrete in combination
6 with an effective method of supplying or retaining moisture. Moisture may be applied by a cover of moist burlap,
7 cotton matting, or other effective means. Moisture may be retained by covering the unit with an impermeable sheet.

8 Heat may be radiant, convection, conducted steam or hot air. Heat the concrete to no more than 100 °F during the first 2
9 hours after pouring the concrete, and then increase no more than 25 °F per hour to a maximum of 175 °F. After curing is
10 complete, cool the concrete no more than 25 °F per hour to 100 °F. Maintain the concrete temperature above 60 °F until the
11 unit reaches stripping strength.

12 Concrete temperature must be monitored with a thermocouple embedded in the concrete (linked with a thermometer
13 accurate to ± 5 °F). The recording sensor (accurate to ± 5 °F) must be arranged and calibrated to continuously record, date,
14 and identify concrete temperature throughout the heating cycle. This temperature record must be provided to the Engineer for
15 inspection and become a part of the documentation required.

16 The Contractor must never allow dry heat to directly touch exposed panel surfaces at any point.

17 **6-02.3(28)D CONTRACTORS CONTROL STRENGTH**

18 Determine the concrete strength at stripping and the verification of design strength by testing cylinders made from the
19 same concrete as the precast panels. The cylinders must be made, handled, and stored per AASHTO T 23 and compression
20 tested per AASHTO Test Method T 22 and AASHTO Test Method T 231.

21 For accelerated cured units, concrete strength must be measured on test cylinders cast from the same concrete as that
22 in the panel. These cylinders must be cured under time-temperature relationships and conditions that simulate those of the
23 panel. If the forms are heated by steam or hot air, test cylinders will remain in the coolest zone throughout curing. If forms are
24 heated another way, the Contractor must provide a record of the curing time-temperature relationship for the cylinders for each
25 panel to the Engineer. When 2 or more panels are cast in a continuous line and in a continuous pour, a single set of test
26 cylinders may represent all panels provided the Contractor demonstrates uniformity of casting and curing to the satisfaction of
27 the Engineer.

28 The Contractor must mold, cure, and test enough of these cylinders to satisfy Specification requirements for measuring
29 concrete strength. The Contractor may use 4" x 8" or 6" x 12" cylinders. The Contractor must let cylinders cool for at least 1/2-
30 hour before testing for release strength.

31 Test cylinders may be cured in a moist room or water tank per AASHTO T-23 after the unit concrete has obtained the
32 required release strength. If, however, the Contractor intends to ship the panel before standard 28 day strength test, determine
33 the design strength for shipping from cylinders placed with the panel and cured under the same conditions as the panel. These
34 cylinders may be placed in a non-insulated, moisture-proof envelope.

35 To measure concrete strength in the precast panel, the Contractor must randomly select 2 test cylinders and average
36 their compressive strengths. The compressive strength in either cylinder must not fall more than 5 percent below the specified
37 strength. If these 2 cylinders do not pass the test, 2 other cylinders must be selected and tested.

38 **6-02.3(28)E FINISHING**

39 The Contractor must provide a finish on all relevant concrete surfaces as defined in Section 6-02.3(14), unless the
40 Contract requires otherwise.

41 **6-02.3(28)F TOLERANCES**

42 The panels must be manufactured as shown on the Drawings, and must comply with the dimensional tolerances listed in
43 the latest edition of PCI-MNL-116, unless otherwise required by the Contract.

44 **6-02.3(28)G HANDLING AND STORAGE**

45 The Contractor must lift all panels only by adequate devices at locations designated on the Shop Drawings. When these
46 devices and locations are not shown on the Drawings, Section 6-02.3(25)L must apply.

47 Precast panels must be stored off the ground on foundations suitable to prevent differential settlement or twisting of the
48 panels. Stacked panels must be separated and supported by dunnage of uniform thickness capable of supporting the panels.
49 Dunnage must be arranged in vertical planes. The upper units of a stacked tier must not be used as storage areas for shorter
50 panels unless substantiated by engineering analysis and approved by the Engineer.

51 **6-02.3(28)H SHIPPING**

52 Precast panels must not be shipped until the concrete has reached the specified design strength, and the Engineer has
53 reviewed the fabrication documentation for Contract compliance and stamped the precast concrete panels "Approved for
54 Shipment." The panels must be supported in such a manner that they are not damaged by anticipated impact on their dead
55 load. Sufficient padding material must be provided between tie chains and cables to prevent chipping or spalling of the
56 concrete.

6-02.3(28) ERECTION

When the precast panels arrive on the project, the Engineer will confirm that they are stamped "Approved for Shipment." The Engineer will evaluate the present panels for damage before accepting them.

The Contractor must lift all panels by suitable devices at locations designated on the Shop Drawings. Temporary shoring or bracing must be provided, if necessary. Panels must be properly aligned and leveled as required by the Drawings. Variations between adjacent panels must be leveled out by a method approved by the Engineer.

6-02.3(29) PATTERNED, COLORED, AND EXPOSED AGGREGATE TREATMENTS

The following 3 treatments may be used with cement concrete referencing Section 6-02. Patterned and Colored or Exposed Aggregate and Colored may be combined for architectural landscaping or artistic surfaces. Payment for the extra effort required to create these 3 treatments will be per Section 6-02.5

Patterned Cement Concrete Surface Treatment: Patterned cement concrete is defined as additional work necessary to imprint cement concrete with a pattern, and is referenced by "Patterned" and "Running Bond Used Brick" or (other pattern) in the Bid Item description and call-outs for locations on the Drawings. Other patterns may be shown on the Drawings or on Drawing Details in the Appendix of the Contract. This extra work is described in Sections 5-05.3(20).

Colored Cement Concrete Treatment: Colored cement concrete is defined as additional work necessary to color cement concrete with a color, and is referenced by "Colored" and a Federal Standard 595B "F (color code)" in the Bid Item description and call-outs for locations on the Drawings. This extra work is described in Sections 5-05.3(20).

Exposed Aggregate Cement Concrete Surface Treatment: Exposed aggregate cement concrete is defined as additional work necessary to expose aggregate on the surface of cement concrete. This extra work is described in Sections 5-05.3(21).

6-02.4 MEASUREMENT

Except as noted below, all classes of concrete will be measured in place by the cubic yard to the neat lines of the Structure as shown on the Drawings.

Concrete in cofferdam seals. Payment for Class 4000W concrete used in these seals will be based on the volume calculated using the neat line dimensions for the seal as shown on the Drawings. For calculated purposes, the horizontal dimension will be increased by 1 foot outside the seal neat line perimeter. The vertical dimension is the distance between the top and bottom neat line elevations. No payment will be made for any concrete that lies outside of these limits to accommodate the Contractor's cofferdam configuration. If the Engineer eliminates the seal in its entirety a Contract Change Order will be issued.

Concrete in a separate lump-sum, Superstructure Bid Item. Any concrete quantities noted under this item in the Contract will not be measured. Although the Contract lists approximate quantities for the Contractor's convenience, the Owner does not guarantee the accuracy of these estimates. Before submitting a Bid, the Contractor must have verified the quantities. Even though actual quantities used may vary from those listed in the Contract, the Owner will not adjust the lump sum Contract price for Superstructure (except for approved changes).

The Owner will not pay for concrete placed below the established elevation of the bottom of any footing or seal.

Lean concrete will be measured by the cubic yard for the quantity of material placed per the producer's invoice, except that lean concrete included in other Contract items will not be measured.

No deduction will be made for pile heads, reinforcing steel, structural steel, bolts, weep holes, rustications, chamfers, edgers, joint filler, junction boxes, miscellaneous hardware, ducts or less than 6-inch diameter drain pipes when computing concrete quantities for payment.

All reinforcing steel will be measured by the computed weight of all metal, including mechanical splices, actually in place and required by the Drawings or the Engineer. Epoxy-coated bars will be measured before coating. The Contractor must furnish without extra allowance:

1. Spreaders, form blocks, wire clips, and other fasteners.
2. Extra steel in splices not shown on the Drawings or specified in the Drawings as optional.
3. Extra shear steel at construction joints not shown on the Drawings when the Engineer permits such joints for the Contractor's convenience.

The weight of mechanical splices will be based on the weight specified in the manufacturer's catalog cut for the specific item.

Use the following table to compute weight of reinforcing steel:

| Steel Reinforcing Bar | | |
|---------------------------------|-------------------------|-----------------------------|
| Deformed Bar Designation Number | Nominal Diameter Inches | Unit Weight Pounds per Foot |
| 3 | 0.375 | 0.376 |
| 4 | 0.500 | 0.668 |
| 5 | 0.625 | 1.043 |

| Steel Reinforcing Bar | | |
|---------------------------------|-------------------------|-----------------------------|
| Deformed Bar Designation Number | Nominal Diameter Inches | Unit Weight Pounds per Foot |
| 6 | 0.750 | 1.502 |
| 7 | 0.875 | 2.044 |
| 8 | 1.000 | 2.670 |
| 9 | 1.128 | 3.400 |
| 10 | 1.270 | 4.303 |
| 11 | 1.410 | 5.313 |
| 14 | 1.690 | 7.650 |
| 18 | 2.260 | 13.600 |

1

2 Gravel backfill will be measured as specified in Section 2-10.

3 Bridge approach slab will be measured by the square yard.

4 Measurement for "Patterned Cement Concrete, (pattern)" will be by the square yard of area where imprinting tools is
5 applied.6 Measurement for "Colored Cement Concrete, (color), F(color code)", will be by the square yard of area of color cement
7 concrete.8 Measurement for "Exposed Aggregate Cement Concrete", will be by the square yard of area of exposed aggregate
9 cement concrete.10 **6-02.5 PAYMENT**11 A Hot Weather Concrete Placement and Curing Plan (Section 6-02.3(6)A1) or a Cold Weather Concrete Placement and
12 Curing Plan (Section 6-02.3(6)A2) is required by the Engineer. All costs associated with the development, submittal, any
13 resubmittal and implementation of this plan are incidental to the various concrete Bid Items and no separate payment will be
14 made.

15 1. "Conc. Class ____", per cubic yard.

16 2. "Conc. Class ____ w/ ____% minimum pozzolans", per cubic yard.

17 3. "Commercial Concrete", per cubic yard.

18 All concrete, except in superstructure when this is covered by a separate Bid Item, is paid for at the unit Contract price
19 per cubic yard in place for the various classes of concrete. All costs with furnishing and applying pigmented sealer to concrete
20 surfaces as specified must be in the unit Contract Price per cubic yard for "Conc. Class ____..." If the concrete is paid for
21 except by class of concrete, then the costs must be in the applicable adjacent item of work

22 4. "Superstructure (name bridge)", lump sum.

23 5. "Superstructure (name bridge) w/ ____% minimum pozzolans", lump sum.

24 All costs in connection with providing holes for vents, for furnishing and installing cell drainage pipes for box girder
25 Structures, and furnishing and placing grout and shims under steel shoes must be in the unit Contract prices for the Bid Items
26 involved.27 All costs associated with the construction of weep holes, including the gravel backfill for drains surrounding the weep
28 holes except as provided in Section 2-10 must be included by the Contractor in the unit Contract price per cubic yard for
29 "Conc. Class ____..."

30 6. "Lean Concrete", per cubic yard.

31 Lean concrete, except when included in another Bid Item, is paid for at the unit Contract price per cubic yard.

32 7. "Steel Reinforcing Bar", per pound.

33 8. "Epoxy-Coated Steel Reinforcing Bar", per pound.

34 Payment for reinforcing steel includes the cost of furnishing, fabricating, placing, and splicing the reinforcement. In
35 Structures of reinforced concrete where there are no structural steel Bid Items, such minor metal parts as expansion joints,
36 bearing assemblies, and bolts will be paid for at the unit Contract price for "Reinforcing Bar" unless otherwise specified.

37 9. "Gravel Backfill for Foundation Class A", per cubic yard.

38 10. "Gravel Backfill for Foundation Class B", per cubic yard.

39 11. "Gravel Backfill for Wall", per cubic yard.

40 12. "Deficient Strength Conc. Price Adjustment", by calculation.

41 "Deficient Strength Conc. Price Adjustment" must be calculated and paid for as described in Section 6-02.3(5)J. To
42 provide a common Proposal for all Bidders, the Owner has entered 0 as an amount for the item "Deficient Strength Conc.

1 Price Adjustment” in the Bid Proposal to become a part of the total Bid by the Contractor. The item “Deficient Strength Conc.
2 Price Adjustment” covers all applicable classes of concrete.

3 All costs for providing, operating, maintaining, moving and removing the cure boxes and providing, maintaining and
4 operating all necessary power sources and connections needed to operate the curing boxes must be included in the applicable
5 concrete Bid Items..

6 13. “**Bridge Approach Slab**”, per square yard.

7 14. “**Bridge Approach Slab w/ ___% minimum pozzolans**”, per square yard.

8 The unit Contract price per square yard for “Bridge Approach Slab...” will be full pay for providing, placing, and
9 compacting the crushed surfacing base course, furnishing and placing Class 4000A concrete, and furnishing and installing
10 compression seal, anchors, and reinforcing steel.

11 15. “**Patterned Cement Concrete Treatment, (pattern)**”, per square yard.

12 The Bid Item price for “Patterned Cement Concrete Treatment” includes all costs for additional work as described in
13 Section 5-05.3(20) and necessary to imprint cement concrete with a pattern referenced in the Bid Item description.

14 16. “**Colored Cement Concrete Treatment, (color), F(color code)**”, per cubic yard.

15 The Bid Item price for “Colored Cement Concrete Treatment” includes all costs for additional work as described in
16 Section 5-05.3(20) and necessary to color cement concrete with a color referenced in the Bid Item description.

17 17. “**Exposed Aggregate Cement Concrete Treatment** ”, per square yard.

18 The Bid Item price for “Exposed Aggregate Cement Concrete Treatment” includes all costs for additional work as
19 described in Section 5-05.3(21) and necessary to expose aggregate of cement concrete per the Contract.

20 **SECTION 6-03 STEEL STRUCTURES**

21 **6-03.1 DESCRIPTION**

22 Section 6-03 describes furnishing, fabricating, erecting, cleaning, and painting steel structures and the structural steel
23 parts of non-steel Structures.

24 Any part of a steel Structure made of non-steel Materials must comply with the Sections of the Standard Specifications
25 governing those Materials.

26 **6-03.2 MATERIALS**

27 Materials must comply with the requirements of the following Sections:
28

| Material | Section |
|--|--------------|
| Structural Steel and Related Materials | Section 9-06 |
| Paints | Section 9-08 |
| Grout | Section 9-20 |

29 Structural steel is classified as:

- 30 1. Structural carbon steel (to be used whenever the Contract does not specify another classification).
- 31 2. Structural low alloy steel.
- 32 3. Structural high strength steel.

33 Unless the Contract states otherwise, the following are classified as structural carbon steel: shims; ladders; stairways;
34 anchor bolts and sleeves; pipe, fittings and fastenings used in handrails; and other metal parts, even if made of other
35 materials, for which payment is not specified.

36 All AASHTO M 270 material used in what the Drawings show as main load carrying tension members or as tension
37 components of flexural members must comply with the Charpy V notch requirements of AASHTO M 270, temperature zone 2.
38 All AASHTO M 270 material used in what the Drawings show as fracture critical members must comply with the Charpy V
39 notch requirements of AASHTO M 270, Fracture Critical Impact Test requirements, temperature zone 2. Charpy V notch
40 requirements for other steel materials must be as specified in the Contract. Filler metals for welding must comply with the
41 toughness requirements of the applicable welding code specified in Section 6-03.3(25).
42

43 The Contractor must submit for the Engineer’s approval a written plan for visibly marking the material so it can be traced.
44 These marks must remain visible at least through the fit up of the main load carrying tension members. The marking method
45 must include the following information:

- 46 a. Material specification designation.
- 47 b. Heat number.
- 48 c. Material test reports to comply with any special requirements.

1 As-built drawings: For steel in main load carrying tension members and in tension components of flexural members, the
2 Contractor must include the heat numbers on the reproducible copies of the as-built Shop Drawings, see Section 1-05.3(11).

3 **6-03.3 CONSTRUCTION REQUIREMENTS**

4 Structural steel fabricators of girders, floorbeams, truss members, and stringers, for permanent steel bridges, must be
5 certified under the AISC Quality Certification Program, Category III, Major Steel Bridges. When fracture critical members are
6 specified in the Contract, structural steel fabricators must also have an endorsement F, Fracture Critical, under the AISC
7 Quality Certification Program.

8 **6-03.3(1) NOTICE OF ROLLING**

9 Before rolling work starts, the Contractor must provide enough advance notice that the Engineer may observe it. The
10 Contractor must notify the Engineer of who is to do the work and where it is to be done. No material must be rolled until the
11 Engineer gives written notice to Proceed.

12 **6-03.3(2) FACILITIES FOR INSPECTION**

13 See Section 1-05.6 and Section 1-06 for the Engineer's right to inspect Material and workmanship.

14 **6-03.3(3) INSPECTOR'S AUTHORITY**

15 See Section 1-05.

16 **6-03.3(4) REJECTIONS**

17 See Section 1-05 and Section 1-06.

18 **6-03.3(5) MILL ORDERS AND SHIPPING STATEMENTS**

19 The Contractor must furnish as many copies of mill orders and shipping statements as the Engineer requires.

20 **6-03.3(6) WEIGHING**

21 Structural steel need not be weighed unless specified otherwise in the Contract. When weight is specified, it may either
22 be calculated or obtained by scales. The Contractor must furnish 4 copies of the calculations or weight slips unless the
23 Contract specifies another quantity. If scale weights are used, the Contractor must record separately the weights of all tools,
24 erection material, and dunnage.

25 **6-03.3(7) SHOP DRAWINGS AND AS-BUILT RECORDS**

26 The Contractor must submit to the Engineer for review all Shop Drawings, and certified mill test reports, for fabricating
27 the steel. Prints of the Shop Drawings must be supplied in these quantities:

28 Ten sets to the Engineer. 4 more sets are required for each affected railroad company on any grade separation structure
29 that carries a railroad over a highway.

30 The Engineer will return the Shop Drawings to the Contractor. When Shop Drawing sheets returned by the Engineer
31 require correction, the Contractor must correct and resubmit them in the quantities required above. No material must be
32 produced until:

- 33 1. The Engineer has reviewed all Shop Drawings; and
- 34 2. The SPU Materials Laboratory has approved the Material source and the fabricator.

35 See Section 1-05.3 regarding Shop Drawings.

36 As-built records: Before the Physical Completion Date can be established, the Contractor must furnish the Engineer 1 set
37 of reproducible copies of the as-built Shop Drawings, see Sections 1-05.3(13) and 1-05.3(14). An additional set of as-built
38 Shop Drawings is required for each affected railroad company on any grade separation Structure that carries a railroad over a
39 transportation Right of Way. The reproducible as-built Shop Drawings must be 22 inches by 34 inches and must comply with
40 the requirements of Section 1-05.3(11).

41 **6-03.3(7)A ERECTION METHODS**

42 The Contractor must submit a steel erection plan and procedure describing the methods the Contractor intends to use to
43 the Engineer for review. The Contractor must have received the Engineer's returned submittal for the erection plan and
44 procedure before doing this work. The Contractor's erection plan and procedure must first be reviewed by the steel fabricator
45 before being submitted to the Engineer. The Contractor's submittal must include evidence that the fabricator has reviewed the
46 erection Shop Drawings and procedures; and must submit the fabricator's review comments with the erection plan submittal.

47 The erection plan and procedure must provide complete details of the erection process including but not limited to:

- 48 1. Temporary falsework support, bracing, guys, deadmen, and attachments to other structure components or objects.
- 49 2. Procedure and sequence of operation.
- 50 3. Girder stresses during progressive stages of erection.
- 51 4. Girder masses, lift points, and lifting devices, spreaders, and glommers.

5. Crane make and model, masses, geometry, lift capacity, outrigger size and reactions.
6. Girder launcher or trolley details and capacity (if intended for use).
7. Locations of cranes, barges, trucks delivering girders, and the location of cranes and outriggers relative to other Structures, including retaining walls and wing walls.

The Contractor may submit for approval the use of an engineered and manufactured lifting bracket bolted to the girder top flanges providing the following requirements are satisfied:

- a. The lifting bracket must be engineered and supporting calculations must be submitted with the erection plan.
- b. The calculations must include critical stresses in the girder including local stresses in the flanges at lifting bracket locations.
- c. The calculations must include computation of the lifting bracket and associated bolt hole locations and the expected orientation of the girder during picking operation.
- d. The lifting bracket must be load tested and certified for a load at least 2 times the working load and at all angles it will be used (angle of load or rigging). Certification documentation from a previous project may be submitted for approval.
- e. Bolt holes in girders added for the lifting bracket connections must be shown on the shop plans and must be drilled in the shop. Field drilling of bolt holes for lifting brackets is not permitted.
- f. Bolt holes in girder top flanges must be filled with high strength bolts after erection as specified in Section 6-02.3(17)K.

The erection plan must include Shop Drawings, notes, catalog cuts, calculations clearly showing the above listed details, assumptions, and dimensions, material properties, Specifications, structural analysis, and any other necessary data. The plan, including lifting bracket working drawings and calculations, must be prepared by, or under the direct supervision of, a Professional Engineer, licensed under Title 18 RCW, State of Washington, in the branch of Civil or Structural, and must carry the engineer's seal and signature, as specified in Section 1-05.3(12).

The Contractor must submit the erection Shop Drawings, calculations, procedure, and fabricator's comments directly to the Engineer, as specified in Section 6-02.3(16). After the plan is reviewed and returned to the Contractor, any change that the Contractor proposes to the reviewed submittal is specified in Section 1-05.3(6).

6-03.3(8) SUBSTITUTIONS

The Contractor must not substitute sections that differ from Drawings or Engineer reviewed Shop Drawings dimensions unless the Contractor has submitted the substitution for review by the Engineer. If the Contractor's submittal requests substitution of heavier members which exceed Contract requirements, such substitution must be at no additional cost to the Owner. Also see the requirements of Sections 1-05.3(6).

6-03.3(9) HANDLING, STORING, AND SHIPPING OF MATERIALS

Markings applied at the mill must distinguish structural low alloy steel from structural carbon steel. The fabricator must keep the 2 classes of steel carefully separated.

Before fabrication, all material stored at the fabricating plant must be protected from rust, dirt, oil, and other foreign matter. The Owner will not accept rust pitted material.

After fabrication, all material awaiting shipment is subject to the same storage requirements as unfabricated material.

All structural steel must arrive at the Project Site in a condition meeting or exceeding the specified requirements. Steel damaged by salt water shipment must be thoroughly cleaned by high pressure water flushing, chemical cleaning, or sandblasting, and repainted with the specified shop coat in compliance with specified requirements.

All material must be stored to prevent rust and loss of small parts. Piled material must rest on skids or platforms, and must not make contact with the ground or with water.

The loading, transporting, unloading, and stockpiling of the structural steel material must be so conducted that the metal is kept clean and free from injury from rough handling.

In field assembly of structural parts, the Contractor must use methods and equipment that must not twist, bend, deform, or otherwise injure the metal. Any bent or twisted member must be corrected before it is placed. The Owner will not accept any member with damage.

Girder sections must be handled to prevent damage to the girders. The Contractor must provide temporary stiffeners to prevent buckling during erection as necessary.

6-03.3(10) STRAIGHTENING BENT MATERIAL

Plates, angles, other shapes, and built up members may be straightened if authorized in writing by the Engineer. Straightening methods must not fracture or injure the metal. Distorted members must be straightened mechanically. A limited quantity of localized heat may be applied only if carefully planned and supervised, and only if the Engineer has approved a heat straightening procedure in writing.

Parts to be heat straightened must be free from all stress and external forces except those that result from the mechanical pressure used with the heat.

After straightening, the Contractor must inspect the member for fractures using a method specified in the Contract.

1 The Engineer will reject metal showing sharp kinks and bends.

2 The procedure for heat straightening of universal mill (UM) plates by the mill or the fabricator must be submitted to the
3 Engineer for review before doing this work.

4 **6-03.3(11) WORKMANSHIP AND FINISH**

5 Workmanship and finish must be first class, equaling the best practice in modern bridge fabrication shops. Welding,
6 shearing, burning, chipping, and grinding must be done neatly and accurately. All parts of the work exposed to view must be
7 neatly finished.

8 Wherever the Drawings show a surface finish symbol, the surface must be machined.

9 **6-03.3(12) FALSEWORK**

10 All falsework must conform to the requirements specified in Section 6-02.

11 **6-03.3(13) FABRICATING TENSION MEMBERS**

12 Plates for main load carrying tension members or tension components of flexural members must be:

- 13 1. Blast cleaned entirely or blast cleaned on all areas within 2 inches of welds to SSPC SP6, Commercial Blast
14 Cleaning; and
- 15 2. Manufactured from plate stock with the primary rolling direction of the stock parallel to the length of the member, or as
16 shown on the Drawings.

17 **6-03.3(14) EDGE FINISHING**

18 All rolled, sheared, and flame cut edges must be true to line and free of rough corners and projections. Corners along
19 exposed edges must be rounded to a minimum radius of 1/16 inch.

20 Sheared edges on plates more than 5/8 inch thick must be planed, milled, ground, or flame cut to a depth of at least 1/8
21 inch.

22 Reentrant corners or cuts must be filleted to a minimum radius of 3/4 inch.

23 Exposed edges of main load carrying tension members or tension components of flexural members must have a surface
24 roughness no greater than 250 micro inches as defined by the American National Standards Institute, ANSI B46.1, Surface
25 Texture. Exposed edges of other members must have surface roughness no greater than 1,000 micro inches.

26 The hardness of flame cut edges of structural low alloy plates, as specified in Section 9-06.22, for main load carrying
27 tension members or tension components of flexural members must comply with the requirements outlined in Appendix A,
28 "Testing Rockwell Hardness of Flame cut Edges" to be found in the appendix of the Project Manual. The Contractor must
29 prevent excessive hardening of plate edges through preheating, postheating, or control of the burning process as
30 recommended by the steel manufacturer and approved by the Engineer.

31 **6-03.3(15) PLANING OF BEARING SURFACES**

32 Ends of columns that bear on base and cap plates must be milled to true surfaces and accurate bevels.

33 When assembled, caps and base plates of columns and the sole plates of girders and trusses must have full contact. If
34 warped or deformed, the plates must be heat straightened, planed, or corrected in some other way to produce accurate, even
35 contact. If necessary for proper contact, bearing surfaces that are in contact with other metal surfaces must be planed or
36 milled. Surfaces of warped or deformed base and sole plates that are to in contact with masonry must be rough finished.

37 On the surface of expansion bearings, the cut of the planer must be in the direction of expansion.

38 **6-03.3(16) ABUTTING JOINTS**

39 Abutting ends of compression members must be faced accurately so they bear evenly when in the Structure. On built up
40 members, the ends must be faced or milled after fabrication.

41 Ends of tension members at splices must be rough finished to produce neat, close joints. A contact fit is not required.

42 **6-03.3(17) END CONNECTION ANGLES**

43 On floorbeams and stringers, end connection angles must be flush with each other and set accurately in relationship to
44 the position and length of the member. End connection angles must not be finished unless specified otherwise in the Contract.
45 If, however, faulty assembly requires them to be milled, milling must not reduce thickness by more than 1/16 inch.

46 **6-03.3(18) BUILT UP MEMBERS**

47 The various pieces forming 1 built up member must be straight and close fitting, true to detailed dimensions, and free
48 from twists, bends, open joints, or other defects.

49 When fabricating curved girders, localized heat or using mechanical force must not be used to bend the girder flanges
50 about an axis parallel to the girder webs.

1 **6-03.3(19) HAND HOLES**

2 Hand holes, whether punched or cut with burning torches, must be true to sizes and shapes shown on the Drawings.
3 Edges must be true to line and ground smooth.

4 **6-03.3(20) LACING BARS**

5 Unless the Contract states otherwise, ends of lacing bars must be neatly rounded.

6 **6-03.3(21) PLATE GIRDERS**

7 **6-03.3(21)A WEB PLATES**

8 If web plates are spliced, clearance between plate ends must not exceed 3/8 inch.

9 **6-03.3(21)B WEB SPLICES AND FILLERS**

10 Web splice plates and fillers under stiffeners must fit within 1/8 inch at each end. Instead of the steel Material specified in
11 the Drawings or Special Provisions, the Contractor may substitute ASTM A 1008 or ASTM A 1011 steel for all filler plates less
12 than 1/4 inch thickness, provided that the grade of filler plate steel meets or exceeds that of the splice plates.

13 **6-03.3(22) EYEBARS**

14 Eyebars must be straight, true to size, and free from twists or folds in the neck or head and from any other defect that
15 would reduce their strength. Heads must be formed by upsetting, rolling, or forging. Dies in use by the manufacturer may
16 determine the shape of bar heads if approved in writing by the Engineer. Head and neck thickness must not overrun by more
17 than 1/16 inch. Welds must not be made in the body or head of any bar.

18 Each eyebar must be properly annealed and carefully straightened before it is bored. Pinholes must be located on the
19 centerline of each bar and in the center of its head. Holes in bar ends must be so precisely located that in a pile of bars for the
20 same truss panel, the pins may be inserted completely without driving. All eyebars made for the same locations in trusses
21 must be interchangeable.

22 **6-03.3(23) ANNEALING**

23 All eyebars must be annealed by being heated uniformly to the proper temperature, then cooled slowly and evenly in the
24 furnace. At all stages, the temperature of the bars must be under full control.

25 Slight bends on secondary steel members may be made without heat. Crimped web stiffeners need no annealing.

26 **6-03.3(24) PINS AND ROLLERS**

27 Pins and rollers must be made of the class of forged steel as specified on the Drawings. They must be turned accurately
28 to detailed dimensions, smooth, straight, and flawless. The final surface must be produced by a finishing cut.

29 Pins and rollers 9 inches or less in diameter may either be forged and annealed, or made of cold finished carbon steel
30 shafting.

31 Pins more than 9 inches in diameter must have holes at least 2 inches in diameter bored longitudinally through their
32 centers. Pins with inner defects will be rejected.

33 The Contractor must provide pilot and driving nuts for each size of pin unless the Contract specifies otherwise.

34 **6-03.3(24)A BORING PIN HOLES**

35 Pin holes must be bored true to detailed dimensions, smooth and straight, and at right angles to the axis of the member.
36 Holes must be parallel with each other unless the Contract specifies otherwise. A finishing cut must always be made.

37 The distance between holes must not vary from detailed dimensions by more than 1/32 inch. In tension members, this
38 distance must be measured from outside to outside of holes. In compression members, this distance must be measured from
39 inside to inside of holes.

40 **6-03.3(24)B PIN CLEARANCES**

41 Each pin must be 1/50 inch smaller in diameter than its hole. All pins must be numbered after being fitted into their holes
42 in the assembled member.

43 **6-03.3(25) WELDING AND REPAIR WELDING**

44 Welding and repair welding of all steel bridges must comply with the AASHTO / AWS D1.5M/D1.5:2010, Bridge Welding
45 Code. Welding and repair welding for all other steel fabrication must comply with AWS D1.1/D1.1M, latest edition, Structural
46 Welding Code. The requirements described in the remainder of this Section must prevail whenever they differ from either of
47 the above welding codes.

48 Welding of structural steel will be permitted only to the extent shown on the Drawings. No welding, including tack and
49 temporary welds, must be done in the shop or field unless the location of the welds is shown on the submitted Shop Drawings
50 reviewed by the Engineer.

1 Welding procedures must be submitted with the Shop Drawings. The procedures must specify the type of equipment to
2 be used, electrode selection, preheat requirements, base materials, and joint details. When the procedures are not
3 prequalified by AWS or AASHTO, evidence of qualification tests indicating the approval of a recognized agency must be in the
4 submittal.

5 Welding must not start until after the Contractor has received the Engineer's review of Shop Drawings as required in
6 Section 6-03.3(7). These Shop Drawings must include procedures for welding, assembly, and any heat straightening or heat
7 curving.

8 Any welded shear connector longer than 8 inches may be made of 2 shorter shear connectors joined with full penetration
9 welds.

10 In shielded metal arc welding, the Contractor must use low hydrogen electrodes.

11 In submerged arc welding, flux must be oven dried at 550 °F for at least 2 hours, then stored in ovens held at 250 °F or
12 more. If not used within 4 hours after removal from a drying or storage oven, flux must be re-dried before use.

13 Preheat and interpass temperatures must conform to the applicable welding code as specified in this Section. When
14 welding main members of steel bridges, the minimum preheat must not be less than 100 °F.

15 If groove welds (web to web or flange to flange) have been rejected, they may be repaired no more than twice. If a third
16 failure occurs, the Contractor must at the Engineer's discretion:

- 17 1. Trim the members, if the Engineer approves, at least 1/2 inch on each side of the weld; or
- 18 2. Replace the members at no additional cost to the Owner.

19 By using extension bars and runoff plates, the Contractor must end groove welds to ensure the soundness of each weld
20 to its ends. The bars and plates must be removed after the weld is finished and cooled. The weld ends must then be ground
21 smooth and flush with the edges of abutting parts.

22 The Contractor must not:

- 23 a. Weld with electrogas or electroslag methods;
- 24 b. Weld nor flame cut when ambient temperature is below 20 °F; or
- 25 c. Use coped holes in the web for welding butt splices in the flanges unless the Drawings show them.

26 **6-03.3(25)A WELDING INSPECTION**

27 The Contractor's inspection procedures, techniques, methods, acceptance criteria and inspector qualifications for
28 welding of steel bridges are per the AASHTO / AWS D1.5M/D1.5: 2010, Bridge Welding Code. The Contractor's inspection
29 procedures, techniques, methods, acceptance criteria and inspector qualifications for welding of steel structures except steel
30 bridges are per AWS D1.1/D1.1M, latest edition, Structural Welding Code. The requirements described in the remainder of this
31 Section must prevail whenever they differ from either of the above welding codes.

32 Nondestructive testing, in addition to visual inspection, must be performed by the Contractor. Unless otherwise specified
33 in the Contract, the extent of inspection is specified in this Section. Testing and inspection must apply to welding performed in
34 the shop and in the field.

35 After the Contractor's welding inspection is complete, the Contractor must allow the Engineer sufficient time to perform
36 quality assurance ultrasonic welding inspection.

37 **6-03.3(25)A1 VISUAL INSPECTION**

38 All welds must be 100 percent visually inspected. Visual inspection must be performed before, during, and after
39 completing welding.

40 **6-03.3(25)A2 RADIOGRAPHIC INSPECTION**

41 Complete penetration tension groove welds in highway bridges must be 100 percent radiographically inspected. These
42 welds include those in the tension area of webs where inspection must cover the greater of these 2 distances:

- 43 1. 15 inches from the tension flange or
- 44 2. 1/3 of the web depth. In addition, use edge blocks conforming to the requirements of AASHTO/AWS D1.5M/D1.5:
45 2010 Bridge Welding Code Section 6.10.14 must for radiographic inspection.

46 The Contractor must maintain the radiographs and the radiographic inspection report in the shop until the last joint to be
47 radiographed in that member is accepted by the radiographer representing the Contractor. Within 2 Working Days following
48 this acceptance, the Contractor must submit the film and 2 copies of the radiographic inspection report to the Engineer.

49 **6-03.3(25)A3 ULTRASONIC INSPECTION**

50 Complete penetration groove welds on plates thicker than 5/16 inch in the following welded assemblies or structures
51 must be 100 percent ultrasonically inspected:

- 52 1. Welded connections and splices in highway bridges and earth retaining structures, except longitudinal butt welds in
53 beam or girder webs.
- 54 2. Bridge bearings and modular expansion joints.

3. Sign bridges, cantilever sign structures, and bridge mounted sign brackets except longitudinal butt joint welds in beams.

4. Light, signal, and strain pole standards; and steel casing for concrete columns.

The testing procedure and acceptance criteria for tubular members must conform with Section 10 of the latest edition of the AWS Structural Welding Code D1.1/D1.1M.

6-03.3(25)A4 MAGNETIC PARTICLE INSPECTION

1. Fillet and partial penetration groove welds: At least 30 percent of each size and type of fillet welds (except intermittent fillet welds) and partial penetration groove welds in the following welded assemblies or Structures must be tested by the magnetic particle method:

- a. Flange to web connections in highway bridges.
- b. End and intermediate pier diaphragms in highway bridges.
- c. Stiffeners and connection plates in highway bridges.
- d. Welded connections and splices in earth retaining Structures.
- e. Boxed members of trusses.
- f. Bridge bearings and modular expansion joints.
- g. Sign bridges, cantilever sign Structures, and bridge mounted sign brackets.
- h. Light, signal, and strain pole standards.

2. Longitudinal butt welds in beam and girder webs: At least 30 percent of each longitudinal butt weld in the beam and girder webs must be tested by the magnetic particle method.

3. Complete penetration groove welds on plates 5/16 inch or thinner must be 100 percent tested by the magnetic particle method. Testing must apply to both sides of the weld, if backing plate is not used.

4. The ends of each complete penetration groove weld at plate edges must be tested by the magnetic particle method.

The Contractor must have all welds of structural members inspected by 100 percent radiographic or ultrasonic inspection, or by a combination of both, as specified in 2. and 3. above and in compliance with the last paragraph of this Section.

Where 100 percent testing is not required, the Engineer may select the location for testing.

If rejectable flaws are found in any test length of weld in item 4. Magnetic Particle Inspection, subitems (a) or (b) in this Section, the full length of the weld or 5 feet on each side of the test length, whichever is less, must be tested.

After repairs of defects have been made, additional nondestructive testing must be performed to ensure that the repairs are acceptable. This testing must include the repaired area plus at least 2 inches on each side of the repaired area.

After the Contractor has completed his welding inspection, the Contractor must allow the Engineer sufficient time to perform quality assurance ultrasonic welding inspection.

The Contractor must maintain the video records of ultrasonic inspections and the ultrasonic inspection reports in the shop until the last joint to be tested by ultrasonic means has been accepted by the inspector conducting these inspections for the Contractor. Within 2 Working Days following this acceptance, the Contractor must mail the film and video record together with 2 copies each of the radiographic and ultrasonic inspection reports to the Engineer.

6-03.3(26) SCREW THREADS

Screw threads must be U.S. Standard and must fit closely in the nuts.

6-03.3(27) HIGH STRENGTH BOLT HOLES

At the Contractor's option under the conditions described in this Section, holes may be punched or subpunched and reamed, drilled or subdrilled and reamed, or formed by numerically controlled drilling operations.

The hole for each high strength bolt must be 1/16 inch larger than the nominal diameter of the bolt.

In fabricating any connection, the Contractor may subdrill or subpunch the holes and then ream full size after assembly or drill holes full size from the solid with all thicknesses of material shop assembled in the proper position. If the Contractor chooses not to use either of these methods, the following must apply:

1. Drill bolt holes in steel splice plates full size using steel templates;
2. Drill bolt holes in the main members of trusses, arches, continuous beam spans, bents, towers, plate girders, box girders, and rigid frames at all connections as follows:
 - a. A minimum of 30 percent of the holes in one side of the connection must be made full size using steel templates.
 - b. A minimum of 30 percent of the holes in the second side must be made full size assembled in the shop.
 - c. All remaining holes may be made full size in unassembled members using steel templates.
3. Drill bolt holes in crossframes, gussets, lateral braces, and other secondary members full size using steel templates.

1 The Contractor must submit for the Engineer's review, a detailed outline of the procedures proposed to accomplish the
2 work from initial drilling through shop assembly.

3 **6-03.3(27)A PUNCHED HOLES**

4 For punched holes, die diameter must not exceed punch diameter by more than 1/16 inch. Any hole requiring
5 enlargement to admit the bolt must be reamed. All holes must be cut clean with no torn or ragged edges. The Owner will reject
6 components having poorly matched holes.

7 **6-03.3(27)B REAMED AND DRILLED HOLES**

8 Reaming and drilling must be done with twist drills, or with short taper reamers, producing cylindrical holes perpendicular
9 to the member. Reamers and drills must be directed mechanically, not hand held. Connecting parts that require reamed or
10 drilled holes must be assembled and held securely as the holes are formed, then match marked before disassembly. The
11 Contractor must provide the Engineer with a diagram showing these match marks. The Owner will reject components having
12 poorly matched holes.

13 Burrs on outside surfaces must be removed. The Contractor must disassemble parts to remove burrs as applicable.

14 If templates are used to ream or drill full size connection holes, the templates must be positioned and angled with
15 accuracy and bolted securely in place. Templates for reaming or drilling matching members, or the opposite face of 1 member,
16 must be duplicates. All splice components must be match marked.

17 **6-03.3(27)C NUMERICALLY CONTROLLED (N/C) DRILLED CONNECTIONS**

18 In forming any hole described in Section 6-03.3(27), the fabricator may use numerically controlled (N/C) drilling or
19 punching equipment if it meets the requirements in this Section.

20 The Contractor must submit for review, a detailed outline of proposed N/C procedures. This outline must:

- 21 1. Cover all steps from initial drilling or punching through check assembly.
- 22 2. Include the specific members of the Structure to be drilled or punched, hole sizes, locations of the common index and
23 other reference points, makeup of check assemblies, and all other information needed to describe the process fully.

24 N/C holes may be drilled or punched to size through individual pieces, or may be drilled through any combination of
25 pieces restrained from moving while being drilled.

26 At the Engineer's request, the Contractor must demonstrate that the N/C procedures consistently produces holes and
27 connections meeting the requirements of these Specifications.

28 **6-03.3(27)D ACCURACY OF PUNCHED, SUBPUNCHED AND SUBDRILLED HOLES**

29 After shop assembly and before reaming, all punched, subpunched, and subdrilled holes must comply with the following
30 standard of accuracy. At least 75 percent of the holes in each connection must allow passing a cylindrical pin 1/8 inch smaller
31 in diameter than nominal hole size. This pin must pass through at right angles to the face of the member without drifting. All
32 holes must allow passage of a pin 3/16 inch smaller in diameter than nominal hole size. The Owner will reject any pieces that
33 fail to comply with these standards.

34 **6-03.3(27)E ACCURACY OF REAMED AND DRILLED HOLES**

35 At least 85 percent of all holes in a connection of reamed or drilled holes must show no offset greater than 1/32 inch
36 between adjacent thicknesses of metal. No hole must have an offset greater than 1/16 inch.

37 Centerlines from the connection must be inscribed on the template, and holes must be located from these centerlines.
38 Centerlines must also be used for accurately locating the template relative to the milled or scribed ends of the members.

39 Templates must have a hardened steel bushing inserted into each hole. These bushings may be omitted, however, if the
40 fabricator can acceptably demonstrate this to the Engineer:

- 41 1. That the template is to be used no more than 5 times, and
- 42 2. That use produces no template wear.

43 Each template must be at least 1/2 inch thick. Use thicker templates to prevent buckling and misalignment as the holes
44 are formed.

45 **6-03.3(27)F FITTING FOR BOLTING**

46 Before drilling, reaming, and bolting starts, all parts of a member must be assembled, well pinned, and drawn firmly
47 together. If necessary, assembled pieces must be taken apart to allow removal of any burrs or shavings produced as the holes
48 are formed. The member must be free from twists, bends, and other deformation.

49 In shop bolted connections, contacting metal surfaces must be sandblasted clean before assembly. Sandblasting must
50 comply with the requirements of the SSPC Specifications for Commercial Blast Cleaning (SSPC SP 6).

51 Any drifting done during assembly must be no more than enough to bring the parts into place. Drifting must not enlarge
52 the holes or distort the metal.

1 6-03.3(28) SHOP ASSEMBLY**2 6-03.3(28)A METHOD OF SHOP ASSEMBLY**

3 Unless the Contract specifies otherwise, the Contractor must choose from the following 5 described shop assembly
4 methods, the method that best fits the proposed erection method. The Contractor must submit and obtain review from the
5 Engineer, both the shop assembly and the erection methods before this work starts.

- 6 1. Full Truss or Girder Assembly: Each truss or girder is completely assembled over the full length of the superstructure.
- 7 2. Progressive Truss or Girder Assembly: Each truss or girder is assembled in stages longitudinally over the full length
8 of the superstructure.
 - 9 a. For Trusses: The first stage must include at least 3 adjacent truss panels. Each truss panel must include all truss
10 members in the space bounded by the top and bottom chords and the horizontal distance between adjacent
11 bottom chord joints.
 - 12 b. For Girders: The first stage must include at least 3 adjacent girder shop sections. Shop sections are measured
13 from the end of the girder to the first field splice or from field splice to field splice.
 - 14 c. For Trusses and Girders – After the first stage has been completed, each subsequent stage must be assembled
15 to include: at least 1 truss panel or girder shop section of the previous stage and 2 or more truss panels or girder
16 shop sections added at the advancing end. The previous stages must be repositioned if necessary, and pinned to
17 ensure accurate alignment.
 - 18 1) For girders on tangents without skews or tapers, the Contractor may assemble subsequent stages which
19 include 1 girder shop section of the previous stage and 2 or more girder shop sections at the advancing end.
 - 20 2) If the bridge is longer than 150 feet, each longitudinal stage must be at least 150 feet long, regardless of the
21 length of individual continuous truss panels or girder shop sections.
 - 22 3) The Contractor may start the assembly sequence at any point on the bridge and proceed in either or both
23 directions from that point.
 - 24 4) No assembly must have less than 3 truss panels or girder shop sections.
- 25 3. Full Chord Assembly: The full length of each chord for each truss is assembled with geometric angles at the joints.
26 Chord connection bolt holes are drilled or reamed while members are assembled. The truss web member
27 connections are drilled/reamed to steel templates set by relating geometric angles to the chord lines.
28 At least 1 end of each web member must be milled or scribed at right angles to its long axis. The templates at both
29 ends of the member must be positioned accurately from the milled end or scribed line.
- 30 4. Progressive Chord Assembly: Adjacent chord sections are assembled in the same way as specified for Full Chord
31 Assembly, using the procedure specified for Progressive Truss or Girder Assembly.
- 32 5. Special Complete Structure Assembly: All structural steel members (superstructure and substructure, including all
33 secondary members) are assembled at one time.

34 6-03.3(28)B CHECK OF SHOP ASSEMBLY

35 The Contractor must check each assembly for alignment, accuracy of holes, fit of milled joints, and other assembly
36 techniques. Drilling or reaming must not start until the Engineer has given written approval. If the Contractor uses N/C drilling,
37 this written approval from the Engineer must be obtained before the assembly or stage is dismantled.

38 6-03.3(29) WELDED SHEAR CONNECTORS

39 All welded shear connectors on steel girder top flanges must be installed in the field after the forms for the concrete
40 bridge deck are in place. The steel surface to be welded must be prepared to SSPC-SP 11, power tool cleaning, just before
41 welding. Installation, production control, and inspection of welded shear connectors must conform to Chapter 7 of the
42 AASHTO/AWS D1.5M/D1.5: 2010 Bridge Welding Code. After the welded shear connectors are installed, the weld and the
43 disturbed steel surface must be cleaned and painted as specified in Section 6-07.3(9)l.

44 6-03.3(30) PAINTING

45 All painting is specified in Section 6-07.

46 6-03.3(30)A ERECTION MARKS

47 Erection marks to allow identification of members in the field must be painted on previously painted surfaces.

48 6-03.3(30)B MACHINE FINISHED SURFACES

49 As soon as possible and before they leave the shop, machine finished surfaces on abutting chord splices, column
50 splices, and column bases must be covered with grease. After erection, the steel must be cleaned and painted as specified.

51 All surfaces of iron and steel castings milled to smooth the surface must be painted with the primer called for in the
52 specified paint system.

1 While still in the shop, machine finished surfaces and inaccessible surfaces of rocker or pin type bearings must receive
2 the full paint system. Surfaces of pins and holes machine finished to specific tolerances must not be painted. However, as
3 soon as possible and before they leave the shop, they must be coated with grease.

4 **6-03.3(31) ALIGNMENT AND CAMBER**

5 Before starting field bolting, the Contractor must:

- 6 1. Adjust the structure to correct grade and alignment.
- 7 2. Regulate elevations of panel points (ends of floorbeams).
- 8 3. Delay bolting at compression joints until adjusting the blocking to provide full and even bearing over the whole joint.

9 On truss spans, a slight excess camber will be permitted as the bottom chords are bolted. But camber and relative
10 elevations of panel points must be correct before the top chord joints, top lateral system, and sway braces are bolted.

11 **6-03.3(31)A MEASURING CAMBER**

12 The Contractor must provide the Engineer with a diagram for each truss that shows camber at each panel point. This
13 diagram must display actual measurements taken as the truss is being assembled.

14 **6-03.3(32) ASSEMBLING AND BOLTING**

15 To bolt any field connection or splice, the Contractor must install and tighten to snug tight enough bolts to bring all parts
16 into full contact with each other before tightening the bolts to the specified minimum tension.

17 "Snug tight" means either the tightness reached by:

- 18 1. A few blows from an impact wrench, or
- 19 2. The full effort of a person using a spud wrench.

20 As erection proceeds, all field connections and splices for each member must be securely drift pinned and bolted as
21 described below, before the weight of the member can be released or the next member is added. Field erection Shop
22 Drawings must specify pinning and bolting requirements that comply with or exceed the following minimums:

- 23 a. Joints in Normal Structures: Fifty percent of the holes in a single field connection and 50 percent of the holes on each
24 side of a single joint in a splice plate must be filled with drift pins and bolts. 30 percent of the filled holes must be
25 pinned. 70 percent of the filled holes must be bolted and tightened to snug tight. Once all these bolts are snug tight,
26 each bolt must be systematically tightened to the specified minimum tension. "Systematically tightened" means
27 starting with bolts in the most rigid part, which is usually the center of the joint, and working out to its free edges. The
28 fully tensioned bolts must be located near the middle of a single field connection or a single splice plate.
- 29 b. Joints in Cantilevered Structures: 75 percent of the holes in a single field connection and 75 percent of the holes on
30 each side of a single joint in a splice plate must be filled with drift pins and bolts. 50 percent of the filled holes must be
31 pinned. 50 percent of the filled holes must be bolted and tightened to snug tight. Once all these bolts are snug tight,
32 each bolt must be systematically tightened to the specified minimum tension. The fully tensioned bolts must be
33 located near the middle of a single field connection or a single splice plate.

34 Cylindrical erection pins (drift pins) must be placed throughout each field connection and each field joint with the greatest
35 concentration in the outer edges of a splice plate or member being bolted. Drift pins must be double-tapered barrel pins of
36 hardened steel. The diameter of the drift pins must be at least 1/32 inch larger than the diameter of the bolts in the connection
37 or the full hole diameter.

38 To complete a joint following one of the methods listed above, the Contractor must fill all remaining holes of the field
39 connection or splice place with bolts and tighten to snug-tight. Once all of these bolts are snug tight, each bolt must be
40 systematically tightened to the specified minimum tension. After these bolts are tightened to the specified minimum tension,
41 the Contractor must replace the drift pins with bolts tightened to the specified minimum tension.

42 The Contractor must complete the joint or connection within 10 Calendar Days of installing the first bolt or within a
43 duration approved by the Engineer. Any bolts inserted in an incomplete connection, either loose or tightened snug-tight, which
44 exceed the specified duration for completing the connection, are subject to the following requirements:

- 45 1) 3 assemblies for each size and length must be removed from connections that are to be tensioned. Rotational
46 capacity tests must be performed on the removed assemblies to demonstrate the assembly has sufficient lubricant to
47 be tensioned satisfactorily.
- 48 2) 5 assemblies must be removed from the connection to establish the inspection torque.
- 49 3) In the case of tension controlled bolts, 3 assemblies must be removed and tested as specified in Section 6-03.3(33)A
50 to verify the minimum specified tension can be achieved before shearing of the spline.

51 Assemblies removed for the purpose of rotational capacity testing, determination of the inspection torques, or verification
52 of tension controlled bolt performance must be replaced with new bolts at no additional expense to the Owner. To minimize the
53 number of removed assemblies, the Contractor may combine rotational capacity testing and inspection torque determination
54 as approved by the Engineer.

55 The Contractor may complete a field bolted connection or splice in a continuous operation before releasing the mass of
56 the member or adding the next member. The Contractor must use drift pins to align the connection. The alignment drift pins

1 must fill between 15 and 30 percent of the holes in a single field connection and between 15 and 30 percent of the holes on
 2 each side of a single joint in a splice plate. Once the alignment drift pins are in place, all remaining holes must be filled with
 3 bolts and tightened to snug tight starting from near the middle and proceeding toward the outer gage lines. Once all of these
 4 bolts are snug tight, the Contractor must systematically tighten all these bolts to the specified minimum tension. The
 5 Contractor must then replace the drift pints with bolts. Each of these bolts must be tightened to the specified minimum tension.

6 All bolts must be placed with heads toward the outside and underside of the bridge. All high strength bolts must be
 7 installed and tightened before the falsework is removed.

8 The Contractor may erect metal railings as erection proceeds. But railings must not be bolted or adjusted permanently
 9 until the falsework is released and the deck placed.

10 The Contractor must not start painting until the Engineer has inspected and accepted field bolting.

11 **6-03.3(33) BOLTED CONNECTIONS**

12 Fastener components must include bolts, nuts, washers, tension control bolt assemblies, and direct tension indicators.
 13 Fastener components must comply with the requirements of Section 9-06.4(2).

14 The Contractor must submit documentation of the bolt tension calibrator for approval by the Engineer, which must include
 15 brand, capacity, model, date of last calibration, and manufacturer’s instructions for use. The Contractor must supply the
 16 approved bolt tension calibrator and all accompanying hardware and calibrated torque wrenches to conduct all testing and
 17 inspections described here. Use of the bolt tension calibrator must comply with manufacturer’s recommendations.

18 Fastener components must be protected from dirt and moisture in closed containers at the site of installation. Only as
 19 many fastener components as are anticipated to be installed during the workshift must be taken from protected storage.
 20 Fastener components that are not incorporated into the Work must be returned to protected storage at the end of the
 21 workshift. Fastener components must not be cleaned or modified from the as-delivered condition. Fastener components that
 22 accumulate rust or dirt must not be incorporated into the Work. Tension control bolt assemblies must not be relubricated,
 23 except by the manufacturer.

24 All bolted connections are slip critical. Painted structures require either Type 1 or Type 3 bolts. Unpainted structures
 25 require Type 3 bolts. Bolts must not be galvanized unless specified in the Contract documents. AASHTO M 253 bolts must not
 26 be galvanized or used in contact with galvanized metal.

27 Washers are required under turned elements for bolted connections and as required in the following:

- 28 1. Use washers under both the head and the nut when AASHTO M 253 bolts are to be installed in structural carbon
- 29 steel, as specified in Section 9-06.1.
- 30 2. Where the outer face of the bolted parts has a slope greater than 1 to 20 with respect to a plane normal to the bolt
- 31 axis, a beveled washer must be used.
- 32 3. Washers must not be stacked unless otherwise approved by the Engineer.
- 33 4. It is acceptable to place a washer under the unturned element.

34 All galvanized nuts must be lubricated by the manufacturer with a lubricant containing a visible dye so a visual check for
 35 the lubricant can be made during field installation. Black bolts must be lubricated by the manufacturer and must be “oily” to the
 36 touch when installed.

37 After assembly, bolted parts must fit solidly together. Bolted parts must not be separated by washers, gaskets, or any
 38 other material. Assembled joint surfaces, including those adjacent to bolt heads, nuts, and washers, must be free of loose mill
 39 scale, burrs, dirt, and other foreign material that would prevent solid seating.

40 When all bolts in a joint are tight, each bolt must carry at least the proof load described in the following table:

41 **Minimum Bolt Tension**

| Bolt Size (Inches) | AASHTO M 164 ASTM F 1852 (Pounds) | AASHTO M 253 (Pounds) |
|-----------------------|--------------------------------------|--------------------------|
| 1/2 | 12,050 | 14,900 |
| 5/8 | 19,200 | 23,700 |
| 3/4 | 28,400 | 35,100 |
| 7/8 | 39,250 | 48,500 |
| 1 | 51,500 | 63,600 |
| 1 1/8 | 56,450 | 80,100 |
| 1 1/4 | 71,700 | 101,800 |
| 1 3/8 | 85,450 | 121,300 |
| 1 1/2 | 104,000 | 147,500 |

1 Before final tightening of any bolts in a bolted connection, the connection must be compacted to a snug tight condition.
 2 Snug tight must include bringing all plies of the connection into firm contact and snug tightening all bolts as specified in Section
 3 6-03.3(32).

4 Final tightening may be done by the Turn-of-Nut Method, the direct-tension indicator method, or the twist off-type tension
 5 control structural bolt/nut/washer assembly method. Preferably, the nut must be turned tight while the bolt is prevented from
 6 rotating. However, if required by either turn-of-nut or direct-tension-indicator methods because of bolt entering and/or wrench
 7 operational clearances, tightening may be done by turning the bolt while the nut is prevented from rotating.

8 1) Turn-of-Nut Method

9 After all specified bolting conditions are satisfied, and before final tightening, the Contractor must match-mark with crayon
 10 or paint the outer face of each nut and the protruding part of the bolt. Each bolt must be final tightened to the specified
 11 minimum tension by rotating the quantity specified in Table 2. To ensure this tightening method is followed, the Engineer will
 12 observe as the Contractor installs, snug tightens, and final tightens all bolts and inspect each match-mark.

13
 14 **Turn of Nut Tightening Method**
 15 **Nut Rotational from Snug Tight Condition**

| Bolt Length ¹ | Disposition of Outer Faces of Bolted Parts | | |
|--------------------------|--|------------------------|------------------------|
| | Condition ² | Condition ³ | Condition ⁴ |
| $L \leq 4D$ | 1/3 turn | 1/2 turn | 2/3 turn |
| $4D < L \leq 8D$ | 1/2 turn | 2/3 turn | 5/6 turn |
| $8D < L \leq 12D$ | 2/3 turn | 5/6 turn | 1 turn |

16 NOTE:

- 17 1. L = Bolt length measured from underside of head to extreme end of point. D = Nominal bolt diameter of bolt being
 18 tightened.
- 19 2. Condition 1: both faces at right angles to bolt axis.
- 20 3. Condition 2: one face at right angle to bolt axis, one face sloped no more than 1 to 20, without bevel washer.
- 21 4. Condition 3: both faces sloped no more than 1 to 20 from right angle to bolt axis, without bevel washer.

22
 23 Nut rotation is relative to the bolt regardless of which element (nut or bolt) is being turned.

24 The following tolerances are permitted: ± 30 degrees (1/12 turn) for final turns of 1/2 turn or less; ± 45 degrees (1/8 turn)
 25 for final turns of 2/3 turn or more.

26 When bolt length exceeds 12D, determine the rotation by actual tests in which a suitable tension device simulates actual
 27 conditions.

28 2) Direct Tension Indicator Method:

29 Direct Tension Indicators (DTIs) must not be used under the turned element. DTIs must be placed under the bolt head
 30 with the protrusions facing the bolt head when the nut is turned. DTIs must be placed under the nut with the protrusions facing
 31 the nut when the bolt is turned.

32 Gap refusal must be measured with a 0.005-inch tapered feeler gage. After all specified bolting conditions are satisfied,
 33 the snug tightened gaps must comply with Table 3 snug tight limits.

34 Each bolt must be final-tightened to comply with Table 3 final-tighten limits. If the bolt is tensioned so that no visible gap
 35 in any space remains, the bolt and DTI must be removed and replaced by a new properly tensioned bolt and DTI.

36 The Contractor must tension all bolts, inspecting all DTIs with a feeler gage, in the presence of the Engineer. DTIs must
 37 be installed by 2 person, or more, crews, with 1 individual preventing the element at the DTI from turning and measuring the
 38 gap of the DTI to determine the proper tension of the bolt.

39 If a bolt, that has had its DTI brought to full load, loosens while bolting the connection, it must be rejected. Reuse of the
 40 bolt and nut are subject to the provisions of this Section. The used DTI must not be reinstalled.

41
 42 **Direct Tension Indicator Requirements**

| Bolt Size (inches) | DTI Spaces | | Maximum Snug Tight Refusals | | Minimum Final Tighten Refusals | |
|-----------------------|------------|-------|-----------------------------|-------|--------------------------------|-------|
| | M 164 | M 253 | M 164 | M 253 | M 164 | M 253 |
| 1/2 | 4 | 5 | 1 | 2 | 2 | 3 |
| 5/8 | 4 | 5 | 1 | 2 | 2 | 3 |
| 3/4 | 5 | 6 | 2 | 2 | 3 | 3 |
| 7/8 | 5 | 6 | 2 | 2 | 3 | 3 |

| Bolt Size (inches) | DTI Spaces | | Maximum Snug Tight Refusals | | Minimum Final Tighten Refusals | |
|-----------------------|------------|-------|-----------------------------|-------|--------------------------------|-------|
| | M 164 | M 253 | M 164 | M 253 | M 164 | M 253 |
| 1 | 6 | 7 | 2 | 3 | 3 | 4 |
| 1 1/8 | 6 | 7 | 2 | 3 | 3 | 4 |
| 1 1/4 | 7 | 8 | 3 | 3 | 4 | 4 |
| 1 3/8 | 7 | 8 | 3 | 3 | 4 | 4 |
| 1 1/2 | 8 | 9 | 3 | 4 | 4 | 5 |

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3) Twist Off-Type Tension Control Structural Bolt/Nut/Washer Assembly Method (Tension Control Bolt Assembly)

Tension control bolt assemblies must include the bolt, nut, and washer packaged and shipped as a single assembly. Unless otherwise approved by the Engineer, tension control bolt assembly components must not be interchanged for testing or installation and must comply with all provisions of ASTM F 1852. If approved by the Engineer, the tension control bolt assembly components may be interchanged within the same component lot for girder web splices or other locations where access to both sides of the connection is restricted.

The tension control bolts must incorporate a design feature intended to either indirectly indicate, or to automatically provide, the minimum tension specified in Table 1.

The Contractor must submit the tension control bolt assembly to the Engineer for approval with: bolt capacities; type of bolt, nut, and washer lubricant; method of packaging and protection of the lubricated bolt; installation equipment; calibration equipment; and installation procedures.

The tension control bolt manufacturer's installation procedure must be followed for installation of bolts in the verification testing device, in all calibration devices, and in all structure connections.

In some cases, proper tensioning of the bolts may require more than 1 cycle of systematic partial tightening before final yield or fracture of the tension control element of each bolt. If yield or fracture of the tension control element of a bolt occurs before the final tightening cycle, that bolt must be replaced with a new one.

Additional field verification testing must be performed upon request.

All bolts and connecting hardware must be stored and handled as to prevent corrosion and loss of lubricant. Bolts that are installed without the same lubricant coating as tested under the verification test will be rejected, and they must be removed from the joint and be replaced with new lubricated bolts at no additional cost to the Owner.

AASHTO M 253 bolts, galvanized AASHTO M 164 bolts, and ASTM F 1852 tension control bolt assemblies must not be reused. Black AASHTO M 164 bolts may be reused once if approved by the Engineer. All bolts to be reused must have their threads inspected for distortion by reinstalling the used nut on the bolt and turning the nut for the full length of the bolt threads by hand. Bolts to be reused must be relubricated per the manufacturer's recommendation and as approved by the Engineer. Used bolts are subject to a rotational capacity test as specified in Section 6-03.3(33)A Pre-Erection Testing. Touching up or retightening bolts previously tightened by the Turn-of-Nut Method, which may have been loosened by the tightening of adjacent bolts is not considered as reuse, provided the snugging up continues from the initial position and does not require greater rotation, including the tolerance, than that required by Table 2.

6-03.3(33)A PRE-ERECTION TESTING

High-strength bolt assemblies (bolt, nut, direct tension indicator, and washer), both black and galvanized, must be subjected to a field rotational capacity test, as outlined below, before any permanent fastener installation. For field installations, the rotational capacity test must be conducted at the Job Site. Each combination of bolt production lot, nut production lot, washer production lot, and direct tension indicator production lot must be tested as an assembly, except tension control bolt assemblies, which must be tested as supplied by the manufacturer. Each rotational capacity test must include 3 assemblies. Once an assembly passes the rotational capacity test, it is approved for use for the remainder of the project unless the Engineer deems further testing is necessary. All tests must be performed in a bolt tension calibrator by the Contractor in the presence of the Engineer. High-strength bolt assemblies used in this test must not be reused. The bolt assemblies must comply with the following requirements after being pretensioned to 15 percent of the minimum bolt tension in Table 1. The assembly is considered nonconforming if the assembly fails to pass any of the following requirements:

1. The measured torque to produce the minimum bolt tension must not exceed the maximum allowed torque value obtained by the following equation:

$$\text{Torque} = 0.25 PD$$

Where: Torque = Calculated Torque (foot-pounds)

P = Measured Bolt Tension (pounds)

D = Normal Bolt Diameter (feet)

2. After placing the assembly through 2 cycles of the required number of turns, where turns are measured from the 15 percent pretension condition, as described in Table 2,

- a. The maximum recorded tension after the 2 turns must be equal to or greater than 1.15 times the minimum bolt tension listed in Table 1.
 - b. Each assembly must be installed to the specified number of turns.
 - c. The fastener components in the assembly must not exhibit shear failure or stripping of the threads as determined by visual examination of bolt and nut threads following removal.
 - d. The bolts in the assembly must not exhibit torsional or torsional/tension failure.
3. If any specimen fails, the assembly will be rejected. Elongation of the bolt between the bolt head and the nut is not considered to be a failure.

Bolts that are too short to test in the bolt tension calibrator must be tested in a steel joint. The Contractor must install the high-strength bolt assemblies (bolt, nut, direct tension indicator, and washer) in a steel joint of the proper thickness; tighten to the snug tight condition; match-mark the outer face of each nut and the protruding part of the bolt with crayon or paint; rotate to the requirements of the Turn of Nut Tightening Method table; and record the torque that is required to achieve the required amount of rotation. The assembly is considered nonconforming if the assembly fails to pass any of the following requirements:

- a. The recorded torque to produce the minimum rotation must not exceed the maximum allowed torque value obtained by the following equation:

$$\text{Torque} = 0.25 PD$$

Where: Torque = Calculated Maximum Allowed Torque (foot-pounds)

P = Specified Bolt Tension per Table 1, multiplied by a factor of 1.15 (pounds)

D = Normal Bolt Diameter (feet)

- b. After placing the assembly through 2 cycles of the required number of turns, where turns are measured from the snug tight condition specified in Section 6-03.3(32), the following conditions must be met: each assembly must be installed to the specified number of turns; the fastener components in the assembly must not exhibit shear failure or stripping of the threads as determined by visual examination of bolt and nut threads following removal; and the bolts in the assembly must not exhibit torsional or torsional/tension failure.
- c. If any specimen fails, the assembly will be rejected. Elongation of the bolt between the bolt head and the nut is not considered to be a failure.

The Contractor must submit the manufacturer's detailed procedure for pre-erection, rotational capacity testing of tension control bolt assemblies to the Engineer for approval and must have an approved procedure before testing.

Three DTIs, per lot, must be tested in a bolt tension calibrator. The bolts must be tensioned to 105 percent of the tension described in Table 1. If all DTI protrusions are completely crushed (all 5 openings with 0 gap), this lot of DTIs is rejected.

Three twist off-type tension controlled bolt assemblies, per assembly lot, must be tested in a bolt tension calibrator. The bolts must first be tensioned to a snug tight condition. Tensioning must then be completed by tightening the assembly nut in a continuous operation using a spline drive installation tool until the spline shears from the bolt. The bolt assembly tension must comply with the requirements of Table 1. If any specimen fails, the assembly lot is rejected.

6-03.3(33)B BOLTING INSPECTION

The Contractor, in the presence of the Engineer, must inspect the tightened bolt using a calibrated inspection torque wrench, regardless of bolting method. The Contractor must supply the inspection torque wrench. Inspection must be performed within 7 Calendar Days from the completion of each bolted connection or as approved by the Engineer.

If the bolts to be installed are not long enough to fit in the Owner furnished tension calibrator, 5 bolts of the same grade, size and condition as those under inspection must be selected by the Contractor in the presence of the Engineer and must be tested using Direct Tension Indicators (DTI) to measure bolt tension. This tension measurement test must be done at least once each inspection day. The Contractor must supply the DTIs. The DTI must be placed under the bolt head. A washer must be placed under the nut, which must be the element turned during performing this tension measurement test. Each bolt must be tightened by any convenient means to the specified minimum tension as indicated by the DTI. The inspecting wrench must then be applied to the tightened bolt to determine the torque required to turn the nut 5 degrees (approximately 1 inch at a 12-inch radius) in the tightening direction. The job-inspection torque must be taken as the average of 3 values thus determined after rejecting the high and low values.

Five representative bolts/nuts/washers and DTIs if used (provided by the Contractor) of the same grade, size, and condition as those under inspection must be placed individually in a bolt tension calibrator to measure bolt tension. This calibration operation must be done at least each inspection day. There must be a washer under the part turned in tightening each bolt if washers are used on the Structure. In the bolt tension calibrator, each bolt must be tightened by any convenient means to the specified tension. Inspection torque wrench must then be applied to the tightened bolt to determine the torque required to turn the nut or head 5 degrees, approximately 1 inch at a 12-inch radius, in the tightening direction. The job-inspection torque must be taken as the average of 3 values thus determined after rejecting the high and low values.

Ten percent, at least 2, or as specified by the Engineer, of the tightened bolts on the Structure represented by the test bolts must be selected at random in each connection. The job-inspection torque must then be applied to each with the inspection wrench turned in the tightening direction, with no restraint applied in the opposite end of the bolt. If this torque turns no bolt head or nut, the Owner will accept the connection as being properly tightened. If the torque turns 1 or more bolt heads or nuts, the job-inspection torque must be applied to all bolts in the connection. Except for tension control bolt assemblies and

1 DTIs with 0 gap at all protrusion spaces, any bolt whose head or nut turns at this stage must be tightened and reinspected.
2 Any tension control bolt assemblies or DTIs that have 0 gap at all protrusion spaces must be replaced if the head or nut turns
3 at this stage.

4 The Contractor must submit the manufacturer's detailed procedure for routine observation to ensure proper use of the
5 tension control bolt assemblies to the Engineer for approval and must have an approved procedure before any assembling of
6 bolted connections.

7 **6-03.3(34) ADJUSTING PIN NUTS**

8 All pin nuts must be tightened thoroughly. The pins must be placed so members bear fully and evenly on the nuts. The
9 pins must have enough thread to allow burring after the nuts are tightened.

10 **6-03.3(35) SETTING ANCHOR BOLTS**

11 Anchor bolts must be set in masonry as required in Section 6-02.3(18). Anchor bolts must be grouted in after the shoes,
12 masonry plates, and keeper plates have been set and the span or series of continuous spans are completely erected and
13 adjusted to line and camber.

14 **6-03.3(36) SETTING AND GROUTING MASONRY PLATES**

15 The following procedure applies to masonry plates for all steel spans, including shoes, keeper plates and turning racks
16 on movable bridges.

17 To set masonry plates, the Contractor must:

- 18 1. Set masonry plates on the anchor bolts.
- 19 2. Place steel shims under the masonry plates to position pin centers or bearings to line and grade and in relationship to
20 each other. Steel shims must be the size and be placed at the locations shown on the Drawings.
- 21 3. Level the bases of all masonry plates.
- 22 4. Draw anchor bolt nuts down tight.
- 23 5. Recheck pin centers or bearings for alignment.
- 24 6. Leave at least 3/4 inch of space under each masonry plate for grout.

25 After the masonry plates have been set and the span or series of continuous spans are completely erected and swung
26 free, the space between the top of the masonry plate and the top of the concrete bearing seat must be filled with grout. Main
27 masonry plates for cantilever spans must be set and grouted in before any steel work is erected.

28 Grout mixture and placement must be as required in Section 6-02.3(20).

29 **6-03.3(37) SETTING STEEL BRIDGE BEARINGS**

30 Masonry plates, shoes, and keeper plates of expansion bearings must be set and adjusted to center the expansion shoe
31 at a normal temperature of 64 °F. Adjustment for any inaccuracy in manufactured length must be made after dead load
32 camber is out.

33 **6-03.3(38) PLACING SUPERSTRUCTURE**

34 The concrete in piers and crossbeams must reach at least 80 percent of design strength before girders are placed on
35 them.

36 **6-03.3(39) SWINGING THE SPAN**

37 Forms weighing less than 5 pounds per square foot of bridge deck area and uniformly distributed along the steel spans
38 may be placed before the spans swing free on their supports. Steel reinforcing bars or concrete bridge deck must not be
39 placed on steel spans until the spans swing free on their supports and elevations are recorded. No simple span or any series
40 of continuous spans will be considered as swinging free until all temporary supports have been released. Reinforcing steel or
41 concrete bridge decks must not be placed on any simple or continuous span steel girder bridge until all its spans are adjusted
42 and its masonry plates, shoes, and keeper plates grouted. For this specification, the structure is considered continuous across
43 hinged joints.

44 After the falsework is released, i.e. the spans swung free, the masonry plates, shoes, and keeper plates are grouted,
45 and before any load is applied, the Contractor, or the Engineer if the Owner is responsible for surveying, must survey
46 elevations at the tenth points along the centerline on top of all girders and floorbeams. The Contractor must calculate the
47 theoretical top of girder or floorbeam flange elevations and compare the calculated elevations to the surveyed elevations. The
48 theoretical pad or haunch depth shown on the Drawings must be increased or decreased by the difference between the
49 theoretical and surveyed top of girder or floorbeam elevations. The soffit (deck formwork) must be set based on the Drawing
50 bridge deck thickness and the adjusted pad or haunch depth.

51 The Contractor must submit all survey data and calculations to the Engineer for review 10 Working Days before placing
52 any load, beyond the maximum 5 pounds per square foot of form weight allowed, on the Structure.

6-03.3(40) DRAINING POCKETS

The Contractor must provide enough holes to drain all water from pockets in trusses, girders, and other members. Unless shown on submitted and reviewed by Engineer Shop Drawings, drain holes must not be drilled without the written review of the Engineer.

6-03.3(41) FLOORBEAM PROTECTION

Each floorbeam that supports a concrete slab joint must be coated on its top and flange edges with a heavy mop of roofing grade asphalt applied hot. This asphalt must conform to ASTM D 312 (not mineral stabilized). A protective covering of asphalt coated glass fiber sheet (ASTM D 4601, Type 1, non-perforated) must be placed over the hot coat of asphalt. This combination coating must be applied over the shop paint. It must take the place of the 2 field coats of paint specified for other parts of the structural steel. The second and third coats are acceptable exceptions and must comply with Section 6-07.3(1)B.

6-03.3(42) SURFACE CONDITION

As the Structure is erected, the Contractor must keep all steel surfaces clean and free from dirt, concrete, mortar, oil, paint, grease, and other stain producing foreign matter. Any surfaces that become stained must be cleaned as follows:

1. Painted steel surfaces must be cleaned by methods required for the type of staining. The method must be submitted to the Engineer for approval; and
2. Unpainted steel surfaces must be cleaned by sandblasting. Sandblasting to remove stains on publicly visible surfaces must be done to the extent that, in the Engineer's opinion, the uniform weathering characteristics of the Structure are preserved.

6-03.3(43) CASTINGS, STEEL FORGINGS, AND MISCELLANEOUS METALS

Castings, steel forgings, and miscellaneous metals must be built to comply with Section 9-06.

6-03.3(43)A SHOP CONSTRUCTION, CASTINGS, STEEL FORGINGS, AND MISCELLANEOUS METALS

This Section's requirements for structural steel (including painting requirements) must also apply to castings, steel forgings, and miscellaneous metals.

Castings must be:

1. True to pattern in form and dimensions.
2. Free from pouring faults, sponginess, cracks, blow holes, and other defects in places that would affect strength, appearance, or value.
3. Clean and uniform in appearance.
4. Filleted boldly at angles.
5. Formed with sharp and perfect arises.

Iron and steel castings and forgings must be annealed before any machining, unless indicated otherwise in the Contract.

6-03.4 MEASUREMENT

Section 1-Cast or forged metal (kind) or copper seals shown on the Drawings will be measured by the pound or will be paid for on a lump sum basis as shown on the Bid Form.

In computing pay weight on the basis of scale weights, the pay quantity of structural steel will be the shop scale weight of the fabricated members weighed on scales meeting the requirements of Section 1-09.2 in the presence of the Engineer. If the shop paint has been applied to the completed member when weighed, 0.4 of 1 percent of the weight of the member must be deducted from the scale weights to compensate for weight of shop paint.

6-03.5 PAYMENT

1. **"Structural Carbon Steel"**, per pound.
2. **"Structural Low Alloy Steel"**, per pound.
3. **"Structural High Strength Steel"**, per pound.

The Bid Item prices Bid for the Bid Items "Structural Carbon Steel", "Structural Low Alloy Steel", and "Structural High Strength Steel" must include all costs for the work required for manufacture, fabrication, transportation, erection, welding inspection, and painting of all structural steel used in the completed structure, including protective coating or treatment as may be called for in the Contract.

For payment, minor items such as bearing plates, pedestals, forged steel pins, anchor bolts, field bolts, and shear connectors are considered structural carbon steel even though these items are made of other materials.

All costs related to inspection of structural welds must be included in the Bid Item price Bid for structural steel and must, in each case, refer to the appropriate inspection method for obtaining optimum quality assurance and at no additional cost to the Owner.

4. **"(Cast or Forged) Steel"**, lump sum or per pound.
5. **"(Cast, Malleable, or Ductile) Iron"**, lump sum or per pound.

1 6. **“Cast Bronze”**, lump sum or per pound.
 2 The Bid Item prices for “(Cast or Forged) Steel”, for “(Cast, Malleable or Ductile) Iron”, and for “Cast Bronze” must
 3 include all costs for the work required to furnish and install the Material as specified.

4 **7. Other payment information**

5 When no Bid Item is in the Bid Form and payment is not otherwise provided, the castings, forgings, and miscellaneous
 6 metal are considered incidental to the construction, and all costs must be included in the Bid Item prices for the Bid Items
 7 involved and at no additional or separate expense to the Owner.

8 Prospective Bidders must verify the estimated weight of structural steel before submitting the Bid.

9 All costs related to filling pockets must be included in the Bid Item prices for structural or cast steel and are at no
 10 additional or separate expense to the Owner.

11 The weight of field bolts is based on the Engineer reviewed shipping list. No payment will be made for any weight over 1
 12 1/2 percent above the computed net weight of the whole item.

13 Reinforcing bars which are threaded will be paid as “Steel Reinforcing Bar, (Grade)” or “Steel Reinforcing Bar, (Grade),
 14 Epoxy Coated” as specified in Section 6-02.5.

15 All costs related to providing drain holes will be included in the Bid Item prices for structural or cast steel and are at no
 16 additional or separate expense to the Owner.

17 All costs related to providing drain holes per Section 6-03.3(40) must be included in the Bid Item prices for structural or
 18 cast steel and are be at no additional or separate expense to the Owner.

19 **SECTION 6-04 TIMBER STRUCTURES**

20 **6-04.1 DESCRIPTION**

21 Section 6-04 describes building any Structure or parts of Structures, except piles, made of treated timber, untreated
 22 timber, or both. The Contractor must erect timber structures on prepared foundations. The Structures must conform to the
 23 dimensions, lines, and grades required by the Drawings, the Engineer, and these Specifications.

24 Any part of a timber structure made of non-timber Materials must comply with the Sections of the Standard Specifications
 25 that govern those Materials.

26 **6-04.2 MATERIALS**

27 Materials must comply with the requirements of the following Sections:
 28

| Material | Section |
|---------------------------------------|--------------|
| Structural Steel and Related Material | Section 9-06 |
| Paints | Section 9-08 |
| Timber and Lumber | Section 9-09 |

29

30 **6-04.3 CONSTRUCTION REQUIREMENTS**

31 **6-04.3(1) STORING AND HANDLING MATERIAL**

32 At the Project Site, the Contractor must store all timber and lumber in stacked piles. Weeds and rubbish under and
 33 around these piles must be removed before the lumber is stacked.

34 Untreated lumber must be open stacked at least 12 inches above the ground and must be piled to shed water and
 35 prevent warping.

36 Treated timber must be:

- 37 1. Cut, framed, and bored (whenever possible) before treatment.
- 38 2. Close stacked and piled to prevent warping.
- 39 3. Covered against the weather to prevent warping or deterioration.
- 40 4. Handled carefully to avoid sudden drops, broken outer fibers, and surface penetration or bruising with tools.
- 41 5. Lifted and moved with rope and chain slings (without using cant dogs, peaveys, hooks, or pike poles).

42 **6-04.3(2) WORKMANSHIP**

43 See Section 1-05.13. Poor workmanship includes deep hammer marks in wood surfaces. Workmanship on metal parts
 44 must comply with requirements of Section 6-03.

45 **6-04.3(3) SHOP DRAWINGS**

46 The Contractor must provide the Engineer with 6 sets of Shop Drawings for all Structures built with treated timber. These
 47 Shop Drawings must show dimensions for all cut, framed, or bored timbers.

1 The Engineer will return to the Contractor 1 set of reviewed Shop Drawings. No material can be framed or bored until the
2 Engineer has completed review of the Shop Drawings. Shop Drawings must be drawn on sheets that conform to the sizes
3 specified in Section 1-05.3(11).

4 **6-04.3(4) FIELD TREATMENT OF CUT SURFACES, BOLT HOLES, AND CONTACT SURFACES**

5 All cut surfaces, bolt holes, and contact surfaces must be treated as specified in Section 9-09.3 for all timber and lumber
6 requiring preservative treatment.

7 All cuts and abrasions in treated timber piles or treated timbers must be trimmed carefully and treated again at the cut or
8 abrasion as specified in Section 9-09.3.

9 **6-04.3(5) HOLES FOR BOLTS, DOWELS, RODS, AND LAG SCREWS**

10 Holes must be bored:

- 11 1. For drift pins and dowels: with a bit 1/16 inch smaller in diameter than the pins and dowels.
- 12 2. For truss rods or bolts: with a bit the same diameter as the rods or bolts.
- 13 3. For lag screws in 2 parts:
 - 14 a. With the shank lead hole the same diameter as the shank and as deep as the unthreaded shank is long; and
 - 15 b. With the lead hole for the threaded part approximately 2/3 of the shank diameter.

16 **6-04.3(6) BOLTS, WASHERS, AND OTHER HARDWARE**

17 Bolts, flat head bolts, dowels, washers, and other hardware, including nails, must be black or galvanized as specified on
18 the Drawings. Hardware not otherwise specified must be galvanized when used in treated timber Structures. Flat head bolts
19 are detailed in the Standard Plans.

20 Use washers of the size and type specified under all bolt heads and nuts that contact wood. Flat head bolts require
21 washers under the nuts only.

22 All bolts must be checked by burring the threads after the nuts have been finally tightened. Vertical bolts must have nuts
23 on the lower ends.

24 Wherever bolts fasten timber to timber, timber to concrete, or timber to steel, the members must be bolted tightly together
25 at installation and retightened just before the Owner accepts the Work. These bolts must have surplus threading of at least 3/8
26 inch per foot of timber thickness to allow future tightening.

27 **6-04.3(7) COUNTERSINKING**

28 Countersinking must be done wherever smooth faces are specified in the Contract. Each recess must be treated as
29 specified in Section 9-09.3.

30 **6-04.3(8) FRAMING**

31 The Contractor must cut and frame lumber and timber to produce close fitting, full contact joints. Each mortise must be
32 true to size for its full depth, and its tenon must fit it snugly. Neither shimmed nor open joints are permitted.

33 **6-04.3(9) FRAMED BENTS**

34 Mudsills must be of pressure treated timber, firmly and evenly bedded to solid bearing, and tamped in place.

35 Concrete pedestals that support framed bents must be finished so sills bear evenly on them. To anchor the sills, set
36 dowels in the pedestals when cast. The dowels must be at least 3/4 inch in diameter and protrude at least 6 inches above the
37 pedestal tops. Pedestal concrete must comply with Section 6-02.

38 Each sill must rest squarely on mudsills, piles, or pedestals. It must be drift bolted to mudsills or piles with 3/4-inch
39 diameter or larger bolts that extend at least 6 inches into the mudsill or pile. Ensure no earth touches the sills and that free air
40 circulation surrounds them.

41 Each post must be fastened to sills with 3/4-inch diameter or larger dowels that extend at least 6 inches into the post.

42 **6-04.3(10) CAPS**

43 Timber caps must rest uniformly across the tops of posts or piles and cap ends must be aligned evenly. Each cap must
44 be fastened with a drift bolt 3/4 inch in diameter or larger that penetrates the post or pile at least 9 inches. The bolt must be
45 approximately in the center of the pile or post.

46 If the roadway grade exceeds 2 percent, each cap must be beveled to match the grade.

47 **6-04.3(11) BRACING**

48 When pile bents are taller than 10 feet, each bent must be braced transversely. Every other pair of bents must be braced
49 longitudinally. No single cross bracing must brace more than 20 feet of vertical distance on the piles. Use more than 1 cross
50 bracing if the vertical distance exceeds 20 feet. Each brace end must be bolted through the pile, post, or cap with a bolt at
51 least 3/4 inch in diameter. Other brace/pile intersections must be bolted or boat spiked as indicated on the Drawings. Cross
52 bracing must lap both upper or both lower caps and must be bolted to the caps or sills at each end.

1 6-04.3(12) STRINGERS

2 All stringers that carry laminated decking or vary more than 1/8 inch in depth must be sized to an even depth at bearing
3 points. Outside stringers must be butt jointed and spliced.

4 Interior stringers must be lapped so that each rests over the full width of the cap or floorbeam at each end. Stringers may
5 cover 2 spans except on sharp horizontal and vertical curves. In this case, joints must be staggered and the stringers either
6 toenailed or drift bolted as specified in the Contract. To allow air circulation on untreated timber structures, the ends of lapped
7 stringers must be separated. Separate by fastening across the lapping face a 1" x 3" wood strip cut 2 inches shorter than the
8 depth of the stringer.

9 Any cross bridging or solid bridging must be neatly and accurately framed, then securely toenailed at each end with 2
10 nails for cross bridging and 4 nails for solid bridging. The Drawings show bridging size and spacing.

11 6-04.3(13) WHEEL GUARDS AND RAILINGS

12 Wheel guards and railings must comply with the construction requirements of Section 6-06.3(1). Construction
13 requirements not addressed in Section 6-06.3(1) must comply with the construction requirements of Section 6-04.

14 6-04.3(14) SINGLE PLANK FLOORS

15 Single plank floors must be made of a single thickness of plank on stringers or joists.

16 The planks must be:

- 17 1. Laid heart side down with tight joints.
- 18 2. Spiked to each joist or nailing strip with at least 2 spikes that are at least 4 inches longer than the plank thickness.
- 19 3. Spiked at least 2-1/2 inches from the edges.
- 20 4. Cut off on a straight line parallel to the centerline of the roadway.
- 21 5. Arranged so that no adjacent planks vary in thickness by no more than 1/16 inch.
- 22 6. Surfaced on 1 side and 1 edge (S1S1E) unless otherwise specified in the Contract.

23 6-04.3(15) LAMINATED FLOORS

24 The strips must be placed on edge and must be drawn down tightly against the stringer or nailing strip and the adjacent
25 strip and, while held in place, must be spiked. Each strip must extend the full width of the deck, unless otherwise specified in
26 the Contract.

27 Each strip must be spiked to the adjacent strip at intervals of not more than 2 feet, the spikes being staggered 8 inches in
28 adjacent strips. The spikes must be of sufficient length to pass through 2 strips and at least halfway through the third. Unless
29 bolting is specified in the Contract, each strip must be toenailed to alternate stringers with 40d common nails and adjacent
30 strips must be nailed to every alternate stringer. The ends of all pieces must be toenailed to the outside stringer. The ends of
31 the strips must be cut off on a true line parallel to the centerline of the roadway. When bolts are used to fasten laminated floors
32 to stringers, the bolts must be placed at the spacing specified in the Contract, and the pieces must be drawn down tightly to
33 the bolting strips. The bolt heads must be driven flush with the surface of the deck. Use double nuts or single nuts and lock
34 nuts on all bolts. The strips must be spiked together in the same manner as specified above.

35 6-04.3(16) PLANK SUBFLOORS FOR CONCRETE DECKS

36 Any plank subfloor must be laid surfaced side down with close joints at right angles to the centerline of the roadway.
37 Planks must be spiked in place as specified in Section 6-04.3(14).

38 Floor planks must be treated as specified in Section 9-09.3.

39 6-04.3(17) TRUSSES

40 Completed trusses must show no irregularities of line. From end to end, chords must be straight and true in horizontal
41 projection. In vertical projection they must show a smooth curve through panel points that conforms to the correct camber. The
42 Engineer will reject any pieces cut unevenly or roughly at bearing points. Before the Contractor places the hand railing, the
43 Contractor must complete all trusses, swing them free of their falsework, and adjust them for line and camber.

44 6-04.3(18) PAINTING

45 See Section 6-07.3(3) for painting of timber Structures.

46 6-04.4 MEASUREMENT

47 Section 1-The criteria in Section 6-03.4 will be used to determine the weight of structural metal except hardware.

48 "Timber and lumber (treated or untreated)" will be measured by the 1,000 board feet (MBM), using nominal thicknesses
49 and widths. Lengths are actual lengths of individual pieces in the finished structure with no deduction for daps, cuts, or splices.
50 To measure laminated timber decking, the Engineer will use the number and after dressing sizes of pieces required on the
51 Drawings. The length of each lamination must be the length remaining in the finished Structure.

52 No specific unit of measurement will apply to the lump sum item of "Structural Metal".

6-04.5 PAYMENT

1. "Timber and Lumber (untreated or name treatment)", per MBM.
2. "Structural Metal", lump sum.

Where no Bid Item for structural metal is included in the Bid Form, full pay for furnishing and placing metal parts must be included in the Bid Item price per MBM for Timber and Lumber (untreated or name treatment).

SECTION 6-05 PILES**6-05.1 DESCRIPTION**

Section 6-05 describes furnishing and driving piles (timber, precast concrete, cast in place concrete, and steel) of the sizes and types specified in the Contract. This work also includes cutting off or building up piles when required.

6-05.2 MATERIALS

Materials must comply with the requirements of the following Sections:

| Material | Section |
|---------------------------|-----------------|
| Reinforcing Steel | Section 9-07 |
| Prestressing Steel | Section 9-07.10 |
| Timber Piling | Section 9-10.1 |
| Concrete Piling | Section 9-10.2 |
| Cast-In-Place Piling | Section 9-10.3 |
| Steel Pile Tips and Shoes | Section 9-10.4 |
| Steel Piling | Section 9-10.5 |
| Mortar | Section 9-20.4 |

6-05.3 CONSTRUCTION REQUIREMENTS**6-05.3(1) PILE TERMS**

1. Allowable Bearing Capacity: Allowable bearing capacity is the ultimate bearing capacity divided by a factor of safety. The Contract may state the factor of safety to be used in calculating the allowable bearing capacity from the ultimate bearing capacity. Absent a specified factor of safety, use a value of 3. must
2. Auger Cast-In-Place Piles: Auger cast-in-place piles are auger drilled soil penetrations to the limits specified in the Contract and then filled with concrete as the auger is removed. A steel cage is typically inserted in the concrete after the concrete is placed.
3. Concrete Piles: Concrete piles may be precast or precast prestressed concrete, or steel casings driven to the ultimate bearing capacity called for in the Contract which are filled with concrete (cast-in-place) after driving.
4. Developed Hammer Energy: The developed hammer energy is the actual gross energy produced by the hammer for a given blow. This value must never exceed the rated hammer energy. The developed energy may be calculated as the ram weight times the drop (or stroke) for drop, single acting hydraulic, single acting air/steam, and open ended diesel hammers. For double acting hydraulic and air/steam hammers, the developed hammer energy must be calculated from ram impact velocity measurements or other means approved by the Engineer. For closed ended diesel hammers, the developed energy must be calculated from the measured bounce chamber pressure for a given blow. Hammer manufacturer calibration data may be used to correlate bounce chamber pressure to developed hammer energy. For a single acting diesel hammer the developed energy is determined using the blows per minute.
5. Follower: A follower is a structural member placed between the hammer assembly, which includes the helmet, and the pile top when the pile top is below the reach of the hammer.
6. Hammer cushion: The hammer cushion is a disk of material placed on top of the helmet but below the anvil or striker plate to relieve impact shock, protecting the hammer and the pile.
7. Helmet: The helmet, also termed the cap, drive cap, or driving head, is used to transmit impact forces from the hammer ram to the pile top uniformly across the pile top such that the impact force of the ram is transmitted axially to the pile. The term helmet can apply to the complete impact force transfer system, which includes the anvil or striker plate, hammer cushion and cushion block, and a pile cushion if used, or just the single piece unit into which these other components (such as anvil and hammer cushion) fit. The helmet does not include the follower, if one is used. For hydraulic hammers, the helmet is sometimes referred to as the anvil.
8. Maximum Driving Resistance: The maximum driving resistance is the pile ultimate bearing capacity, or ultimate bearing capacity plus overdriving, to reach minimum tip elevation as specified in the Contract, whichever is greater.

- 1 9. Minimum Tip Elevation: The minimum tip elevation is the elevation to which the pile tip must be driven. Driving deeper
2 to obtain the required bearing capacity may be required.
- 3 10. Overdriving: Over driving of piles occurs when the ultimate bearing capacity calculated from the equation in Section
4 6-05.3(12), or the wave equation if applicable, exceeds the ultimate bearing capacity required in the Contract to reach
5 the minimum tip elevation specified in the Contract, or as required by the Engineer.
- 6 11. Pile Cushion: The pile cushion is a disk of material placed between the helmet and the pile top to relieve impact
7 shock, primarily to protect the pile.
- 8 12. Pile Driving Analyzer: A pile driving analyzer (PDA) is a device which can measure the transferred energy of a pile
9 driving system, the compressive and tensile stresses induced in the pile due to driving, the bending stresses induced
10 by hammer misalignment with the pile, and estimate the ultimate capacity of a pile at a given blow.
- 11 13. Pile Driving Refusal: Pile driving refusal is defined as 15 blows per inch for the last 4 inches of driving. This is the
12 maximum blow count allowed during overdriving.
- 13 14. Pile Driving System: The pile driving system includes, but is not limited to, the hammer, leads, helmet or cap, cushion
14 and pile.
- 15 15. Pile Head: The end of the pile struck by the hammer for driving. Also known as head, head end, butt, butt end, and
16 pile top.
- 17 16. Pile Shoe: A hard metal tip secured to the driving end of a pile for protecting the pile tip during penetration into the
18 soil.
- 19 17. Pile Tip: The penetrating end of the pile opposite the pile head where end bearing may occur. Also known as tip.
- 20 18. Rated Hammer Energy: The rated energy represents the theoretical maximum quantity of gross energy that a pile
21 driving hammer can generate. The rated energy of a pile driving hammer must be stated in the hammer
22 manufacturer's catalog or Specifications for that pile drive hammer.
- 23 19. Steel Piles: Open ended or closed ended pipe piles, or H piles.
- 24 20. Transferred Hammer Energy: The transferred hammer energy is the energy transferred to the pile for a given blow.
25 This value must never exceed the developed hammer energy. Factors that cause transferred hammer energy to be
26 lower than the developed hammer energy include friction during the ram downstroke, energy retained in the ram and
27 helmet during rebound, and other impact losses. The transferred energy can only be measured directly by sensors
28 attached to the pile. A pile driving analyzer (PDA) may be used to measure transferred energy.
- 29 21. Ultimate Bearing Capacity: Ultimate bearing capacity refers to the vertical load carrying capacity (in units of force) of
30 a pile as determined by the equation in Section 6-05.3(12), the wave equation analysis, pile driving analyzer and
31 CAPWAP, static load test, or any other means as required by the Contract.
- 32 22. Wave Equation Analysis: Wave equation analysis is an analysis performed using the wave equation analysis program
33 (WEAP) with a version dated 1987 or later. The wave equation may be used as specified here to verify the
34 Contractor's proposed pile driving system. The pile driving system includes, but is not limited to, the pile, the hammer,
35 the helmet, and any cushion. The Engineer may also use the wave equation to determine pile driving criteria as may
36 be required in the Contract.

37 6-05.3(2) ORDERING PILES

38 The length of piles given in the Bid Form is for estimating purposes only and is not to be used as an order list.
39 No order list for piles will be furnished by the Engineer.

40 All piles must be ordered by the Contractor. Determine the length required from the results obtained by the driving of the
41 test piles called for in the Contract and from subsurface exploration data. Increase the lengths, at no additional cost to the
42 Owner, the amount necessary to provide for fresh heading and to reach from the cutoff elevation up to the position of the
43 driving equipment.

44 See Section 6-05.3(10) regarding test piles.

45 6-05.3(3) MANUFACTURE OF PRECAST CONCRETE PILES

46 Precast concrete piles must consist of concrete sections reinforced to withstand handling and driving stresses. These
47 may be reinforced with deformed steel bars or prestressed with steel strands. The Drawings show dimensions and details. If
48 the Drawings require piles with square cross-sections, the corners must be chamfered 1 inch.

49 All precast or prestressed concrete piles must comply with the requirements of WSDOT Standard Plan E -4.

50 Temporary stress in the prestressing reinforcement of prestressed piles, before loss from creep and shrinkage, must be
51 75 percent of the minimum ultimate tensile strength. For short periods during manufacture, the reinforcement may be
52 overstressed to 80 percent of ultimate tensile strength if stress after transfer to concrete does not exceed 75 percent of that
53 strength.

54 Prestressed concrete piles must have a final (effective) prestress of at least 1,000 psi.

55 Unless the Engineer approves splices, all piles must be full length.

56 The Engineer intends to perform inspection as specified in Section 1-06.1.

6-05.3(3)A CASTING AND STRESSING

Reinforcing bars, hoops, shoes, and similar elements must be placed as specified in the Contract. All parts must be securely tied together and placed to the specified spacings. No concrete can be placed until all reinforcement is in place and the forms are secured.

The Contractor must perform quality control inspection. The manufacturing plant for precast concrete piles must be certified by the Precast/Prestressed Concrete Institute's Plan Certification Program for the type of precast piles to be produced and must be approved by WSDOT as a Certified Precast Concrete Fabricator before start of production.

Before the start of production of the piles, the Contractor must provide the Engineer advance notification of the production schedule. The Engineer may inspect the fabrication of concrete piles as specified in Section 1-05 and Section 1-06.

In casting concrete piles, the Contractor must:

1. Cast them either vertically or horizontally.
2. Use metal forms with smooth joints and inside surfaces that can be thoroughly cleaned after each use.
3. Brace and stiffen the forms to prevent distortion.
4. Place concrete continuously in each pile, guarding against horizontal or diagonal cleavage planes.
5. Ensure the reinforcement is properly embedded.
6. Use internal vibration around the reinforcement during concrete placement to prevent rock pockets from forming.
7. Cast test cylinders with each set of piles as concrete is placed.

Forms must be metal and must be braced and stiffened to keep their shape under pressure of wet concrete. Forms must have smooth joints and inside surfaces easy to reach and clean after each use. That part of a form which shapes the end surface of the pile must be a true plane at right angles to the pile axis.

Each pile must contain a cage of non-prestressed reinforcing steel sized and located as indicated on the Drawings. Spiral steel reinforcing must be secured in position and must have a minimum 1-1/2-inch concrete cover from the outside pile surface.

Prestressing steel must be tensioned as required in Section 6-02.3(25)C.

The Drawings specify tensioning stress for strands or wires. Tension must be measured by jack pressure as described in Section 6-02.3(25)C. Mechanical locks or anchors must temporarily maintain cable tension. All jacks must have hydraulic pressure gauges, accurately calibrated and accompanied by a certified calibration curve no more than 180 days old, which allow stress calculations at all times.

All tensioned piles must be pretensioned. Post tensioning is not allowed.

The Contractor must not stress any pile until test cylinders made with it reach a compressive strength of at least 3,300 psi.

6-05.3(3)B FINISHING

As soon as the forms for each precast concrete pile are removed, must fill all holes and irregularities in the pile with 1:2 mortar. That part of any trestle pile to be underground or below the low water line and all parts of any pile to be used in salt water or alkaline soil must receive only this mortar treatment. That part of any trestle pile that shows above the ground or water line must be given a Class 2 finish as specified in Section 6-02.3(14)B.

6-05.3(3)C CURING

Precast Concrete Piles: The Contractor must:

1. Keep the concrete continuously wet with water after placement for at least 10 days with Type I or II Portland cement or at least 3 days with Type III;
2. Remove side forms no sooner than 24 hours after concrete placement, and then only if the surrounding air remains at no less 50 °F for 5 days with Type I or II Portland cement or 3 days with Type III; and

The Contractor may cure precast piles with saturated steam or hot air, as described in Section 6-02.3(25)D, provided the piles are kept continuously wet until the concrete has reached a compressive strength of 3,300 psi.

Precast Prestressed Concrete Piles must be cured as required in Section 6-02.3(25)D.

6-05.3(4) MANUFACTURE OF STEEL CASINGS FOR CAST IN PLACE CONCRETE PILES

The diameter of steel casings must be as specified in the Contract. Spiral welded steel pile casings are not allowed for steel pile casings greater than 24 inches in diameter. A full penetration groove weld with a maximum 1/16-inch offset between welded edges is required.

6-05.3(5) MANUFACTURE OF STEEL PILES

Steel piles must be made of rolled steel H pile sections, steel pipe piles, or of other structural steel sections described in the Contract. Spiral welded steel pile casings are not allowed for steel pipe piles greater than 24 inches in diameter. A full penetration groove weld with a maximum 1/16-inch offset between welded edges is required.

1 **6-05.3(6) SPLICING STEEL CASINGS AND STEEL PILES**

2 The Engineer will normally allow steel piles and steel casings for cast in place concrete piles to be spliced. However, the
3 Contractor must obtain the Engineer's advance approval on the need and the method for splicing. Welded splices must be
4 spaced at a minimum distance of 10 feet. Only welded splices are permitted.

5 Splice welds must comply with Section 6-03.3(25) and AWS D1.1 Structural Welding Code. Splicing of steel piles must
6 be performed using an approved weld procedure. Submit a weld procedure to the Engineer for approval before welding. For
7 ASTM A 252 Material, mill certification for each lot of pipe to be welded must accompany the submittal.

8 The Contractor is responsible for weld splicing of steel casings for cast in place concrete piles. Casings that collapse or
9 are not water tight, must be replaced at no additional cost to the Owner.

10 Steel casing joints must not be offset more than 1/16 inch.

11 **6-05.3(7) STORAGE AND HANDLING**

12 The Contractor must store and handle piles in ways that protect them from damage.

13 **6-05.3(7)A TIMBER PILES**

14 Timber piles must be stacked closely and in a manner to prevent warping. The ground beneath and around stored piles
15 must be cleared of weeds, brush, and rubbish. Piles must be covered against the weather if the Engineer requires it.

16 The Contractor must take special care to avoid breaking the surface of treated piles. They must be lifted and moved with
17 equipment, tools, and lifting devices which do not penetrate or damage the piles. If timber piles are rafted, any attachments
18 must be within 3 feet of the butts or tips. Any surface cut or break must be repaired as per Section 9-09.3. The Engineer may
19 reject any pile because of a cut or break.

20 **6-05.3(7)B PRECAST CONCRETE PILES**

21 The Contractor must not handle any pile until test cylinders made with the same batch of concrete as the pile reach a
22 compressive strength of at least 3,300 psi.

23 Storing and handling methods must protect piles from fractures by impact and undue bending stresses. Handling
24 methods must never stress the reinforcement more than 12,000 psi. Allow for twice the calculated load for impact and shock
25 effects. The method of lifting the piles must be submitted to the Engineer for approval. Take extra care to not damage the
26 surface of any pile to be used in sea water or alkaline soil.

27 **6-05.3(7)C STEEL CASINGS AND STEEL PILES**

28 The Engineer will reject bent, deformed, or kinked piles.

29 **6-05.3(8) PILE TIPS AND SHOES**

30 Timber piles must be driven with squared ends unless subsurface conditions require attaching metal shoes. Pile tips and
31 shoes must be securely attached to the piles per the manufacturer's recommendations.

32 When required in the Contract, use conical steel pile tips when driving steel casings. The tips must be inside fit, flush
33 mounted such that neither the tip nor weld bead protrudes more than 1/16 inch beyond the nominal outside diameter of the
34 steel casing.

35 If conical tips are not required in the Contract, the lower end of each casing must have a steel driving plate thick enough
36 to keep the casing water tight and free from distortion as it is driven. The diameter of the steel driving plate must be less than
37 the outside diameter of the steel casing.

38 Where called for in the Contract, use inside fit cutting shoes when driving open ended steel piles. The cutting shoes must
39 be flush mounted such that neither the shoe nor the weld bead protrudes more than 1/16 inch beyond the nominal outside
40 diameter of the steel pile. The cutting shoe must be of an inside diameter at least 0.75 inches less than the nominal inside
41 diameter of the steel pile.

42 The Contractor must submit to the Engineer for approval, Shop Drawings of the proposed pile tip or shoe with design
43 calculations, Specifications, material chemistry and installation requirements, and must also be prepared to provide a pile
44 driving test demonstrating suitability of the proposed pile tip. The test must be performed in the presence of the Engineer or an
45 acceptable to the Engineer independent AASHTO certified testing agency, and must consist of driving a pile fitted with the
46 proposed tip. The pile must be located outside the proposed foundation limits if the pile cannot be visually inspected, see
47 Section 6-05.3(11)F. The pile must be driven to a depth sufficient to develop the required bearing capacity specified in the
48 Contract and in ground conditions determined by the Engineer to be equivalent to the ground conditions at the Project Site.
49 For closed ended casings or piles, the pile need not be removed if, in the opinion of the Engineer, the pile can be evaluated for
50 evidence of damage to the pile or the tip. For open ended steel casings or piles, timber piles or H piles, the pile must be
51 removed for evaluation.

1 **6-05.3(9) PILE DRIVING EQUIPMENT**2 **6-05.3(9)A PILE DRIVING EQUIPMENT APPROVAL**

3 Before driving any piles, the Contractor must submit to the Engineer for approval, the details of each proposed pile
4 driving system. The pile driving system must comply with the minimum requirements for the combinations of hammer type and
5 pile type specified in this Section. These requirements are minimums and may need to be increased to ensure that the
6 required bearing capacity can be achieved, that minimum tip elevations can be reached, and to prevent pile damage.

7 The Contractor must submit a wave equation analysis for pile driving systems required by Contract or for all pile driving
8 systems used to drive piles with required ultimate bearing capacities of 300 tons or greater. The wave equation analysis must
9 be performed by, and bear the stamp of, a civil engineer licensed under Title 18 RCW in the State of Washington, see Section
10 1-05.3(12). The wave equation analysis must be performed per the requirements of this Section and the user's manual for the
11 program. The wave equation analysis must verify that the proposed pile driving system does not produce stresses greater than
12 90 percent of the yield stress for steel piles, or steel casings for cast in place concrete piles. For prestressed concrete piles,
13 the allowable driving stress must be 3 times the square root of f_{cm} , plus prestress in tension, and $0.85f_c$ minus prestress in
14 compression. For precast concrete piles that are not prestressed, the allowable driving stress must be 70 percent of the yield
15 stress of the steel reinforcement in tension, and $0.85f_c$ in compression. The wave equation must also verify that the pile driving
16 system does not exceed the refusal criteria at the depth of penetration anticipated for achieving the required ultimate bearing
17 capacity and minimum tip elevation. The wave equation analysis must verify that at bearing, the maximum driving resistance is
18 100 blows per foot or less. Unless otherwise specified in the Contract, input the following default values into the wave equation
19 analysis program:

| Wave Equation Analysis Default Values | |
|---|-------|
| Output option (IOUT) | 0 |
| Factor of safety applied to (R_{ult}) | 1.0 |
| Type of damping | Smith |
| Residual stress option | No |
| (R_{ult}) is equal to the maximum driving resistance for the pile | |

21 NOTE: R_{ult} is the resistance of the pile used in the wave equation analyses. If the ultimate bearing capacity equals
22 the maximum driving resistance, a setup factor of 1.3 may be used in the wave equation analysis to account for pile
23 setup. To use a setup factor in the wave equation analysis, R_{ult} in the analysis is the ultimate bearing capacity divided
24 by 1.3. If the maximum driving resistance exceeds the ultimate bearing capacity, do not use a setup factor, and R_{ult} is
25 equal to the maximum driving resistance of the pile.

26 **Hammer Efficiencies**

| Hammer | For Analysis of Driving Resistance | For Analysis of Driving Stresses |
|--|------------------------------------|----------------------------------|
| Single acting diesel hammers | 0.72 | 0.84 |
| Closed ended diesel hammers | 0.72 | 0.84 |
| Single acting air/steam hammers | 0.60 | 0.70 |
| Double acting air/steam hammers | 0.45 | 0.53 |
| Hydraulic hammers or other external combustion hammers having ram velocity monitors that may be used to assign an equivalent stroke. | 0.85 | 1.00 |

28 Within 15 Working Days after the Engineer receipt of the submittal, the Contractor will be notified of the Engineer's
29 review. If the Contractor wishes to change the pile driving system after the Contractor's proposed system has been accepted,
30 the Contractor must comply with the requirements of Section 1-05.3(5).
31

32 **6-05.3(9)B PILE DRIVING EQUIPMENT MINIMUM REQUIREMENTS**

33 For each drop hammer used, the Contractor must weigh it in the Engineer's presence or provide the Engineer with a
34 certificate of its weight. The exact weight must be stamped on the hammer. Drop hammers must have a weight of not less
35 than:

- 36 1. 3,000 pounds for piles under 50 feet long that have an ultimate bearing capacity of not more than 60 tons,
- 37 2. 4,000 pounds for piles 50 feet and longer or that have an ultimate bearing capacity of 60 to 90 tons.

38 If a drop hammer is used for timber piles, it is preferable to use a heavy hammer and operate with a short drop.

1 For each diesel, hydraulic, steam, or air driven hammer used, the Contractor must provide the Engineer with the
 2 manufacturer's Specifications and catalog. These must show all data needed to calculate the developed energy of the hammer
 3 used.

4 Underwater hammers may be used only with approval of the Engineer.

5 Drop hammers on timber piles must have a maximum drop of 10 feet. Do not use drop hammers to drive timber piles that
 6 have ultimate bearing capacities of more than 60 tons.

7 When used on timber piles, diesel, hydraulic, steam, or air driven hammers must provide at least 13,000 foot pounds of
 8 developed energy per blow. The ram of any diesel hammer must have a weight of at least 2,700 pounds.

9 Precast concrete, and precast prestressed concrete piles must be driven with a single acting steam, air, hydraulic, or
 10 diesel hammer with a ram weight of at least half as much as the weight of the pile, but never less than the minimums stated in
 11 the tables following. The ratio of developed hammer energy to ram weight must not exceed 6. Steel casings for cast in place
 12 concrete, steel pipe, and steel H piles must also be driven with diesel, hydraulic, steam, or air hammers.

13 These hammers must provide at least the following developed energy per blow:

14 **Minimum Developed Energy per Blow (ft-lbs)**

| Maximum Driving Resistance (tons) | Air or Steam Hammers | Open Ended Diesel Hammers | Closed Ended Diesel Hammers | Hydraulic Hammers |
|-----------------------------------|----------------------|---------------------------|-----------------------------|-------------------|
| Up to 165 | 21,500 | 23,000 | 30,000 | 18,500 |
| 166-210 | 27,500 | 29,500 | 38,000 | 23,500 |
| 211-300 | 39,000 | 41,500 | 54,000 | 33,500 |
| 301-450 | 59,000 | 63,000 | 81,000 | 50,500 |

16 The ram of any diesel or hydraulic hammer must have the following minimum weights:

| Maximum Driving Resistance (tons) | Minimum Ram Weight (lbs) |
|-----------------------------------|--------------------------|
| Up-165 | 2,700 |
| 166-210 | 4,000 |
| 211-300 | 5,000 |
| 301-450 | 6,500 |

19 The minimum hammer size requirement may be waived by the Engineer if a wave equation analysis demonstrates the
 20 ability of the hammer to obtain the required bearing capacity and minimum tip elevation without damage to the pile.

21 Vibratory hammers may be used to drive piles provided the location and plumbness requirements of this Section are met.
 22 The required bearing capacity for all piles driven with vibratory hammers will be determined according to Section 6-05.3(12) by
 23 driving the pile at least an additional 2 feet using an impact hammer. This method of determining bearing capacity will be
 24 accepted provided the blows per inch are constant or increasing. If the pile cannot be driven 2 feet, the pile will be considered
 25 acceptable for bearing if the pile is driven to refusal.

26 If water jets are used, the number of jets and water volume and pressure must be enough to erode the material adjacent
 27 to the pile at the tip. The equipment must include a minimum of 2 water jet pipes and two 3/4-inch jet nozzles. The pump must
 28 produce a constant pressure of at least 100 psi at each nozzle.

30 **6-05.3(9)C PILE DRIVING LEADS**

31 All piles must be driven with fixed lead drivers. The leads must be fixed on the top and bottom during the pile driving
 32 operation. Leads must be long enough to eliminate the need for any follower (except for timber piles as specified in Section 6-
 33 05.3(11)E. To avoid bruising or breaking the surface of treated timber piles, use spuds and chocks as little as possible. In
 34 building a trestle or foundation with inclined piles, leads must be adapted for driving batter piles.

35 A helmet of the right size for the hammer must distribute the blow and protect the top of steel pile or steel casing from
 36 driving damage. The driving head must be positioned symmetrically below the hammer's striking parts, so the impact forces
 37 are applied concentric to the pile top.

38 For piles with specified ultimate bearing capacities of 300 tons or greater, pile driving leads except those fixed at the top
 39 and bottom may be used to complete driving when all following criteria are met:

- 40 1. Each plumb and battered pile is located and initially driven at least 20 feet in true alignment using fixed leads or other
 41 approved means.
- 42 2. The pile driving system (hammer, cushion and pile) must be analyzed by Pile Driving Analyzer (PDA) to verify that
 43 driving stresses in the pile are not increased due to eccentric loading during driving, and transferred hammer energy
 44 is not reduced due to eccentric loading during driving, for all test piles and at least 1 production pile per pier.

1 The Contractor must submit the revised fixing of leads set-up and PDA analysis to the Engineer before pile driving.

2 **6-05.3(10) TEST PILES**

3 If specified in the Contract, the Contractor must drive test piles to determine pile lengths satisfying the specified load
4 carrying capacity, penetration, or both. Test piles must:

- 5 1. Be made of the same material and have the same tip diameter as the permanent piles (although test piles for treated
6 timber piles may be treated or untreated).
- 7 2. Be driven with pile tips if the permanent piles are to have tips.
- 8 3. Be prebored when preboring is specified for the permanent piles.
- 9 4. Have the same cross-section and other characteristics of the permanent piles for steel casings for cast in place
10 concrete, precast concrete, precast prestressed concrete, or steel pipe or H piles.
- 11 5. Be long enough to accommodate Project Site soil conditions and Contract requirements.
- 12 6. Be driven with the same equipment and methods to be used for the permanent piles.
- 13 7. Be located where the Engineer directs. and
- 14 8. Be driven before the permanent piles in a pier.

15 Test piles may also be driven by the Contractor, at no additional cost to the Owner, as evidence that the pile driving
16 system selected does not damage the pile or result in refusal before reaching any specified minimum tip elevation.

17 Timber test piles must be driven outside the footing and cut off 1 foot below the finished groundline. Timber test piles
18 must not be used in place of permanent piles.

19 Steel test piles and all types of concrete test piles must become permanent piles. The Engineer will reduced the number
20 of these permanent piles by the number of test piles.

21 The Contractor must base test pile length on test hole data provided in the Contract. Any test pile not long enough to
22 comply with Contract requirements must be replaced, or spliced if the Contract allows splicing, at no additional cost to the
23 Owner.

24 In foundations and trestles, test piles must be driven to at least 15 percent more than the bearing capacity required for
25 the permanent piles, except where pile driving criteria is determined by the wave equation. When pile driving criteria is
26 specified to be determined by the wave equation, the test piles must be driven to the same ultimate bearing capacity as the
27 production piles. Test piles must penetrate to at least the minimum tip elevations specified in the Contract. If no minimum tip
28 elevation is specified, test piles must extend at least 10 feet below the bottom of the concrete footing or groundline, and 15
29 feet below the bottom of the concrete seal.

30 When any test pile to be left as a permanent pile has been damaged by handling or driving, remove and replace the pile
31 at no additional cost to the Owner. The Engineer may direct the Contractor to overdrive the test pile to more than 15 percent
32 above the minimum bearing capacity for permanent piles or above ultimate bearing capacity if the wave equation is used to
33 determine driving criteria. In this case, the overdriving must be at no additional cost to the Owner. But if pile damage results
34 from this overdriving, any removal and replacement will be at the Owner's expense.

35 **6-05.3(11) DRIVING PILES**

36 **6-05.3(11)A TOLERANCES**

37 For elevated pier caps, the tops of piles at cut off elevation must be within 2 inches of the locations specified in the
38 Contract. For piles capped below final grade, the tops of piles at cut off elevation must be within 6 inches of the horizontal
39 locations specified in the Contract. No pile edge must be nearer than 4 inches from the edge of any footing or cap. Piles must
40 be installed such that the axial alignment of the top 10 feet of the pile is within 4 percent of the specified alignment. No
41 misaligned steel or concrete piles must be pulled laterally. A properly aligned section must not be spliced onto a misaligned
42 section for any type of pile. All piles must be driven vertically unless indicated otherwise on the Drawings.

43 **6-05.3(11)B FOUNDATION PIT PREPARATION**

44 The Contractor must replace any damaged pile, whether before or during driving, at no additional cost to the Owner.

45 The Contractor must complete all foundation pits (and build any required cofferdams or cribs) before driving foundation
46 piles. The Contractor must adjust pit depths to allow for upheaval caused by pile driving. Before constructing the footing or pile
47 cap, the Contractor must restore the pit bottom to the specified elevation by removing heaved material or by backfilling with
48 granular material specified in the Contract.

49 **6-05.3(11)C PREPARATION FOR DRIVING**

50 Treated and untreated timber piles must be cut square on the butt ends on-site just before driving. If piles are to be
51 driven into or through hard soils, then caps, collars, or bands must be placed on the butt ends to prevent crushing or brooming.
52 If the head area of the pile is larger than that of the hammer face, the head must be snipped or chamfered to fit the hammer.
53 On treated piles, the heads must be snipped or chamfered to at least the depth of the sapwood to avoid splitting the sapwood
54 from the pile body.

55 The Contractor must match timber pile sizes in any single bent to prevent sway braces from undue bending or distorting.

1 When driven, pile faces must be turned as shown on the Drawings.

2 No precast prestressed pile can be driven until sample concrete test cylinders taken of the pile concrete pour reach the
 3 minimum compressive strength specified in the Contract. On all other precast piles, the concrete test cylinders must reach a
 4 compressive strength of at least 4,000 psi before the piles are driven.

5 Helmets of approved design must protect the heads of all precast concrete piles as they are driven. Each helmet must
 6 have fitted into it a cushion adjacent to the pile head. The bottom side of the helmet must be recessed sufficiently to
 7 accommodate the required pile cushion and hold the pile in place during positioning and driving. Determine the inside helmet
 8 diameter before casting the pile. The pile head must be formed to fit loosely inside the helmet.

9 Steel Casing, steel pipe, or H piles must have square cut ends. During driving, each pile head must be protected by a
 10 fitted metal pile helmet.

11 **6-05.3(11)D ACHIEVING MINIMUM TIP ELEVATION AND BEARING**

12 Once pile driving has started, each pile must be driven continuously until the required load bearing capacity specified in
 13 the Contract has been achieved. Pauses during pile driving, except for splicing, mechanical breakdown, or other unforeseen
 14 events, must are not allowed.

15 If the Contract specifies a minimum tip elevation, the pile must be driven to at least the minimum tip elevation, even if the
 16 load bearing capacity has been achieved. If a pile does not develop the required load bearing capacity at the minimum tip
 17 elevation, must continue driving the pile until the required bearing capacity is achieved. If no minimum tip elevation is
 18 specified, then the piles must be driven to the load bearing capacity specified in the Contract and the following minimum
 19 penetrations:

| Pile Application | Pile Tip Minimum Penetration |
|-----------------------------------|--|
| Pile supporting cross beams bents | 10 feet below final top of ground elevated pile caps elevation |
| Piles supporting foundations | 10 feet below bottom of foundation |
| Piles with a concrete seal | 15 feet below bottom of seal |

21
 22 If overdriving is required to reach a specified minimum tip elevation, the Contractor must provide a pile driving system
 23 that does not result in damage to the pile, or produces refusal before the minimum tip elevation is reached.

24 So long as the pile is not damaged and the embankment or foundation material being driven through is not permanently
 25 damaged, must use normal means necessary to:

- 26 1. Secure the minimum depth specified.
- 27 2. Penetrate hard material that lies under a soft upper layer.
- 28 3. Penetrate through hard material to obtain the specified minimum tip elevation.
- 29 4. Penetrate through a previously placed embankment.

30 Normal means refer to methods such as preboring, spudding, or jetting. Blasting or drilling through obstructions are not
 31 considered normal means and must not be used.

32 Prebored holes and pile spuds must have a diameter no larger than the least outside dimension of the pile. After the pile
 33 is driven, the Contractor must fill all open spaces between the pile and the soil caused by the preboring or spudding with dry
 34 sand, or pea gravel, or controlled density fill as approved by the Engineer.

35 If water jets are used, the jets must be withdrawn before the pile reaches its final penetration, and the pile must then be
 36 driven to its final penetration and bearing capacity. The pile must be driven a minimum of 2 feet to obtain bearing after the jets
 37 are withdrawn, or to refusal, whichever occurs first. If the water jets loosen a pile previously driven, it must be re-driven in
 38 place or pulled and replaced by a new pile. To check on pile loosening, the Contractor must attempt to re-drive at least 1 in
 39 every 5 piles as selected by the Engineer.

40 If the Engineer requires, must overdrive the pile beyond the minimum load bearing capacity and minimum tip elevation
 41 specified in the Contract. In this case, the Contractor is not required to:

- 42 a. Use other than normal means to achieve the additional penetration.
- 43 b. Bear the expense of removing or replacing any pile damaged by overdriving.
- 44 c. Bear the expense of overdriving the pile more than 3 feet as specified in Section 6-05.5.

45 In driving piles for footings with seals, the Contractor must not use any method (such as jetting or preboring) that might
 46 reduce friction capacity.

47 **6-05.3(11)E OF FOLLOWERS OR DRIVING**

48 Do not use followers to drive concrete or steel piles. On timber piles, the Contractor may use steel followers if the driving
 49 head and cap fit snugly over the pile head. Wood followers are not allowed. The Engineer prefers, however, that the hammer
 50 strike the pile head directly without any cushion, block, or follower. If a follower is used, the Contractor must, in every group of

10 piles, drive 1 long pile without a follower to the required bearing capacity and minimum tip elevation. Use this long pile to test the bearing capacity of the piles driven with a follower in the group. The tip elevation of the long pile must be similar to the tip elevations of the piles driven with the follower. If the tip elevations vary considerably, the Contractor must re-drive the remaining piles in the group to the tip elevation of the longer pile.

6-05.3(11)F PILE DAMAGE

The Contractor must remove and replace any pile which is damaged at no additional cost to the Owner.

After driving a steel casing for a cast in place concrete pile, the Contractor must leave it empty until the Engineer has inspected and accepted it. The Contractor must provide to the Engineer a light suitable for inspecting the entire length of its interior. The Engineer will reject any casing improperly driven, that shows partial collapse that would reduce its bearing capacity, that has been reduced in diameter, or that does not keep out water. The Contractor must remove and replace any rejected casing at no additional cost to the Owner.

Pile heads which have been broomed, rolled, or otherwise damaged must be cut back to undamaged material before proceeding with driving or acceptance of the pile.

6-05.3(11)G PILE CUTOFF

Trim the tops of all piles to the true plane and to the elevation specified in the Contract. If a pile is driven below cutoff elevation without the Engineer's approval, must remove and replace the pile at no additional cost to the Owner, even if this requires a longer pile. Any pile that rises as nearby piles are driven must be driven down again.

Any piles under timber caps or grillages must be sawed to the exact plane of the structure above them and fit it exactly. No shimming on top of timber piles to adjust for inaccurate pile top elevations will be permitted. If a timber pile is driven out of line, it must be straightened without damage before it is cut off or braced.

Steel casings must be cut off at least 6 inches below the finished groundline or at the low water line if a casing may be visible.

6-05.3(11)H PILE DRIVING FROM OR NEAR ADJACENT STRUCTURES

Do not drive piles from an existing structure unless:

1. The existing structure is to be demolished within the Contract.
2. The existing structure is permanently closed to traffic.
3. Working Shop Drawings are submitted as specified in Section 6-01.8 and 6-02.3(16), showing the structural adequacy of the existing structure to safely support all construction loads.

To minimize the detrimental effects of pile driving vibrations on new concrete less than 28 days old, do not drive piles closer to the new concrete than the distance determined by the following formula:

$$D = C \times \sqrt{E}$$

Where:

D = distance in feet

E = rated hammer energy in foot-pounds

C = coefficient described in the following table based on the number of days of curing time:

| Curing Time (days) | Coefficient (C) | Curing Time (days) | Coefficient (C) |
|--------------------|-----------------|--------------------|-----------------|
| 1 | 0.34 | 6 | 0.12 |
| 2 | 0.23 | 7-9 | 0.11 |
| 3 | 0.18 | 10-13 | 0.10 |
| 4 | 0.15 | 14-20 | 0.09 |

This distance may be reduced if approved in writing by the Engineer.

6-05.3(12) DETERMINATION OF BEARING VALUES

Use the following formula to determine ultimate bearing capacities:

$$P = F \times E \times L_n(10N)$$

Where:

P = ultimate bearing capacity, in tons

F = 1.65 for air/steam hammers

= 1.55 for open ended diesel hammers

= 1.2 for close ended diesel hammers

= 1.9 for hydraulic hammers

- 1 = 0.6 for drop hammers
 2 E = developed energy, equal to W times H, inft-kips
 3 W = weight of ram, in kips
 4 H = vertical drop of hammer or stroke of ram, in feet
 5 N = average penetration resistance in blows per inch for the last 4 inches of driving
 6 L_n = the natural logarithm, in base "e"
 7

8 For closed end diesel hammers (double acting), the developed hammer energy (E) is determined from the bounce
 9 chamber reading. Hammer manufacturer calibration data may be used to correlate bounce chamber pressure to developed
 10 hammer energy. For double acting hammer hydraulic and air/steam hammers, the developed hammer energy must be
 11 calculated from ram impact velocity measurements or other means approved by the Engineer. For open ended diesel
 12 hammers (single acting), use the blows per minute to determine the developed energy (E).

13 The above formula applies only when:

- 14 1. The hammer is in good working condition and operating as within the manufacturer's recommendations.
- 15 2. A follower is not used.
- 16 3. The pile top is not damaged.
- 17 4. The pile top is free from broomed or crushed wood fiber.
- 18 5. The penetration occurs at a reasonably quick, uniform rate and the pile has been driven at least 2 feet after any
 19 interruption in driving greater than 1 hour in length.
- 20 6. There is no perceptible bounce after the blow. If a significant bounce cannot be avoided, twice the height of the
 21 bounce must be deducted from "H" to determine its true value in the formula. and
- 22 7. If "N" is greater than or equal to 1.0 blow/inch.

23 If "N" required to achieve the required ultimate bearing capacity using the above formula is less than 1.0 blow/inch, the
 24 pile must be driven until the penetration resistance is a minimum of 1.0 blow/inch for the last 2 feet of driving. For timber piles,
 25 bearing capacities calculated by the formula above are considered effective only when it is less than the crushing strength of
 26 the piles.

27 The Engineer may require the Contractor to install a pressure gauge on the inboard end of the hose to monitor pressure
 28 at the hammer.

29 If water jets are used in driving, determine bearing capacities by either:

- 30 a. Calculating it with the driving data and the formula in this Section after the jets have been withdrawn and the pile is
 31 driven at least 2 feet, or
- 32 b. Applying a test load.

33 **6-05.3(13) TREATMENT OF TIMBER PILE HEADS**

34 After cutting timber piles to correct elevation, the Contractor must thoroughly coat the heads of all untreated piles with 2
 35 coats of an approved preservative that meets the requirements of Section 9-09 (except concrete encased piles).

36 After cutting treated timber piles to correct elevation, the Contractor must brush 3 coats of an approved preservative that
 37 meets the requirements of Section 9-09 on all pile heads (except those to be covered with concrete footings or concrete caps).
 38 The pile heads must then be capped with alternate layers of an approved roofing asphalt and a waterproofing fabric that meets
 39 the requirements of Section 9-11.2. The cap must be made of 4 layers of an approved roofing asphalt and 3 layers of fabric.
 40 The fabric must be a single piece cut large enough to cover the pile top and fold down at least 6 inches along all sides of the
 41 pile. After the fabric cover is bent down over the pile, fasten its edges with large head galvanized nails or with 3 turns of
 42 galvanized wire. The edges of the cover must be neatly trimmed.

43 On any treated timber pile encased in concrete, the cut end must receive 2 coats of an approved preservative that meets
 44 the requirements of Section 9-09 and then a heavy coat of an approved roofing asphalt.

45 **6-05.3(14) EXTENSIONS AND BUILD UPS OF PRECAST CONCRETE PILES**

46 The Contractor must add extensions, or build ups (if necessary) on precast concrete piles after they are driven to the
 47 required bearing capacity and minimum tip elevation.

48 Before adding extensions or build ups to precast prestressed piles, the Contractor must remove any spalled concrete,
 49 leaving the pile fresh headed and with a top surface perpendicular to the axis of the pile. The concrete in the build up must
 50 reach a minimum compressive strength of 5,000 psi at 28 days.

51 Before adding to a non-prestressed precast concrete pile, the Contractor must cut the pile head to a depth 40 times the
 52 diameter of the vertical reinforcing bar. The final cut must be perpendicular to the axis of the pile. Use reinforcement of the
 53 same density and configuration as used in the pile in the build up and fasten firmly to the projecting steel. Forms must be
 54 placed to prevent concrete from leaking along the pile. The concrete in the build up must reach a minimum compressive
 55 strength of 4,000 psi at 28 days.

1 Just before placing the concrete for extensions or build ups to precast or precast prestressed concrete piles, the
2 Contractor must thoroughly wet the top of the pile. Forms must remain in place at least 3 days.

3 **6-05.3(15) COMPLETION OF CAST IN PLACE CONCRETE PILES**

4 After acceptance of the casing by the Engineer, see Section 6-05.3(11)F, the driven casing must be cut off horizontally at
5 the required elevation. They must be clean and free of water when concrete and reinforcing steel are placed.

6 These piles must consist of steel casings driven into the ground, reinforced as specified, and filled with designation P
7 concrete.

8 **6-05.3(15)A REINFORCEMENT**

9 All reinforcing bars must be fastened rigidly into a single unit, then lowered into the casing before the concrete is placed.
10 Do not use lose bars.

11 Spiral hooping reinforcement must be deformed steel bar, plain steel bar, cold drawn wire, or deformed wire.

12 **6-05.3(15)B PLACING CONCRETE**

13 Remove all debris and water from the casing before placing concrete. If the casing cannot be dewatered, it must be
14 removed (or cut off 2 feet below the ground surface and filled with sand) and a new casing must be driven at a location
15 determined by the Engineer.

16 Place concrete continuously through a rigid conduit at least 5 feet long. Direct the concrete down the center of the pile
17 casing completely filling the casing including around the reinforcement. The top 5 feet of concrete must be placed with the tip
18 of the conduit below the top of fresh concrete. Vibrate, as a minimum, the top 10 feet of concrete. In all cases, the concrete
19 must be vibrated to a point at least 5 feet below the original groundline.

20 **6-05.4 MEASUREMENT**

21 Measurement for driving (type) pile will be the number of piles driven in place.

22 In these categories, measurement will be the number of linear feet driven below pile cutoff, or as described in the
23 Engineer's order list:

- 24 1. Furnishing timber piles (untreated or name of treatment).
- 25 2. Precast concrete and precast prestressed concrete piles.

26 In these categories, measurements will be the number of linear feet driven below cut-off:

- 27 a. Cast in place concrete piles.
- 28 b. Furnishing steel piles.

29 Measurement for furnishing and driving test piles will be the number furnished and driven as the Contract requires.

30 Measurement for steel pile tips or shoes will be by the number of tips or shoes actually installed and driven in place on
31 steel casings or steel piles.

32 No specific unit of measurement will apply to the item "Precast Concrete Pile Buildup".

33 **6-05.5 PAYMENT**

- 34 1. "Furnishing and Driving (Type) Test Pile", per each.

35 The Bid Item price for "Furnishing and Driving (Type) Test Pile" must include all costs for the work required for furnishing
36 and driving test piles to the bearing capacity or penetration required by the Engineer, furnishing and installing a pile tip when
37 pile tips are specified for the permanent piles, preboring when preboring is specified for the permanent piles, for pulling the
38 piles or cutting them off as required, and for removing them from the Job Site or for delivery to the Owner for salvage when
39 directed by the Engineer. For cast-in-place concrete test piles, this price must include furnishing, fabricating, and installing the
40 steel reinforcing bar cage and furnishing, casting, and curing the concrete. This Bid Item price must also include all costs with
41 moving all pile driving equipment or other necessary equipment to the Project Site and for removing all such equipment from
42 the Project Site after the piles have been driven. If, after the test piles have been driven, it is found necessary to eliminate the
43 pile from all or any part of the Structure, moving the pile driving equipment to and from the Project Site must be at no
44 additional cost to the Owner.

- 45 2. "Driving Timber Pile (untreated or name treatment)", per each.

46 The Bid Item price for "Driving Timber Pile (untreated or name treatment)" must include all costs for the work required to
47 drive the specified timber pile including any metal shoes which the Contractor has determined to be beneficial to the pile
48 driving.

- 49 3. "Driving Concrete Pile (Size)", per each.

- 50 4. "Driving Steel Pile", per each.

51 The Bid Item price for "Driving (type) Pile (____)" must include all costs for the work required to drive the pile to the
52 ultimate bearing and/or penetration specified.

- 53 5. "Furnishing Timber Piles, (Untreated or Name Treatment)", per linear foot.

1 6. "Furnishing Concrete Piles, (Size)", per linear foot.

2 7. "Furnishing Steel Piles", per linear foot.

3 The unit Contract price per linear foot for "Furnishing (type) Piling (____)" must be full pay for furnishing the piling
4 specified, including furnishing, fabricating, and installing the steel reinforcing bar cage, and furnishing casting, and curing the
5 concrete, as required for concrete piling. Such price must also be full pay, for furnishing timber, precast concrete, or precast-
6 prestressed concrete piling length ordered from an Engineer's order sheet but not driven.

7 8. "Precast Concrete Pile Buildup", per each.

8 Payment for build ups of precast or precast prestressed concrete piles will be made as specified in Section 1-09.4. No
9 payment will be made for build ups or additional lengths of build up made necessary because of damage to the pile during
10 driving. The length of splice for precast concrete piles includes the length cut off to expose reinforcing steel for the splice. The
11 length of splice for precast prestressed piles includes the length in which holes are drilled and reinforcing bars are grouted.

12 9. "Furnishing Steel Pile Tip or Shoe (Size)", per each.

13 The Bid Item price for "Furnishing Steel Pile Tip or Shoe (Size)" must include all costs for the work required to furnish
14 and install the pile tip or shoe. Payment for pile tip or shoe for test piles or test piles incorporated as permanent piles must be
15 included in the Bid Item "Furnishing and Driving (Type) Test Pile" and no separate or additional payment will be made.

16 **10. Other payment information**

17 Payment for build ups of precast or precast prestressed concrete piles will be made as specified in Section 1-09.4. No
18 payment will be made for build ups or additional lengths of build up made necessary because of damage to the pile during
19 driving. The length of splice for precast concrete piles includes the length cut off to expose reinforcing steel for the splice. The
20 length of splice for precast prestressed piles includes the length in which holes are drilled and reinforcing bars are grouted.

21 Any pile damaged or destroyed before or when it is being driven must be replaced by the Contractor at no additional cost
22 to the Owner.

23 The Bid Item prices for driving piles must cover all costs related to water jets, preboring, or spudding. All costs the
24 Contractor incurs in re-driving piles loosened because of water jets, preboring, or spudding must be at no additional cost to the
25 Owner.

26 The Bid Item price for furnishing concrete pile (size specified) must cover all costs related to the pile build up above the
27 steel casing.

28 All costs to remove and replace test piles intended to remain as permanent piles but which were damaged in handling or
29 driving must be at no additional cost to the Owner.

30 All costs to remove and replace any pile damaged in driving or straightening or driven below grade must be at no
31 additional cost to the Owner.

32 Should it be determined by survey that the elevations of the pile tops have heaved after installation, the Contractor must
33 re-drive the heaved piles to a pile tip penetration equal to or greater than that achieved during initial driving of the heaved pile
34 at no additional cost to the Owner.

35 All pile cutoffs and damaged pile must become the property of the Contractor and must be disposed of by the Contractor.

36 The Engineer will inspect all piles before driving and may have any pile damaged or destroyed before or when it is being
37 driven replaced by the Contractor, at no additional cost to the Owner.

38 The Contractor must furnish the lengths of pile to reach from cutoff elevation up to the position of the driving equipment
39 at no additional cost to the Owner.

40 All cost and expense to perform the work of removing the heaved soil within the limits of the footing excavation and filling
41 the voids remaining from extracted piles with sand and pea gravel are incidental to the construction and must be included in
42 the Bid Item prices for the Bid Items of Work involved in the project at no additional cost to the Owner.

43 All cost and expense for design of pile including uplift and pile build ups, and pile markings for blow count are incidental
44 to the pile Bid Items and must be at no additional cost to the Owner.

45 All cost for submittals is specified in Section 1-05.3.

46 Payment for "Steel Reinforcing Bar" is specified in Section 6-02.5.

47 All cost and expense for jetting, sand and pea gravel, and vibration monitoring are incidental to the Bid Item price for the
48 pile Bid Item and must be at no additional cost to the Owner.

49 Unless otherwise specified in the Contract, the cost of PDA testing per Section 6-05.3(9)C must be included in the
50 various Bid Item prices for driving piles and must be at no additional cost to the Owner.

51 The cost of overdriving per Section 6-05.3(11)D is incidental to the Bid Item prices for furnishing and driving piles and
52 must be at no additional cost to the Owner.

53 **SECTION 6-06 BRIDGE AND PEDESTRIAN RAILINGS**

54 **6-06.1 DESCRIPTION**

55 Section 6-06 describes providing and building bridge railings and pedestrian railings.

6-06.2 MATERIALS

Material must comply with the requirements of the following Sections:

| Material | Section |
|----------------|-----------------|
| Timber Railing | Section 9-09 |
| Metal Railing | Section 9-06.14 |

6-06.3 CONSTRUCTION REQUIREMENTS**6-06.3(1) TIMBER WHEEL GUARDS AND RAILINGS**

Timber wheel guards and timber railings must be true to line and grade and framed accurately. Construction methods not specified in this Section must comply with the construction requirements of Section 6-04.

Unless the Contract indicates otherwise, wheel guards must be:

1. Beveled and surfaced on the roadway side and surfaced on the top edge. They may be surfaced on 4 sides (S4S).
2. Laid in sections at least 12 feet long.
3. Bolted through the floor plank and outside stringer (or nailing piece) with 3/4-inch diameter bolts spaced no more than 4 feet apart.

All rails and rail post material must be S4S and painted as required in Section 6-04 and Section 6-07. Railing members must be fastened securely together, with the bolts tightened once at installation, and again just before the Physical Completion Date. Provide the Engineer at least 3 Working Days advance notice of the last tightening.

6-06.3(2) METAL RAILINGS

Metal railing includes posts, web members, and horizontal members of the sidewalk and roadway railing. Unless the Contract indicates otherwise, railings must be made of aluminum alloy or steel.

Before fabricating the railing, submit Shop Drawings for the Engineer's review as specified in Section 1-05.3. The Contractor may substitute other rail connection details for those shown on the Drawings if details of these changes are shown and noted in the Shop Drawings and if the Engineer approves (Section 1-05.3(6)). Anchor bolts must be positioned with a template to ensure that bolts match the hole spacings of the bottom channels or anchorage plates.

Where specified, cover plates must fit the bottom channel tightly after being snapped into position.

Metal railings must be installed true to line and grade (or camber). After first setting the railing, readjust all or part, as necessary to create an overall line and grade as indicated on the Drawings.

6-06.4 MEASUREMENT

Timber railing will be measured by the linear foot along the line and slope at the base of the completed railing.

Metal railing will be measured by the linear foot along the line and slope at the base of the completed railing.

6-06.5 PAYMENT

1. "Bridge Railing, (Type)", per linear foot.
2. "Metal Railing, (Type)", per linear foot.

The Bid Item prices for "Bridge Railing, (Type)" and for "Metal Railing, (Type)" must include all costs for the work required to construct the railings as shown on the Drawings and as specified in this Section, including longitudinal, vertical and inclined structural members, plates, fastenings, anchor bolts, galvanizing, grouting, and painting as specified. If no Bid Item is in the Bid Form for "Bridge Railing, (Type)" and "Metal Railing, (Type)" and payment is not otherwise provided, all metal railings must be included in the Bid Item price for the Bid Item "Structural Carbon Steel" as specified in Section 6-03.

3. "Timber Railing, (Type)", per linear foot.

The Bid Item price for "Timber Railing, (Type)" must include all costs for the work required to construct, provide hardware, and paint the complete railings and posts as shown on the Drawings.

SECTION 6-07 PAINTING**6-07.1 DESCRIPTION**

Section 6-07 describes containment, surface preparation, shielding adjacent areas from unwanted surface preparation, testing and disposing of surface preparation debris, furnishing and applying paint, shielding adjacent areas from unwanted paint, and cleaning up after painting is completed. The work must comply with all requirements of the Drawings, these Specifications, and the Engineer. Terminology here uses definitions from the SSPC steel structures painting manual, Volume 2, Systems and Specifications.

6-07.2 MATERIALS

Materials must comply with the requirements of the following Sections:

| Material | Section |
|--|-----------|
| Paint | 9-08.1 |
| Powder Coating Materials for Coating Galvanized Surfaces | 9-08.2 |
| Abrasive Blast Media | 9-08.4(1) |
| Lead Abatement Additive | 9-08.4(1) |
| Bird Guano Treatment | 9-08.5(1) |
| Fungicide Treatment | 9-08.5(2) |
| Water | 9-08.5(3) |
| Filter Fabric | 9-08.6 |
| Single Component Urethane Sealant | 9-08.7 |
| Foam Backer Rod | 9-08.8 |

6-07.3 CONSTRUCTION REQUIREMENTS

6-07.3(1) WORK FORCE QUALIFICATIONS

6-07.3(1)A WORK FORCE QUALIFICATIONS FOR SHOP APPLICATION OF PAINT

Shop application of paint must comply with Section 1-06.

6-07.3(1)B WORK FORCE QUALIFICATIONS FOR FIELD APPLICATION OF PAINT

The Contractor preparing the surface and applying the paint must be certified under SSPC QP 1.

The Contractor removing and otherwise disturbing existing paint containing lead and other hazardous materials must be certified under SSPC-QP 2, Category A.

Instead of the above SSPC certifications, the Contractor performing the specified work may complete one of the following actions:

1. Substitute documentation of successful completion of 2 bridge painting projects in the past 10 years involving complete paint removal, including paint containing lead and other hazardous materials, with reapplication of a 3-component moisture-cured polyurethane paint system. The documentation must include the name and size of the project, the Dates of the work, the owner's name, and name and contact information for an owner's contact person.
2. Employ a quality control inspector for the project. Inspectors must be NACE-certified CIP Level 3.

6-07.3(2) PAINTING PLAN SUBMITTALS

The Contractor must submit a painting plan to the Engineer for approval as specified in Section 1-05.3.

For shop application of paint, the painting plan must include the documents listed in Sections 6-07.3(2)B and 6-07.3(2)E, item 2, the product data sheet for the primer coat with coefficient of friction certification, and paint samples as specified in Section 6-07.3(7).

For field application of paint, the painting plan must include the documents listed in Section 6-07.3(2)A through 6-07.3(2)F.

6-07.3(2)A WORK FORCE QUALIFICATIONS SUBMITTAL COMPONENT

The work force qualifications submittal component of the painting plan must include:

1. Documentation of the Contractor's workforce qualifications as specified in Section 6-07.3(1).
2. Resume of qualifications and contact information for the Contractor's on-site supervisors. An on-site supervisor must be present for each workshift at the bridge site, and each on-site supervisor must have 3 years' minimum of industrial painting field experience with 1 year minimum of field supervisory or management experience in paint removal projects.

6-07.3(2)B CONTRACTOR'S QUALITY CONTROL PROGRAM SUBMITTAL COMPONENT

The Contractor's quality control program submittal component of the painting plan must include:

1. Description of the inspection procedures and techniques and the acceptance criteria for all phases of work.
2. Procedure for implementation of corrective action.
3. The paint system manufacturer's recommended methods of preventing defects.

4. The Contractor's frequency of quality control inspection.
5. Description of the equipment used for inspection of prepared surfaces and inspection of paint.
6. Example completed forms of the daily quality control report used to record the inspection work and tests performed by the Contractor's quality control personnel.

6-07.3(2)C PAINT SYSTEM MANUFACTURER AND PAINT SYSTEM INFORMATION SUBMITTAL COMPONENT

The paint system manufacturer and paint system information submittal component of the painting plan must include:

1. Product data sheets and information on the paint materials, paint preparation, and paint application, as specified by the paint manufacturer, including:
 - a. Samples and documents specified in Section 6-07.3(7) for each paint and thinner.
 - b. All application instructions, including the mixing and thinning directions.
 - c. Recommended spray nozzles and pressures.
 - d. Minimum and maximum drying time between coats.
 - e. Restrictions on temperature and humidity.
 - f. Repair procedures as specified in Section 6-07.3(10)P.
 - g. Maximum dry film thickness for each coat.
 - h. Minimum wet film thickness for each coat to achieve the specified minimum dry film thickness.
2. Identification of, and contact information for, the paint system manufacturer's technical representative.
3. For painting of new steel, the friction coefficient of the faying surface, including test results and the paint manufacturer's certificate of compliance in support of the friction coefficient.

6-07.3(2)D HAZARDOUS WASTE CONTAINMENT, COLLECTION, TESTING, AND DISPOSAL SUBMITTAL COMPONENT

The hazardous waste containment, collection, testing, and disposal submittal component of the painting plan must include:

1. Filter fabric attachment and support as specified in Section 6-07.3(10)A.
2. Abrasive blasting containment system attachment and support as specified in Section 6-07.3(10)A.
3. Details of Job Site material storage facilities and containment waste storage facilities, including location, security, and environmental control.
4. Methods and materials used to contain, collect, and dispose of all containment waste and all construction-related waste, including transportation of waste.
5. Details of the containment waste sampling plan conforming to WAC 173-303 for waste designated as Dangerous Waste or extremely hazardous waste.
6. The name of, and contact information for, the accredited analytical laboratory performing the testing of the containment waste samples as specified in Section 6-07.3(10)F.
7. Process for tracking the disposal of hazardous waste, including a sample form of the tracking documentation.

6-07.3(2)E CLEANING AND SURFACE PREPARATION EQUIPMENT SUBMITTAL COMPONENT

The cleaning and surface preparation equipment submittal component of the painting plan must include:

1. Details of the water jetting operation, including:
 - a. Water source.
 - b. A list and description of the water jetting equipment, including maximum water discharge rates and pressure.
 - c. Methods and materials used to protect vehicular and pedestrian traffic from wash water when conducting overhead water jetting operations.
2. Details of the abrasive blast cleaning operation, including:
 - a. Description of the abrasive blast cleaning procedure.
 - b. Type, manufacturer, and brand of abrasive blast material and all associated additives, including Materials Safety Data Sheets (MSDS).
 - c. Description of the abrasive blast cleaning equipment to be used.

6-07.3(2)F PAINT APPLICATION EQUIPMENT AND OPERATIONS SUBMITTAL COMPONENT

The paint application equipment and operations submittal component of the painting plan must include:

1. Description of the equipment used for paint application operations.
2. Details of Job Site material storage facilities, including location, security, and environmental control.

- 1 3. Description of the supports and platforms used to support equipment, materials, and workers, including scaffolds,
- 2 platforms, accordion lifts, and barges, and the methods used to attach, moor, and anchor these supports and
- 3 platforms.
- 4 4. Drip tarps as specified in Section 6-07.3(10)O.
- 5 5. Methods and materials used to protect surrounding structures, equipment, and property from exposure to, and
- 6 damage from, painting operations.
- 7 6. Details of paint application operations for areas of limited and restricted access.
- 8 7. Description of the method for the removal of any accidental spills or drips on traffic that occur during the normal
- 9 painting operations, and provisions for providing a vehicle-cleaning station.

6-07.3(2)G PAINTING PLAN MEETING

At the option of the Owner, a painting plan meeting may be scheduled following review of the Contractor’s initial submittal of the plan. The Contractor must be represented by the superintendent, on-site supervisors, and quality control inspectors.

6-07.3(3) QUALITY CONTROL AND QUALITY ASSURANCE

6-07.3(3)A QUALITY CONTROL AND QUALITY ASSURANCE FOR SHOP APPLICATION OF PAINT

For shop application of paint, quality control procedures must be as approved by the Engineer.

6-07.3(3)B QUALITY CONTROL AND QUALITY ASSURANCE FOR FIELD APPLICATION OF PAINT

For field application of paint, the Contractor must conduct quality control inspections as required by SSPC-PA 1, using the personnel and the processes outlined in the painting plan as accepted by the Engineer. Maintain current copies of the SSPC Painting Manual, Volumes 1 and 2, at the Project Site at all times. The Contractor’s quality control operations must include monitoring and documenting:

- 1. Equipment, personnel, and materials used.
- 2. Environmental conditions (ambient air temperature and humidity, steel surface temperature, dew point, wind direction, and velocity).
- 3. Steel surface condition, profile, and preparation.
- 4. Paint application and film thickness.

A copy of the Contractor’s daily quality control report, signed and dated by the Contractor’s quality control inspector, accompanied by copies of the test results of quality control tests performed on the work covered by the daily quality control report, must be submitted to the Engineer before the end of the next day’s workshift.

The Contractor must provide the Engineer time and access to perform quality assurance testing. Each painting operation phase is considered a hold point, from which the Contractor cannot proceed with continuing work until receiving the Engineer’s approval.

The Engineer may perform quality assurance testing at each of the following phases of painting operations:

- a. After SSPC-SP 1 cleaning.
- b. After water jetting.
- c. After abrasive blast cleaning, hand and power tool surface cleaning, and compressed air surface cleaning.
- d. After applying each coat when dry.
- e. During final inspection of all work at the end of the project.

Quality assurance testing may include the following tests:

- 1) Environmental conditions for painting per ASTM D 337.
- 2) Cleanness of abrasive blasting media and ionic contamination of abrasive blasting media per ASTM D 4940.
- 3) Cleanness of compressed air per ASTM D 4285.
- 4) Pictorial of surface preparation standards per SSPC-VIS 1, 3, 4, and 5.
- 5) Surface profile by Keanne-Tator comparator per ASTM D 4417.
- 6) Surface profile by replica tape per ASTM D 4417.
- 7) Wet film thickness per ASTM D 4414.
- 8) Dry film thickness by magnetic gage per SSPC-PA 2 modified.
- 9) Dry film thickness by Tooke gage per ASTM D 4138.

The Contractor must repair all damage to paint resulting from Owner’s quality assurance inspections at no additional cost or time to the Owner

6-07.3(4) PAINT SYSTEM MANUFACTURER’S TECHNICAL REPRESENTATIVE

The paint system manufacturer’s technical representative must be present at the Job Site for the pre-painting conference and for the first day of paint application, and must be available for consultation for the full project duration.

6-07.3(5) PRE-PAINTING CONFERENCE

A pre-painting conference must be held 5 to 10 Working Days before starting painting operations to discuss the painting plan, construction operations, personnel, and equipment to be used. These persons are required to attend:

1. (Representing the Contractor) The superintendent, on-site supervisors, and all crew members in charge of cleaning and preparing the surfaces, containing, collecting and disposing of all removed materials, applying the paint, and performing all quality control inspections, measurements and tests; and the paint system manufacturer's technical representative.

2. The Engineer.

If the Contractor's key personnel change between any work operations, an additional conference may be held.

For projects that include painting of multiple structures, a separate conference may be held for each structure, at the discretion of the Engineer.

6-07.3(6) PAINT CONTAINERS, STORAGE, AND HANDLING**6-07.3(6)A PAINT CONTAINERS**

Paint container labels must include the following information:

1. Manufacturer's name and product name, with batch number and date of manufacture.
2. Color name and Federal Standard 595 color number, where applicable.
3. Shelf life of the product, from date of batch manufacture.
4. Storage requirements and temperature limits.

Paint containers must conform to U.S. DOT hazardous material shipping regulations. Paint must be delivered to the Job Site in the manufacturer's original unopened containers with the original manufacturer's label legible and intact. Paint will be rejected if the container has a puncture or if the lid shows signs of paint leakage. Each container must be filled with paint and sealed airtight. Each container must be filled with the quantity of paint required to yield the specified quantity when measured at 70 °F. All paint must be shipped in new suitable containers having a capacity not greater than 5 gallons.

6-07.3(6)B PAINT STORAGE

Do not use or store paint materials on-site after the shelf life expiration date.

Paint material shipping, handling, and storage must conform to Sections 1-06.4 and Section 9-08 and the following requirements:

1. Paint materials must be stored in the manufacturer's original containers in a weather-tight space where the temperature is maintained within the storage temperature range recommended by the paint manufacturer, but in no case where the temperature is lower than 40 °F or greater than 100 °F.
2. The Contractor must monitor the paint material storage facility with a high-low recording thermometer device.
3. The paint material storage facility must be separate from the storage facilities used for storing painting equipment and used for storing containment waste and construction-generated waste.

6-07.3(7) PAINT SAMPLING AND TESTING

The Contractor must provide the Engineer 1 quart of each paint and each thinner representing each lot. Samples must be accompanied with a Material Safety Data Sheet and a paint drawdown sample.

If the quantity of paint required for each component of the paint system for the entire project is 20 gallons or less, then the paint system components will be accepted as specified in Section 9-08 with a paint drawdown sample.

Sampling and testing performed by the Owner is not construed as determining or predicting the performance or compatibility of the individual paint or the completed paint system.

6-07.3(8) EQUIPMENT**6-07.3(8)A PAINT FILM THICKNESS MEASUREMENT GAGES**

Paint dry film thickness measurements must be performed with either a Type 1 pull-off gage or a Type 2 electronic gage as specified in SSPC Paint Application Specification 2, Measurement of Dry Paint Thickness with Magnetic Gages.

Paint wet film thickness measurement gages must be stainless steel with notches graduated in 1 mil increments.

6-07.3(9) PAINTING NEW STEEL STRUCTURES

All materials classified as non-galvanized structural steel must be painted with a 4-coat paint system as specified in Section 6-07.3(9)A. The primer coat must be shop-applied. The intermediate, intermediate stripe, and top coats must be field-applied after erection and following any primer coating repair operations.

Steel surfaces embedded in concrete, and faying (contact) surfaces of bolted connections, including all surfaces internal to the connection and all filler plates, must receive the primer coat only. Stainless steel surfaces are not required to be painted. Welded shear connectors are not required to be painted except for the weld area.

1 Temporary attachments or supports for scaffolding or forms must not damage the paint system.

2 **6-07.3(9)A PAINT SYSTEM**

3 The paint system applied to new steel surfaces includes:

4

| Coating | Section |
|--------------------------|------------|
| Primer Coat | 9-08.1(2)C |
| Intermediate Coat | 9-08.1(2)G |
| Intermediate Stripe Coat | 9-08.1(2)G |
| Top Coat | 9-08.1(2)H |

5

6 All paint coating components of the selected paint system must be produced by the same manufacturer.

7 Paint formulations to be used on faying surfaces must be Class B coatings with a mean slip coefficient not less than 0.50.
8 Determine the slip coefficient by testing per Test Method to Determine the Slip Coefficient for Coatings Used in Bolted Joints
9 as adopted by the Research Council on Structural Connections.

10 **6-07.3(9)B PAINT COLOR**

11 Each successive coat must be a contrasting color to the previously applied coat. The color of the top coat must be
12 specified in the Drawings or Special Provisions and must conform to Section 9-08.1(8).

13 **6-07.3(9)C MIXING AND THINNING PAINT**

14 Paint must be mixed per the manufacturer’s written recommendations to a smooth, lump-free consistency. Mixing must
15 be done, to the extent possible, in the original containers and must be continued until all metallic powder or pigment is in
16 suspension. The mixed paint must be kept under continuous agitation up to and during the time of application.

17 **6-07.3(9)D COATING THICKNESS**

18 Dry film thickness must be measured per SSPC Paint Application Specification 2. Measurement of Dry Paint Thickness
19 with Magnetic Gages.

20 The minimum dry film thickness of the primer coat must not be less than 2.5 mils.

21 The minimum dry film thickness of the intermediate stripe and top coats must not be less than 3.0 mils.

22 The dry film thickness of each coat must not be thicker than the paint manufacturer’s recommended maximum thickness.

23 If the specified number of coats does not produce a combined dry film thickness of at least the sum of the thicknesses
24 required per coat, apply another full coat of the top coat of paint. The dry film thickness must not be thicker than the paint
25 manufacturer’s recommended maximum thickness.

26 **6-07.3(9)E SURFACE TEMPERATURE REQUIREMENTS BEFORE APPLICATION OF PAINT**

27 For application of the paint system, the temperature of the steel surface must be greater than 40 °F and less than 115 °F.

28 **6-07.3(9)F SHOP SURFACE CLEANING AND PREPARATION**

29 Provide a roughened surface profile by an abrasive blasting procedure as accepted by the Engineer. The profile must be
30 as specified in the Contract requirements or per the paint manufacturer’s recommendations, whichever is greater. The entire
31 steel surface to be painted, including surfaces specified in Section 6-07.3(9)G to receive a mist coat of primer, must be
32 cleaned to a near white condition per SSPC-SP 10 and must be in this condition immediately before paint application.

33 **6-07.3(9)G APPLICATION OF SHOP PRIMER COAT**

34 After receiving the Engineer’s approval of the prepared surface, the primer must be applied so as to produce a uniform,
35 even coating that has fully bonded with the metal. Primer must be applied with the spray nozzles and pressures recommended
36 by the manufacturer of the paint system, so as to attain the film thicknesses specified.

37 Steel girder top flanges and soldier pile flanges to be embedded in concrete must be prepared as specified in Section 6-
38 07.3(9)F and must then receive a mist coat of the specified primer with a dry film thickness of 0.5 to 1.0 mils.

39 Provide access to the steel to allow inspection as accepted by the Engineer. The access must not mar or damage any
40 freshly painted surfaces.

41 Do not paint high-strength field bolts before erection.

42 **6-07.3(9)H CONTAINMENT FOR FIELD COATING**

43 The Contractor must use a containment system as specified in Section 6-07.3(10)A.

6-07.3(9)I APPLICATION OF FIELD COATINGS

Before applying field coatings, the Contractor must field install welded shear connectors on the steel girder top flanges as specified in Section 6-03.3(29)) and as shown on the Drawings.

Upon completion of erection Work, all uncoated areas remaining, including bolts, nuts, washers, and splice plates, must be prepared as specified in Section 6-07.3(9)F, followed by a field primer coat of an organic zinc paint selected from the same approved paint system and paint manufacturer as the other paint for the Structure. The intermediate and top coats must be applied per the manufacturer's written recommendations.

The minimum drying time between coats must be as described in the approved product data sheets, but not less than 12 hours. Determine whether the paint has cured sufficiently for proper application of succeeding coats.

The maximum time between intermediate and top coats must be as per the manufacturer's written recommendations. If the maximum time between coats is exceeded, prepare all newly coated surfaces per SSPC-SP 7, brush-off blast cleaning, and repaint with the same paint that was cleaned, at no additional cost to the Owner.

Dry film thickness measurements will be made as specified in Section 6-07.3(9)D.

All paint damage that occurs must be repaired per the manufacturer's written recommendations and as accepted by the Engineer. On bare areas or areas of insufficient primer thickness, the repair must include the application of the field-applied organic zinc primer system, and the final 2 coats of the paint system. On areas where the primer is at least equal to the minimum required dry film thickness, the repair must include the application of the final 2 coats of the paint system. All paint repair operations must be performed by the Contractor at no additional cost or time to the Owner

6-07.3(10) PAINTING EXISTING STEEL STRUCTURES

Painting existing steel structures includes providing containment, cleaning, preparing the surface, painting metal surfaces, and disposal of generated waste. Painting of existing steel structures must be done in the following sequence:

1. Containment.
2. Bird guano, fungus, and vegetation removal.
3. Dry cleaning.
4. Surface preparation.
5. Treatment of pack rust and gaps.
6. Paint system application.

6-07.3(10)A CONTAINMENT

The containment system must be as per SSPC Technology Guide 6, Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations Class 2. Protect the surrounding environment from all debris or damage resulting from the Contractor's operations.

The containment length must not exceed the length of a span (defined as pier to pier). The containment system must not cause any damage to the existing structure. All clamps and other attachment devices must be padded or designed such that they do not mark or otherwise damage the steel member to which they are attached. All clamps and other attachment devices must be fully described in the Contractor's painting plan submittal as accepted by the Engineer. Field-welding of attachments to the existing structure is not allowed. Do not drill holes into the existing structure or through existing structural members except as described in the Contractor's painting plan submittal as accepted by the Engineer. All provisions for dust collection, ventilation, and auxiliary lighting within the containment system must be fully described in the Contractor's painting plan submittal as accepted by the Engineer.

The containment system must be quickly removable in case of high winds. The Engineer will make the final determination on whether operations must stop.

Emissions must be limited to the Level 2 Emissions standard in SSPC Technology Guide 6, Section 5.5, and assessed by Method A, Visible Emissions. If failure to the containment system occurs or if signs of failure to the containment system are present, the Contractor must stop work immediately. Work must not resume until the failure has been corrected to the satisfaction of the Engineer.

Do not remove the containment system until all cleaned and painted surfaces have been inspected and approved by the Engineer.

Before starting work each day, the Contractor must inspect all containment systems to verify they are in place and functioning properly. Any necessary maintenance to restore full function must be completed before starting work.

6-07.3(10)B BIRD GUANO, FUNGUS, AND VEGETATION REMOVAL

Bird guano and bird nesting materials must be removed in the dry. Following dry removal, apply a treatment solution as specified in Section 9-08.5(1), followed by hand-scrubbing and rinsing with water as specified in Section 9-08.5(3). The bird guano, bird nesting materials, and treatment solution must be contained and collected.

Treat all areas of fungus growth and vegetative growth. Apply a treatment solution as specified in Section 9-08.5(2) to the fungus areas for a period recommended by the solution manufacturer or as specified by the Engineer, but in no case less than 5 minutes. The fungus, vegetative growth, and treatment solution must be contained and collected.

1 Bird guano, bird nesting materials, fungus, and vegetative growth must be disposed of at a land disposal site approved
2 by the Engineer. Provide the Engineer with 1 copy of the disposal receipt, including a description of the disposed material.

3 **6-07.3(10)C DRY CLEANING**

4 Dry cleaning must include removal of accumulated dirt and debris on the surfaces to be painted. Collected dirt and debris
5 must be disposed of at a land disposal site approved by the Engineer. The Contractor must provide the Engineer with 1 copy
6 of the disposal receipt, must including a description of the disposed material

7 **6-07.3(10)D SURFACE PREPARATION BEFORE OVERCOAT PAINTING**

8 The Contractor must remove any visible oil, grease, and road tar per SSPC SP 1.

9 Following any preparation by SSPC-SP1, all steel surfaces to be painted must be prepared per either SSPC-SP 12 WJ-
10 4/LP WC water jetting surface cleaning or SSPC-SP 7, brush-off blast cleaning. Surfaces inaccessible to water jetting or
11 brush-off blast must be prepared per SSPC-SP 15, commercial grade power tool cleaning, as allowed by the Engineer.

12 Following water jetting or brush-off blast cleaning, the Contractor must perform spot abrasive blast cleaning per SSPC-
13 SP 6, commercial blast cleaning. Spot abrasive blast cleaning must be performed in such a manner that the adjacent areas of
14 work are protected from damage. Areas exhibiting coating failure down to the steel substrate, and those exhibiting visible
15 corrosion, must be prepared down to clean bare steel per SSPC-SP 6. Exposed steel areas that have an average exposed
16 diameter of less than 1-1/2 inches and no other similar area closer than 4 inches do not require spot abrasive blast cleaning or
17 edge feathering unless required by the Engineer. Provide a sharp angular surface profile by an abrasive blasting procedure as
18 accepted by the Engineer. The profile must be 1 mil minimum or per the paint manufacturer's recommendations, whichever is
19 greater. For small areas, as allowed by the Engineer, the Contractor may substitute cleaning per SSPC-SP 11, power tool
20 cleaning. The prepared area must extend at least 2 inches into adjacent tightly adhering, intact coating.

21 Following spot abrasive blast cleaning of exposed steel surfaces, edges of tightly adherent coating remaining must be
22 feathered so that the recoated surface has a smooth appearance. Water jetting must be performed with water conforming to
23 Section 9-08.5(3). Immediately before painting, the Contractor must clean all steel surfaces and staging areas with dry, oil free
24 compressed air per ASTM D 4285.

25 **6-07.3(10)E SURFACE PREPARATION – FULL PAINT REMOVAL**

26 For structures where full removal of existing paint is specified, all steel surfaces to be painted must be prepared per
27 SSPC-SP 10, near-white metal blast cleaning. Surfaces inaccessible to near-white metal blast cleaning must be prepared per
28 SSPC-SP 11, power tool cleaning to bare metal, as allowed by the Engineer.

29 **6-07.3(10)F COLLECTING, TESTING, AND DISPOSAL OF CONTAINMENT WASTE**

30 The sealed waste containers must be labeled as required by state and federal laws. All confined materials must be
31 collected and secured in sealed containers at the end of each shift or daily at a minimum to prevent the weight of the confined
32 materials from causing failure to the containment system. The sealed waste containers must be stored as specified in Section
33 1-06.4, the painting plan as accepted by the Engineer, and the following requirements:

- 34 1. Containers must be stored on an impermeable surface that accommodates sweeping or vacuuming.
- 35 2. Landside storage of the containers must be at an elevation above the ordinary high water level (OHWL) elevation.
36 The container storage area must not be in a stormwater runoff course or an area of standing water.
- 37 3. The container storage area must be a fenced, secured site, separate from the storage facilities for paint materials and
38 paint equipment.
- 39 4. The containers must not be stored at the on-site landside storage site for longer than 90 Calendar Days.

40 All material collected by and removed from the containment system must be taken to a landside staging area, provided
41 by the Contractor and approved by the Engineer, for further processing and storage before transporting for disposal. Handling
42 and storage of material collected by and removed from the containment system must conform to Section 1-06.4. Storage of
43 containment waste materials must be in a facility separate from the storage facilities used for paint materials and paint
44 equipment.

45 Containment waste is defined as all paint chips and debris removed from the steel surface and all abrasive blast media,
46 as contained by the containment system. After all waste from the containment system has been collected, the Contractor must
47 have a minimum of 3 samples of the wastes tested by an accredited analytical laboratory. Each sample must be taken from a
48 different storage container unless directed otherwise by the Engineer.

49 The debris must be tested for metals using the Toxicity Characteristics Leaching Procedure (TCLP) and EPA Methods
50 1311 and 6010. At a minimum, the materials to be analyzed must include Arsenic, Barium, Cadmium, Chromium Coppers,
51 Lead, Mercury, Selenium, and Silver.

52 If the average of the tested samples is at or above all threshold limits as stated in the Dangerous Waste Regulation,
53 WAC 173-303, the containment waste will be designated as Dangerous Waste and must be disposed of at a permitted
54 hazardous waste repository. If the average of the tested samples is below the threshold limits, the containment waste will be
55 designated as Solid Waste and must be disposed of at a permitted sanitary landfill that will accept the waste. Disposal must be
56 per WAC 173-303 for waste designated Dangerous Waste or Extremely Hazardous Waste and per WAC 173-304 for waste
57 designated as Solid Waste.

1 The Contractor must supply 2 copies of the transmittal documents or bill of lading listing the waste material shipped from
2 the Job Site to the waste disposal site. 1 copy of the shipment list must show the signature of the Engineer and must have the
3 waste site operator's confirmation for receipt of the waste.

4 If the containment wastes are designated as Dangerous Wastes or Extremely Hazardous Waste under WAC 173-303,
5 Owner will provide to the Contractor the appropriate EPA identification number.

6 Unless noted otherwise, the Owner will not provide a waste site for the disposal of excess materials and debris.

7 Submit 1 copy of all TCLP results to the Engineer.

8 Submit waste disposal documentation to the Engineer within 15 Working Days of each disposal. This documentation
9 must include the quantity and type of waste disposed of with each disposal shipment.

10 **6-07.3(10)G TREATMENT OF PACK RUST AND GAPS**

11 Pack rust is defined as the condition where 2 or more pieces of steel fastened together by rivets or bolts have been
12 pressed apart by crevice corrosion caused by the buildup of corrosion products at the interface of the steel pieces.

13 Pack rust forming a gap between steel surfaces of 1/16 inch or greater must be cleaned to a depth of 1/2 of the gap
14 width, up to a maximum of 1/4 inch. The cleaned gap must be treated with rust penetrating sealer and caulked to form a water
15 tight seal along the top edge and the 2 sides of the steel pieces involved, using the rust penetrating sealer and caulk as
16 approved by the Engineer. Do not caulk the bottom edge or lowest edge of the steel pieces involved.

17 The type of rust penetrating sealer and caulk used must be compatible with the paint system used and must be applied
18 per the rust penetrating sealer and caulk manufacturer's instructions.

19 When caulking joints where only one steel piece edge is exposed, a fillet of caulk must be formed that is not less than 1/8
20 inch or the width of the pack rust gap. The fillet is not required where there is no separation of the steel pieces due to pack
21 rust.

22 At locations where gaps between steel surfaces exceed 1/4 inch, the Contractor must fill the gap with foam backer rod
23 material and sealant as approved by the Engineer. The foam backer rod material must be of sufficient diameter to fill the
24 crevice or gap. Apply sealant over the foam backer rod material to form a water tight seal.

25 **6-07.3(10)H PAINT SYSTEM**

26 The 5-coat paint system applied to existing steel surfaces includes:
27

| Coating | Section |
|--------------------------|------------|
| Primer Coat | 9-08.1(2)F |
| Primer Stripe Coat | 9-08.1(2)F |
| Intermediate Coat | 9-08.1(2)G |
| Intermediate Stripe Coat | 9-08.1(2)G |
| Top Coat | 9-08.1(2)H |

28
29 All paint coating components of the selected paint system must be produced by the same manufacturer. Do not change
30 to a different paint system once the initial paint system has been applied to any portion of the bridge unless otherwise
31 approved in writing by the Engineer.

32 **6-07.3(10)I PAINT COLOR**

33 Each of the 5 coats must be a contrasting color to the previously applied full coat. The color of the top coat must be as
34 shown on the Drawings or Special Provisions and must be as specified in Section 9-08.1(8). Tinting must occur at the factory
35 during manufacture and placement in containers, before initial shipment. Application Job Site tinting is not allowed except as
36 otherwise approved by the Engineer.

37 **6-07.3(10)J MIXING AND THINNING PAINT**

38 The Contractor must thoroughly mix paint by mechanical means to ensure a uniform composition. Do not mix paint by air
39 stream bubbling or boxing. Paint must be mixed in the original containers and mixing must continue until all pigment or metallic
40 powder is in suspension. Take care to ensure that the solid material that has settled to the bottom of the container is
41 thoroughly dispersed. After mixing, inspect the paint for uniformity and to ensure that no unmixed pigment or lumps are
42 present.

43 Catalysts, curing agents, hardeners, initiators, or dry metallic powders that are packaged separately may be added to the
44 base paint per the paint manufacturer's written recommendations and only after the paint is thoroughly mixed to achieve a
45 uniform mixture with all particles wetted. Add the proper volume of curing agent to the correct volume of base and mix
46 thoroughly. Use the mixture within the pot life specified by the manufacturer. Unused portions must be discarded at the end of
47 each work day.

1 Do not add additional thinner at the application site except as approved by the Engineer. The quantity and type of
2 thinner, if allowed, must be per the manufacturer's Specifications.

3 When recommended by the manufacturer, constantly agitate paint during application by use of paint pots equipped with
4 mechanical agitators.

5 Strain all paint after mixing to remove undesirable matter, but without removing the pigment or metallic powder.

6 Paint must be stored and mixed in a secure, contained location to eliminate the potential for spills into State waters and
7 onto the ground and highway surfaces.

8 **6-07.3(10)K COATING THICKNESS**

9 The minimum dry film thickness of each coat (primer, intermediate, top, and all stripe coats) must not be less than 3.0
10 mils. The dry film thickness must not be thicker than the paint manufacturer's recommended maximum thickness.

11 The minimum wet film thickness of each coat must be specified by the paint manufacturer to achieve the minimum dry
12 film thickness.

13 Film thickness, wet and dry, will be measured by gages conforming to Section 6-07.3(8)A.

14 Wet measurements will be taken immediately after the paint is applied per ASTM D 4414. Dry measurements will be
15 taken after the coating is dry and hard per SSPC Paint Application Section 2.

16 Each painter must be equipped with wet film thickness gages and is responsible for performing frequent checks of the
17 paint film thickness throughout application.

18 Coating thickness measurements may be made by the Engineer after the application of each coat and before the
19 application of the succeeding coat. In addition, the Engineer may inspect for uniform and complete coverage and appearance.
20 100 percent of all thickness measurements must comply with or exceed the minimum wet film thickness. In areas where wet
21 film thickness measurements are impractical, dry film thickness measurements may be made. If a question arises about an
22 individual coat's thickness or coverage, it may be verified by the use of a Tooke gage per ASTM D 4138.

23 If the specified number of coats does not produce a combined dry film thickness of at least the sum of the thicknesses
24 required per coat, if an individual coat does not comply with the minimum thickness, or if visual inspection shows incomplete
25 coverage, the coating system will be rejected and the Contractor must discontinue painting and surface preparation operations
26 and must submit a proposal for repair to the Engineer. The repair proposal must include documentation demonstrating the
27 cause of the less-than-minimum thickness, along with physical test results, as necessary, and modifications to Work methods
28 to prevent similar results. Do not resume painting or surface preparation operations until receiving the Engineer's approval of
29 the completed repair.

30 **6-07.3(10)L ENVIRONMENTAL CONDITION REQUIREMENTS BEFORE APPLICATION OF PAINT**

31 Paint must be applied only during periods when:

- 32 1. Air temperature and paint temperature are between 35 °F and 115 °F.
- 33 2. Steel surface temperature is between 35 °F and 115 °F.
- 34 3. Steel surface does not show wet drops and is not wet.
- 35 4. Relative humidity is within the manufacturer's recommended range.
- 36 5. The anticipated ambient temperature will remain above 35 °F during the paint drying period.

37 Application is not allowed if conditions are not favorable for proper application and performance of the paint.

38 Do not apply paint when weather conditions are unfavorable to proper curing. If a paint system manufacturer's
39 recommendations allow for application of a paint under environmental conditions except those specified, submit a letter from
40 the paint manufacturer specifying the environmental conditions under which the paint can be applied. Application of paint
41 under environmental conditions except those specified in this Section is not allowed without the Engineer's approval.

42 **6-07.3(10)M STEEL SURFACE CONDITION REQUIREMENTS BEFORE APPLICATION OF PAINT**

43 The steel surface to be painted must be free of moisture, dirt, dust, grease, oil, loose, peeling or, chalky paint, abrupt
44 paint edges, salts, rust, mill scale, and other foreign matter and substances that would prevent the bond of the succeeding
45 application. Protect freshly painted surfaces from contamination by abrasives, dust, or foreign materials from any other source.
46 Prepare contaminated surfaces to the satisfaction of the Engineer before applying additional paint.

47 Prepared surfaces must be kept clean at all times, before painting and between coats.

48 Edges of existing paint must be feathered per SSPC-PA 1, Note 16.9.

49 **6-07.3(10)N FIELD COATING APPLICATION METHODS**

50 The Contractor must apply paint materials per the manufacturer's recommendations by air or airless spray, brush, roller,
51 or any combination of these methods unless otherwise specified. Spray application of the paint must be accomplished with
52 spray nozzles and at pressures as recommended by the paint manufacturer to ensure application of paint at the specified film
53 thickness. Use brushes to apply the stripe coat, to ensure complete coverage around structural geometric irregularities, and to
54 push the paint into gaps between existing steel surfaces and around rivets and bolts. All application techniques must be per

1 Section 7, SSPC-PA 1. Painters using brushes must work from pails containing a maximum of 2 gallons of paint, to minimize
2 the impact of any spill.

3 **6-07.3(10)O APPLYING FIELD COATINGS**

4 The first coat must be a primer coat applied to steel surfaces cleaned to bare metal. The second coat must be a primer
5 stripe coat applied to all steel surfaces cleaned to bare metal and defined to receive a stripe coat. The third coat must be an
6 intermediate coat. The fourth coat must be an intermediate stripe coat applied to steel surfaces defined to receive a stripe
7 coat. The fifth coat must be the top coat. The intermediate (third) and top (fifth) coats must encapsulate the entire surface area
8 of the structure members specified to be painted.

9 Before the application of paint, the Contractor must clean the bridge deck surface for the purpose of dust control.

10 During painting operations the Contractor must furnish, install, and maintain drip tarps below the areas to be painted to
11 contain all spilled paint, buckets, brushes, and other deleterious material, and prevent such materials from reaching the
12 environment below or adjacent to the structure being painted. Drip tarps must be absorbent material and hung to minimize
13 puddling.

14 In addition to the requirements of the Specifications, paint application must conform to:

- 15 1. The best practices of the trade.
- 16 2. The written recommendations of the paint manufacturer.
- 17 3. All applicable portions of the SSPC-PA 1.

18 Do not apply primer paint to any surface until the surface has been inspected and approved by the Engineer. Any area to
19 which primer paint has been applied without the Engineer's inspection and approval will be considered improperly cleaned.
20 The unauthorized application must be completely removed and the entire area recleaned to the satisfaction of the Engineer.
21 After the area has been recleaned, inspected, and approved, the Contractor may again initiate the painting sequence. No
22 additional payment or extension of time, as specified in Section 1-08.8, will be allowed for the removal of any unauthorized
23 paint application and recleaning of the underlying surface.

24 All steel surfaces cleaned to bare metal by abrasive blast cleaning must receive the primer coat within the same work
25 day as the cleaning to bare metal and before any rust forms. Each successive coat must be applied as soon as possible over
26 the previous coat, accounting for drying time of the preceding coat, weather, atmospheric temperature and other
27 environmental conditions, and the paint manufacturer's recommendations. Each coat must be dry before recoating and must
28 be sufficiently cured so that succeeding or additional coats may be applied without causing damage to the previous coat.
29 Recoat times must be per the paint manufacturer's recommendations, but not less than 12 hours. Revision of recoat times to
30 except those recommended by the paint manufacturer require the approval of the Engineer. If the maximum time between
31 coats is exceeded, all affected areas must be prepared to SSPC-SP 7, brush-off blast cleaning, and recoated with the
32 Contract-specified system at no additional expense or time to the Owner.

33 Each coat must be applied in a uniform layer, completely covering the preceding coat. The Contractor must correct runs,
34 sags, skips, or other deficiencies before application of succeeding coats. Such corrective work may require recleaning,
35 application of additional paint, or other means as determined by the Engineer, at no additional cost to the Owner.

36 If fresh paint is damaged by the elements, replace or repair the paint to the satisfaction of the Engineer at no additional
37 cost to the Owner.

38 After applying the primer or intermediate coats, apply a primer or intermediate stripe coat, respectively, on all edges,
39 corners, seams, crevices, interior angles, junction of joint members, rivet or bolt heads, nuts and threads, weld lines, and any
40 similar surface irregularities. The coverage of each stripe coat must extend at least 1 inch beyond the irregular surface. The
41 stripe coat must be of sufficient thickness to completely hide the surface being covered and must be followed as soon as
42 possible by the application of the subsequent coat to its specified thickness.

43 If the primer coat leaves unsealed cracks or crevices, these must be sealed with single-component urethane sealant
44 conforming to Section 9-08.7 and applied per the manufacturer's recommendations before the intermediate coats are applied.

45 The Contractor must correct paint deficiencies before application of succeeding coats. Such corrective work may require
46 recleaning, application of additional paint, or other corrective measures per the paint manufacturer's recommendations and as
47 specified by the Engineer. Such corrective work must be completed at no additional expense or time to the Owner.

48 Each application of primer, primer stripe, intermediate, intermediate stripe, and top coat are considered as separately
49 applied coats, including for the purposes of film thickness and coverage requirements. Do not use a preceding or subsequent
50 coat to remedy a deficiency in another coat. Apply the top coat to at least the minimum specified top coat thickness, to provide
51 a uniform appearance and consistent finish coverage, even if the total thickness of the prime and intermediate coats is found
52 to exceed the specified total thickness for the primer and intermediate coats.

53 If roadway or sidewalk planks lie so close to the metal that they prevent proper cleaning and painting, remove or cut the
54 planks to provide at least a 1-inch clearance. Any plank removal or cutting must be approved by the Engineer. Replace all
55 planks after painting. If removal breaks or damages the planks and makes them unfit for reuse, the Contractor must replace
56 them at no expense to the Owner

1 6-07.3(10)P FIELD COATING REPAIR

2 Paint repair must be per SSPC-PA 1. Repair areas must be cleaned of all damaged paint and the system reapplied using
 3 all coats typical to the paint system. Each coat must be thoroughly dry before applying subsequent coats. Paint repair must be
 4 per the paint manufacturer's recommendations and as approved by the Engineer. All paint repair operations must be
 5 performed by the Contractor at no additional cost or time to the Owner.

6 6-07.3(10)Q CLEANUP

7 Cleaning of equipment must not pollute the environment per Section 1-07.5. Solvents, paints, paint sludge, cans,
 8 buckets, rags, brushes, and other waste associated with this project must be collected and disposed of off-site.
 9 Cleanup of the Project Site must conform to Sections 1-04.10 and 6-01.10.

10 6-07.3(11) PAINTING OR POWDER COATING OF GALVANIZED SURFACES

11 Galvanized surfaces specified to be coated after galvanizing must receive either paint as specified in Section 6-07.3(11)A
 12 or powder coating as specified in Section 6-07.3(11)B. The color of the finish coat must be as specified in the Special
 13 Provisions.

14 6-07.3(11)A PAINTING OF GALVANIZED SURFACES

15 All galvanized surfaces receiving paint must be prepared for painting per the ASTM D 6386. The method of preparation
 16 must be as agreed on by the paint manufacturer and the galvanizer. Do not start painting until receiving the Engineer's
 17 approval of the prepared galvanized surface.

18 6-07.3(11)A1 ENVIRONMENTAL CONDITIONS

19 Steel surfaces must be greater than 35 °F and less than 115 °F, or per the manufacturer's recommendations, whichever
 20 is more stringent.

21 6-07.3(11)A2 PAINT COAT MATERIALS

22 Paint the dry surface as follows:

| Coating | Paint Type | Name |
|-------------|--------------------|---------------------------------------|
| First Coat | Section 9-08.1(2)E | Epoxy polyamide |
| Second Coat | Section 9-08.1(2)H | Moisture-cured aliphatic polyurethane |

24
 25 Select all coats from the approved products listed in the current Qualified Products List. The coating material for the first
 26 and second coats must be from the same manufacturer.

27 Each coat must be dry before the next coat is applied. All coats applied in the shop must be dried hard before shipment.

28 6-07.3(11)B POWDER COATING OF GALVANIZED SURFACES

29 Powder coating of galvanized surfaces includes:

| Coating | Paint Type | Name |
|-------------|----------------|--------------------------|
| First Coat | Section 9-08.2 | Epoxy powder primer coat |
| Second Coat | Section 9-08.2 | Polyester finish coat |

31 32 6-07.3(11)B1 SUBMITTALS

- 33 Submit the following information to the Engineer for approval:
- 34 1. The name, location, and contact information (mail address, phone, and email) for the firm performing the powder
 35 coating operation.
 - 36 2. Quality control (QC) programs established and followed by the firm performing the powder coating operation. Forms
 37 to record inspection and testing of coatings as part of the QC program must be included in the submittal.
 - 38 3. Project-specific powder coating plan, including identification of the powder coating materials used (and
 39 manufacturer), and specific cleaning, surface preparation, preheating, powder coating application, curing, shop and
 40 field coating repair, handling, and storage processes to be taken for the assemblies being coated for this project.
 - 41 4. Product data and MSDS sheets for all powder coating and coating repair materials.

42 6-07.3(11)B2 GALVANIZING

43 Before the galvanizing operation, identify to the galvanizer the specific assemblies and surfaces receiving the powder
 44 coating after galvanizing, to ensure that the galvanizing method used on these assemblies is compatible with subsequent

1 application of a powder coating system. Specifically, such assemblies must neither be water-quenched nor receive a chromate
2 conversion coating as part of the galvanizing operation.

3 **6-07.3(11)B3 GALVANIZED SURFACE CLEANING AND PREPARATION**

4 Galvanized surfaces receiving the powder coating must be cleaned and prepared for coating per ASTM D 6386, and the
5 project-specific powder coating plan as accepted by the Engineer.

6 Assemblies conforming to the ASTM D 6386 definition for newly galvanized steel must receive surface smoothing and
7 surface cleaning per ASTM D 6386, Section 5, and surface preparation per ASTM D 6386, Section 5.4.1.

8 Assemblies conforming to the ASTM D 6386 definition for partially weathered galvanized steel must be checked and
9 prepared per ASTM D 6386, Section 6, before then receiving surface smoothing and surface cleaning per ASTM D 6386,
10 Section 5, and surface preparation per ASTM D 6386, Section 5.4.1.

11 Assemblies conforming to the ASTM D 6386 definition for weathered galvanized steel must be prepared per ASTM D
12 6386, Section 7 before then receiving surface smoothing and surface cleaning per ASTM D 6386, Section 5, and surface
13 preparation per ASTM D 6386, Section 5.4.1 except as follows:

- 14 1. Ferrous metal abrasives are prohibited as a blast media for surface preparation.
- 15 2. Surface preparation must be accomplished using dry abrasive blasting through a blast nozzle with compressed air.
16 Abrasive blasting with a centrifugal wheel is prohibited.

17 The Contractor must notify the Engineer of all surface cleaning and preparation activities and must provide the Engineer
18 opportunity to perform quality assurance inspection, as specified in Section 1-05.6, at the completion of surface cleaning and
19 preparation activities before starting powder coating application.

20 **6-07.3(11)B4 POWDER COATING APPLICATION AND CURING**

21 After surface preparation, the 2-component powder coating must be applied per the powder coating manufacturer's
22 recommendations, the project-specific powder coating plan as accepted by the Engineer, and as follows:

- 23 1. Preheat must be sufficient to prevent pinholes from forming in the finished coating system.
- 24 2. Apply the epoxy primer coat, followed by a partial cure.
- 25 3. Apply the polyester finish coat, followed by the finish cure.

26 **6-07.3(11)B5 TESTING**

27 The firm performing the powder coating operation must conduct, or make arrangements for, QC testing on all assemblies
28 receiving powder coating for this project, per the powder coating firm's QC program as documented in item 2 of the Submittal
29 Section above. Testing may be performed on coated surfaces of production manufactured items, or on a representative test
30 panel coated alongside the production manufactured items being coated. There must be a minimum of 1 set of tests
31 representing each cycle of production manufactured items coated and cured. Perform additional tests must at the Engineer's
32 request. Repair of damaged coatings on production manufactured items is the responsibility of the firm applying the powder
33 coating, and must be per the project-specific powder coating plan as accepted by the Engineer. At a minimum, the QC testing
34 must test for:

- 35 1. Visual inspection for the presence of coating holidays and other unacceptable surface imperfections.
- 36 2. Coating thickness measurement as specified in Section 6-07.3(5). The minimum thickness of the epoxy primer
37 coating and polyester finish coating must be 3 mils each.
- 38 3. Hardness testing per ASTM D 3363, with the finish coat providing a minimum hardness value of H.
- 39 4. Adhesion testing per ASTM D 4541 for 400 psi minimum adhesion for the complete 2-component coating system.
- 40 5. Powder Coating Institute (PCI) #8 recommended procedure for solvent cure test.

41 The results of the QC testing must be documented in a QC report and submitted to the Engineer for approval.

42 The Engineer must be provided notice and access to all assemblies at the powder coating facility for the purposes of
43 Owner's acceptance inspection, including notice and access to witness all hardness and adhesion testing performed by the
44 firm conducting the QC testing, as specified in Section 1-05.6.

45 Assemblies not meeting the above requirements will be subject to rejection by the Engineer. Rejected assemblies must
46 be repaired or recoated by the Contractor, at no additional expense to the Owner per the project-specific powder coating plan
47 as accepted by the Engineer, until the assemblies satisfy the acceptance testing requirements.

48 Do not ship assemblies must from the powder coating firm's facility to the Project Site until receiving the Engineer's
49 approval of the QC Report and assembly inspection performed by the Engineer.

50 **6-07.3(11)B6 COATING PROTECTION FOR SHIPPING, STORAGE, AND FIELD ERECTION**

51 After curing and acceptance, the Contractor must protect the coated assemblies with multiple layers of bubble wrap or
52 other protective wrapping materials specified in the project-specific powder coating plan as accepted by the Engineer.

53 During storage and shipping, each assembly must be separated from other assemblies by expanded polystyrene spacers
54 and other spacing materials specified in the project-specific powder coating plan as accepted by the Engineer.

1 After erection, all coating damage due to the Contractor's shipping, storage, handling, and erection operations must be
 2 repaired, at no additional expense to the Owner, per the project-specific powder coating plan as accepted by the Engineer.
 3 Provide the Engineer access to all locations of all powder-coated members for verification of coating conditions before and
 4 following all coating repairs.

5 **6-07.3(12) PAINTING TIMBER STRUCTURES**

6 **6-07.3(12)A NUMBER OF COATS AND COLOR**

7 Unless the Contract specifies otherwise:

8 1. Rails and rail posts on timber bridges must receive 2 coats (with the wheel guard painted only on its top edge and
 9 roadway side).

10 2. Other timber work must receive 3 coats if the Contract requires other timber work to be painted.

11 Paint color must be as specified in the Contract.

12 **6-07.3(12)B APPLICATION**

13 All wood surfaces to be painted must be prepared per the paint manufacturer's recommendations and be thoroughly dry
 14 and free from oil and dirt. Paint must be applied by brush, spread evenly, and worked thoroughly into all seasoning cracks,
 15 corners, and recesses. Do not apply a later coat until the full thickness of the previous coat has dried.

16 Final brush strokes with aluminum paint must be made in the same direction to ensure that powder particles leaf evenly.

17 If a painted surface has been stained by creosote, it must be given 1 or more coats of an approved shellac before
 18 repainting.

19 **6-07.3(12)C PAINTING TREATED TIMBER**

20 Do not paint timber treated with creosote or oil borne pentachlorophenol preservatives unless otherwise specified.

21 Timber treated with water borne preservatives must be clean and be reduced to no more than 18 percent moisture
 22 content before it is painted. Any visible salt crystals on the wood surface must be washed and brushed away with the moisture
 23 content reduced again to the specified level before painting. Stored timber awaiting painting must be covered and stacked with
 24 spreaders to ensure air circulation.

25 **6-07.4 MEASUREMENT**

26 Spot abrasive blast cleaning of steel surfaces as specified in Section 6-07.3(10)D will be measured by the square foot of
 27 surface area to be cleaned to bare metal as specified by the Engineer.

28 No specific unit of measurement will apply to the lump sum items of "Cleaning and Painting - ____" and "Containment
 29 of Abrasives".

30 **6-07.5 PAYMENT**

31 1. "Cleaning and Painting - ____", lump sum.

32 The lump sum Contract price for "Cleaning and Painting - ____" will be full pay for the Work as specified, including
 33 developing all submittals, arranging for and accommodating contact and on-site attendance by the paint manufacturer's
 34 technical representative, furnishing and placing all necessary staging and rigging, furnishing, operating and mooring barges,
 35 furnishing and operating fixed and movable work platforms, accommodating Owner inspection access, conducting the
 36 Contractor's quality control inspection program, providing material, labor, tools, and equipment, furnishing containers for
 37 containment waste, collecting and storing containment waste, collecting, storing, testing, and disposing of all containment
 38 waste not conforming to the definition in Section 6-07.3(10)F, performing all cleaning and preparation of surfaces to be
 39 painted, applying all coats of paint and sealant, correcting coating deficiencies, completing coating repairs, and completing
 40 Project Site cleanup.

41 Progress payments for "Cleaning and Painting - ____" will be made on a monthly basis and will be based on the
 42 percentage of the total estimated area satisfactorily cleaned and coated as determined by the Engineer. Payment will not be
 43 made for areas that are otherwise complete but have repairs outstanding.

44 2. "Spot Abrasive Blast Cleaning", per square foot.

45 The unit Contract Price per square foot for "Spot Abrasive Blast Cleaning" will be full pay for performing the spot abrasive
 46 blast cleaning work as specified in Section 6-07.3(10)D.

47 3. "Containment of Abrasives", lump sum.

48 The lump sum Contract Price for "Containment of Abrasives" will be full payment for all costs incurred by the Contractor
 49 in complying with the requirements as specified in Section 6-07.3(10)A to design, construct, maintain, and remove
 50 containment systems for abrasive blasting operations.

51 All costs in connection with testing containment waste, transporting containment waste for disposal, and disposing of
 52 containment waste as specified in Section 6-07.3(10)F will be per the Special Provisions.

1 No separate payment for painting new steel or timber structures will be made. All costs related to painting new steel
2 structures and painting or powder coating of galvanized surfaces are included in payment items in Section 6-03.5. Payment for
3 painting of timber structures will be as specified in Section 6-04.5.

4 SECTION 6-08 WATERPROOFING

5 6-08.1 DESCRIPTION

6 Section 6-08 describes applying waterproofing Materials to Portland cement concrete surfaces as required by the
7 Contract.

8 6-08.2 MATERIALS

9 Materials must comply with the requirements of the following Sections:
10

| Material | Section |
|---------------------------|---------|
| Asphalt for Waterproofing | 9-11.1 |
| Waterproofing Fabric | 9-11.2 |
| Portland Cement Mortar | 9-11.3 |
| Mortar | 9-20.4 |
| Waterproofing Admixture | 9-23.5 |

11 6-08.3 CONSTRUCTION REQUIREMENTS

12 6-08.3(1) STORAGE OF FABRIC

13 The fabric must be stored in a dry, protected place. Do not store rolls standing on end.
14

15 6-08.3(2) PREPARATION OF SURFACE

16 Preparation of surfaces must be per the manufacturer's recommendations. Concrete surfaces must be reasonably
17 smooth and without projections or holes that might puncture the waterproofing membrane. The surfaces must be dry, with all
18 dust and loose material removed. Do not apply waterproofing in wet weather or when the air temperature is below 35 °F
19 unless the Engineer approves in writing.

20 6-08.3(3) APPLICATION OF WATERPROOFING

21 Unless the manufacturer's instructions state otherwise, waterproofing asphalt must be stirred frequently as it is heated to
22 between 300 °F and 350 °F. Each heating kettle must have a thermometer.

23 Each coat of primer or asphalt must start at the low point of the surface so water runs over (not against or along) the
24 laps.

25 In applying the waterproofing, the Contractor must:

- 26 1. Apply a coat of primer and let it dry before applying the first asphalt coat;
- 27 2. Mop hot asphalt on a band about 20 inches wide across the full length of the surface;
- 28 3. Immediately roll a starter strip of half width fabric into the asphalt, pressing it into place to rid it of all air bubbles and
29 to conform it closely to the surface;
- 30 4. Mop hot asphalt over the starter strip and an adjacent section of surface so the fresh asphalt forms a band slightly
31 wider than the full width of the fabric;
- 32 5. Immediately roll a full width strip of fabric into the fresh asphalt, pressing it into place as before;
- 33 6. Mop hot asphalt on the latest strip and on an adjacent band of the surface slightly wider than the full width of the
34 fabric;
- 35 7. Immediately roll another strip of fabric into the asphalt, lapping the earlier strip by at least 2 inches and pressing it into
36 place as before;
- 37 8. Repeat steps 6 and 7 until the entire surface is covered; and
- 38 9. Mop the entire surface with a final coating of hot asphalt.

39 The 3 complete moppings of asphalt must ensure that no fabric layer ever touches another fabric layer or the concrete
40 surface. Examine all laps and ensure they are thoroughly sealed down.

41 Each mopping must cover completely, with a coat heavy enough to hide the fabric weave and all gray spots from the
42 concrete. On horizontal surfaces, use at least 12 gallons of asphalt for every 100 square feet of finished work. On vertical
43 surfaces, use at least 15 gallons per 100 square feet.

44 At the end of each day's work, all fabric laid must have received its final mopping of asphalt.

1 Wherever the membrane ends or is punctured by drains, pipes, or similar, seal the area to prevent water from entering
 2 between the waterproofing and the concrete surface.

3 All flashing, such as at curbs, against girders, and spandrel walls, must be made of separate sheets that lap the main
 4 membrane by at least 12 inches. Flashing must be sealed closely:

- 5 a. With full metal flashing; or
- 6 b. By imbedding its upper edges in a groove poured full of an acceptable joint cement.

7 At each expansion joint, the membrane must not be broken but must be folded to allow movement. At either end of the
 8 bridge, the membrane must run well down abutments and must allow for expansion and contraction.

9 **6-08.3(4) PROTECTION COURSE**

10 If the Drawings require, place a layer of mortar at least 1-1/2 inches thick over the whole surface of the membrane just
 11 after it has cooled to air temperature. This layer must be a mix of 1 part Portland cement to 2 parts sand. It must be distributed
 12 evenly over the membrane, tamped gently into place, finished by hand to a smooth, hard surface, then covered and kept moist
 13 for 1 week.

14 **6-08.4 MEASUREMENT**

15 Section 1-Measurement for "Waterproofing" will be the number of square yards of the actual surface of the waterproofed
 16 area and will not include required overlap.

17 **6-08.5 PAYMENT**

- 18 1. "Waterproofing", per square yard.

19 The Bid Item price for "Waterproofing" must include all costs for the work required to furnish and construct the
 20 waterproofing.

- 21 2. **Other payment information**

22 Waterproofing of construction joints not shown on the Drawings must be included in the Bid Item price for
 23 "Waterproofing".

24 **SECTION 6-09 MODIFIED CONCRETE OVERLAYS**

25 **6-09.1 DESCRIPTION**

26 Section 6-09 describes scarifying concrete bridge decks, preparing and repairing bridge deck surfaces designated and
 27 marked for further deck preparation, and placing, finishing, and curing modified concrete overlays.

28 **6-09.2 MATERIALS**

29 Materials must comply with the requirements of the following Sections:
 30

| Material | Section |
|------------------|-----------|
| Portland Cement | 9-01.2(1) |
| Fine Aggregate | 9-03.1(2) |
| Coarse Aggregate | 9-03.1(3) |
| Mortar | 9-20.4 |
| Burlap Cloth | 9-23.3 |
| Admixtures | 9-23.4 |
| Fly Ash | 9-23.6 |
| Microsilica Fume | 9-23.8 |
| Water | 9-25.1 |

31 Portland cement must be either Type I or Type II. Type III Portland cement is not allowed.

32 Fine aggregate must be Class 1. Coarse aggregate must be AASHTO grading No. 7 or No. 8.

33 Fly ash must be Class F only.

34 Microsilica admixture must be either a dry powder or a slurry admixture. Microsilica will be accepted based on submittal
 35 to the Engineer of a manufacturer's certificate of compliance conforming to Section 1-06.3. If the microsilica is a slurry
 36 admixture, the microsilica content of the slurry must be certified as a percent by mass.
 37

38 Latex admixture must be a non-toxic, film-forming, polymeric emulsion in water to which all stabilizers have been added
 39 at the point of manufacture. The latex admixture must be homogeneous and uniform in composition, and must conform to the
 40 following:

- 1 Polymer Type: Styrene Butadiene
 2 Stabilizers: see table.
 3

| Stabilizer Requirements | |
|-------------------------|--------------------------|
| Latex | Non-ionic surfactants |
| Portland Cement | Polydimethyl siloxane |
| Percent Solids | 46.0-49.0 |
| Weight per Gallon | 8.4 pounds at 77 °F |
| Color | White |
| PH (as shipped) | 9 minimum |
| Freeze/Thaw Stability | 5 cycles (5 °F to 77 °F) |
| Shelf Life | 2 years minimum |
| Latex | Non-ionic surfactants |

- 4
 5 Latex admixture will be accepted based on submittal to the Engineer of a manufacturer's certificate of compliance as
 6 specified in Section 1-06.3.
 7 High Molecular Weight Methacrylate (HMWM) resin for crack and joint sealing must conform to the following:
 8

| HMWM Resin Requirements | |
|-------------------------|---|
| Viscosity | <25 cps (Brookfield RVT with UL adaptor, 50 rpm at 77 °F) ... California Test 434 |
| Density | 8.5-8.8 pounds per gallon at 77 °F... ASTM D 2849 |
| Flash Point | >200 °F, PMCC (Pinsky-Martens CC) |
| Vapor Pressure | <0.04 inches Hg at 77 °F, ASTM D 323 |
| Tg (DSC) | >136 °F, ASTM D 3418 |
| Gel Time | 60 minutes minimum |

- 9
 10 The promoter/initiator system for the methacrylate resin must consist of a metal drier and peroxide.
 11 Sand for abrasive finish must be crushed sand, oven dried, and stored in moisture proof bags. The sand must conform to
 12 the following gradation:
 13

| Sieve Size | Percent Passing ¹ | |
|------------|------------------------------|---------|
| | Minimum | Maximum |
| No. 10 | 98 | 100 |
| No. 16 | 55 | 75 |
| No. 20 | 30 | 50 |
| No. 30 | 8 | 25 |
| No. 50 | 0 | 5 |
| No. 100 | 0 | 3 |

- 14 1. NOTE: All percentages are by weight.

15 **6-09.3 CONSTRUCTION REQUIREMENTS**

16 **6-09.3(1) EQUIPMENT**

17 **6-09.3(1)A POWER DRIVEN HAND TOOLS**

- 18 Power driven hand tools may be used for concrete scarification in areas not accessible to scarification machines, and for
 19 further deck preparation Work, except for the following:

- 20 1. Jack hammers more forceful than the nominal 30 pound class.
- 21 2. Chipping hammers more forceful than the nominal 15 pound class.

- 22 The power driven hand tools must be operated at angles less than 45 degrees as measured from the surface of the deck
 23 to the tool.

1 **6-09.3(1)B ROTARY MILLING MACHINES**

2 Rotary milling machines must have a maximum operating weight of 50,000 pounds and conform to the requirements in
3 Section 1-07.7.

4 **6-09.3(1)C HYDRO-DEMOLITION MACHINES**

5 Hydro-demolition machines must consist of filtering and pumping units operating in conjunction with a remote-controlled
6 robotic device, using high-velocity water jets to remove 1/2 inch of sound concrete with the simultaneous removal of all
7 deteriorated concrete. Hydro demolition machines must also clean any exposed reinforcing steel of all rust and corrosion
8 products.

9 **6-09.3(1)D SHOT BLASTING MACHINES**

10 Shot blasting machines must consist of a self-contained mobile unit, using steel abrasive to remove 1/2 inch of sound
11 concrete. The shot blasting machine must vacuum and store all material removed from the scarified concrete surface into a
12 self-contained unit.

13 **6-09.3(1)E AIR COMPRESSOR**

14 Air compressors must be equipped with oil traps to eliminate oil from being blown onto the bridge deck during
15 sandblasting and air cleaning.

16 **6-09.3(1)F VACUUM MACHINE**

17 Vacuum machines must be capable of collecting all dust, concrete chips, freestanding water and other debris
18 encountered while cleaning during deck preparation. The machines must be equipped with collection systems that allow the
19 machines to be operated in air pollution sensitive areas and must be equipped to not contaminate the deck during final
20 preparation for concrete placement.

21 **6-09.3(1)G WATER SPRAYING SYSTEM**

22 The water spraying system must include a portable high-pressure sprayer with a separate water supply of potable water.
23 The sprayer must be readily available to all parts of the deck being overlaid and must be able to discharge water in a fine mist
24 to prevent accumulation of free water on the deck. Sufficient water must be available to thoroughly soak the deck being
25 overlaid and to keep the deck wet before concrete placement.

26 The Contractor must certify that the water spraying system meets these requirements:

- 27 1. Pressure: 2,200 psi minimum
- 28 2. Flow Rate: 4.5 gpm minimum
- 29 3. Fan Tip: 15 degree to 25 degree range

30 **6-09.3(1)H MOBILE MIXER FOR LATEX MODIFIED CONCRETE**

31 Proportioning and mixing must be accomplished in self-contained, self-propelled, continuous-mixing units conforming to
32 the following requirements:

- 33 1) The mixer must be equipped so that it can be grounded.
- 34 2) The mixer must be equipped to provide positive measurement of the Portland cement being introduced into the mix.
35 Use an approved recording meter, visible at all times and equipped with a ticket printout.
- 36 3) The mixer must be equipped to provide positive control of the flow of water and latex admixture into the mixing
37 chamber. Water flow must be indicated by an approved flow meter with a minimum readability of 1/2 gallon per
38 minute, accurate to ± 1 percent. The water system must have a bypass valve capable of completely diverting the flow
39 of water. Latex flow must also be indicated by an approved flow meter with a minimum readability of 2 gallons per
40 minute, accurate to ± 1 percent. The latex system must be equipped with a bypass valve suitable for obtaining a
41 calibrated sample of admixture.
- 42 4) The mixer must be equipped to be calibrated to automatically proportion and blend all components of the specified
43 mix on a continuous or intermittent basis as required by the finishing operation, and must discharge mixed material
44 through a conventional chute directly in front of the finishing machine.

45 The Contractor must inspect each mobile mixer in the presence of the Engineer per these requirements:

- 46 a. Check the manufacturer's inspection plate or mix setting chart for the serial number, the proper operating revolutions
47 per minute (rpm), and the approximate number of counts on the cement meter to deliver 94 pounds of cement.
- 48 b. Make a general inspection of the mobile mixer to ensure cleanliness and good maintenance practices.
- 49 c. Check to see that the aggregate bins are empty and clean and that the bin vibrators work.
- 50 d. Verify that the cement aeration system operates, that the vent is open, and that the mixer is equipped with a
51 grounding strap. Check the cement meter feeder to ensure that all fins and pockets are clean and free from
52 accumulated cement. If the operator cannot demonstrate, through visual inspection, that the cement meter feeder is
53 clean, all cement must be removed from the bin and the cement meter feeder inspected. The aeration system must
54 be equipped with a gauge or indicator to verify that the system is operating.

- 1 e. Verify that the main belt is clean and free of any accumulated material.
 2 f. Check the latex strainer to ensure cleanliness.

3 The initial calibration includes:

4 1. Cement Meter

- 5 a. Refer to the truck manufacturer's mix setting chart to determine the specified operating rpm and the approximate
 6 number of counts required on the cement meter to deliver 94 pounds of cement.
 7 b. Place at least 40 bags (about 4,000 pounds) of cement in the cement bin.
 8 c. Ensure the mixer is resting on a level surface.
 9 d. Ensure the mixer is grounded.
 10 e. Adjust the engine throttle to obtain the specified rpm. Operate the unit, discharging cement until the belt has made
 11 1 complete revolution. Stop the belt. Reset the cement meter to zero. Position a suitable container to catch the
 12 cement and discharge approximately 1 bag of cement. With a stopwatch, measure the time required to discharge
 13 the cement. Record the number of counts on the cement meter and determine the weight of the cement in the
 14 container. Repeat the process of discharging approximately 1 bag of cement until 6 runs are made. Reset the
 15 cement meter to 0 for each run.

16 Example:

| Run No. | Cement Counts | Weight of Cement | Time In Seconds |
|--------------|---------------|------------------|-----------------|
| 1 | 66 | 95 | 31 |
| 2 | 68 | 96 | 31.2 |
| 3 | 67 | 95.5 | 31.0 |
| 4 | 66 | 95 | 29.8 |
| 5 | 67 | 95.25 | 30.5 |
| 6 | 66 | 95 | 30.8 |
| TOTAL | 400 | 571.75 | 184.3 |

18 Pounds of cement per count on cement meter:

19 Weight of Cement / Number of Counts = $571.75 / 400 = 1.43 \text{ LB / Count}$
 20

21 Counts per bag (94 pounds):

22 $94 / 1.43 = 65.7 \text{ Counts Bag}$
 23

24 Pounds of cement discharged per second:

25 Weight of Cement / Time in Seconds = $571.75 / 184.3 = 3.10 \text{ LB / SEC.}$
 26

27 Required time to discharge 1 bag:

28 Time = $94 / 3.10 = 30.32 \text{ SEC / Bag}$
 29

30
 31 2. Latex Throttling Valve

- 32 a. Check to be sure that the latex strainer is unobstructed.
 33 b. The latex throttling valve must be adjusted to deliver 3.5 gallons of latex (29.4 pounds) for each bag of cement.
 34 From the above calculation 30.32 seconds are required to deliver 1 bag of cement.
 35 c. With the unit operating at the specified rpm, discharge latex into a container for 30.3 seconds and determine the
 36 weight of latex. Continue adjusting the valve until 29.4 to 29.5 pounds of latex is discharged in 30.3 seconds.
 37 Verify the accuracy of this valve setting 3 times.

38 3. Water Flow Meter

- 39 a. Set the water flow meter by adjusting it to flow at 1/2 gallon per minute.
 40 b. Collect and weigh the water discharged during a 1 minute interval with the equipment operating at the specified
 41 rpm. Divide the weight of water by 8.34 to determine the number of gallons.
 42 c. Repeat items a. and b., above, with the flow meter adjusted to 1-1/2 gallons per minute.

43 4. Aggregate Bin Gates

- 1 a. Set the gate openings to provide the quantity of aggregate required to produce concrete having the specified
- 2 proportions.
- 3 b. Discharge a representative sample of the aggregates through the gates and separate on the No. 4 sieve.
- 4 Aggregates must comply with the requirements for proportions as specified in Section 6-09.3(3)E.
- 5 c. Adjust the gate openings if necessary to provide the proper ratio of fine aggregate to total aggregate.
- 6 5. Production of Trial Mix: Operate each mobile mixer must to produce at least 1/2 cubic yard of concrete, which must
- 7 be in compliance with these Specifications, before acceptance of the mobile mixer for project use. The Engineer will
- 8 perform yield, slump, and air tests on the concrete produced by each mixer. Calibration of each mobile mixer must be
- 9 done by the Contractor in the presence of the Engineer. A complete calibration is required on each mixer on each
- 10 concrete placement unless, after the initial calibration, the personnel having the responsibility of mixer calibration on
- 11 subsequent concrete placement were present during the initial calibration of the mixer and during the concrete
- 12 placement operations and are able to verify the dial settings of the initial calibration and concrete placement.
- 13 If these criteria are met, a complete calibration need not be repeated provided that a single trial run verifies the
- 14 previous settings of the cement meter, latex throttling valve, water flow meter, and aggregate gradations, and that the
- 15 mixer has not left the project and the Engineer is satisfied that a complete calibration is not needed.

16 **6-09.3(1) READY-MIX TRUCKS FOR FLY ASH MODIFIED AND MICROSILICA MODIFIED CONCRETE**

17 Ready-mix trucks must conform to Section 6-02.3(4)A.

18 **6-09.3(1)J FINISHING MACHINE**

19 The finishing machine must comply with the requirements of Section 6-02.3(10) and the following requirements:

20 The finishing machine must be equipped with a rotating cylindrical double drum screed not exceeding 60 inches in length
21 preceded by a vibrating pan. The vibrating pan must be constructed of metal and be of sufficient length and width to properly
22 consolidate the mixture. The vibrating frequency of the vibrating pan must be variable with positive control between 3,000 and
23 6,000 rpm. A machine with a vibrating pan as an integral part may be proposed and will be considered for approval by the
24 Engineer. Other finishing machines are allowed subject to approval of the Engineer.

25 **6-09.3(2) SUBMITTALS**

26 The Contractor must submit the following items to the Engineer for approval as specified in Section 6-01.8:

- 27 1. The type of machine (rotary milling, hydro-demolition, or shot blasting) selected by the Contractor for use in this
- 28 project to scarify concrete surfaces.
- 29 2. The axle loads and axle spacing of the rotary milling machine, if used.
- 30 3. The Runoff Water Disposal Plan, if a hydro-demolition machine is used. The Runoff Water Disposal Plan must
- 31 describe all provisions for the containment, collection, filtering, and disposal of all runoff water and associated
- 32 contaminants and debris generated by the hydro-demolition process, including containment, collection and disposal
- 33 of runoff water and debris escaping through breaks in the bridge deck.
- 34 4. The method and materials used to contain, collect, and dispose of all concrete debris generated by the scarifying
- 35 process, including provisions for protecting adjacent traffic from flying debris.
- 36 5. The mix design for concrete Class M, and either fly ash modified concrete, microsilica modified concrete, or latex
- 37 modified concrete, as selected by the Contractor for use in this project as specified in Section 6-09.3(3).
- 38 6. Samples of the latex admixture and the Portland cement for testing and compatibility, if latex modified concrete is
- 39 used).
- 40 7. Paving equipment Specifications and details of the screed rail support system, including details of anchoring the rails
- 41 and providing rail continuity.

42 Do not start scarifying operations until receiving the Engineer's approval of items 1 through 4 as applicable for the
43 Contractor's scarifying method. Do not start placing modified concrete overlay until receiving the Engineer's approval of items
44 5 through 7 as applicable for the Contractor's selected type of modified concrete.

45 **6-09.3(3) CONCRETE OVERLAY MIXES**

46 **6-09.3(3)A GENERAL**

47 For fly ash, microsilica, and latex modified concrete, adjust the slump to accommodate the gradient of the bridge deck,
48 subject to the maximum slump specified.

49 For fly ash and microsilica modified concrete, calculate the maximum water-cement ratio using all available mix water,
50 including the free water in both the coarse and fine aggregate, and in the microsilica slurry if a slurry is used.

51 For fly ash and microsilica modified concrete, use all water-reducing and air entraining admixtures and superplasticizers,
52 must be used per the admixture manufacturer's recommendations, and as approved by the Engineer.

53 **6-09.3(3)B CONCRETE CLASS M**

54 Concrete Class M for further deck preparation patching concrete must be proportioned using the following mix design:

Concrete Class M Mix Proportions

| Material | Proportion |
|------------------------------|--------------|
| Portland Cement | 705 pounds |
| Fine Aggregate | 1,280 pounds |
| Coarse Aggregate | 1,650 pounds |
| Water-Cement Ratio | 0.37 maximum |
| Air ($\pm 1\text{-}1/2\%$) | 6% |
| Slump (± 1 inch) | 5 inches |

The use of a water-reducing admixture conforming to AASHTO M 194 Type A is required to produce patching concrete with the desired slump, and must be used per the admixture manufacturer's recommendations. Air entraining admixtures must be per AASHTO M 154 and the admixture manufacturer's recommendations. The use of accelerating admixtures or other types of admixtures is not allowed.

6-09.3(3)C FLY ASH MODIFIED CONCRETE

Fly ash modified concrete must be a workable mix, uniform in composition and consistency. Mix proportions per cubic yard are as follows:

Fly Ash Modified Concrete Mix Proportions

| Material | Proportion |
|------------------------------|------------------------|
| Portland Cement | 611 pounds |
| Fly Ash | 275 pounds |
| Fine Aggregate | 38% of total aggregate |
| Coarse Aggregate | 62% of total aggregate |
| Water-Cement Ratio | 0.30 maximum |
| Air ($\pm 1\text{-}1/2\%$) | 6% |
| Slump | 7 inches maximum |

6-09.3(3)D MICROSILICA MODIFIED CONCRETE

Microsilica modified concrete must be a workable mix, uniform in composition and consistency. Mix proportions per cubic yard are as follows:

Microsilica Modified Concrete Mix Proportions

| Material | Proportion |
|------------------------------|------------------|
| Portland Cement | 658 pounds |
| Microsilica Fume | 52 pounds |
| Fine Aggregate | 1,515 pounds |
| Coarse Aggregate | 1,515 pounds |
| Water-Cement Ratio | 0.33 maximum |
| Air ($\pm 1\text{-}1/2\%$) | 6% |
| Slump | 7 inches maximum |

6-09.3(3)E LATEX MODIFIED CONCRETE

Latex modified concrete must be a workable mix, uniform in composition and consistency. Mix proportions per cubic yard are as follows:

Latex Modified Concrete Mix Proportions

| Material | Proportion |
|----------------------------|--------------------------------|
| Portland Cement | 1.00 parts by weight |
| Fine Aggregate | 2.40-2.75 parts by weight |
| Coarse Aggregate | 1.75-2.00 parts by weight |
| Latex Admixture | 3.50 gallons per bag of cement |
| Water-Cement Ratio | 0.33 maximum |
| Air Content of Plastic Mix | 6% maximum |
| Slump | 7 inches maximum |

Proportion the aggregates must such that the quantity of aggregate passing the Number 4 sieve is 65 ± 5 percent of the total aggregate (fine plus coarse). All calculations must be based on dry weights.

The moisture content of the fine aggregate and coarse aggregate must be no more than 3.0 and 1.0 percent, respectively, above the saturated surface dry condition.

The water limit for calculating the water-cement ratio must include the added water, the free water in the aggregates, and 52 percent of the latex admixture.

6-09.3(4) STORING AND HANDLING

6-09.3(4)A AGGREGATE

Store and handle aggregates must as to prevent variations of more than 1.0 percent in moisture content of the stockpile.

For latex modified concrete, the moisture content of the aggregate when proportioning must be as specified in Section 6-09.3(3)E.

6-09.3(4)B LATEX ADMIXTURE

The admixture must be kept in suitable containers that will protect it from freezing and from exposure to temperatures in excess of 85 °F. Do not store containers of the admixture in direct sunlight for periods in excess of 10 days. When stored in direct sunlight the top and sides of the containers must be covered with insulating blanket material.

Storage of the admixture may extend over a period greater than 10 days as long as the conditions specified above are maintained and the latex admixture is agitated or stirred once every 10 days. Stir or agitate the admixture must mechanically per the manufacturer's recommendation and as approved by the Engineer. If the ambient temperature is higher than 85 °F at any time during the storage period, cover the admixture with insulated blankets or other means that will maintain the admixture temperature below 85 °F.

Strain the admixture must through a Number 10 strainer when it is introduced into the mixing tank from the storage containers.

6-09.3(4)C HIGH MOLECULAR WEIGHT METHACRYLATE RESIN (HMWM)

Store HMWM resin must in a cool dry place and protected from freezing and exposure to temperature in excess of 100 °F. The promoter and initiator, if supplied separate from the resin, must not contact each other directly. Do not store containers of promoters and initiators together in a manner that will allow leakage or spillage from one to contact the containers or material of the other.

6-09.3(5) SCARIFYING CONCRETE SURFACE

6-09.3(5)A GENERAL

Do not start scarifying a concrete bridge deck surface unless completion of the scarification and concrete overlay can be accomplished within the current construction season.

Do not start scarifying a concrete bridge deck surface until receiving the Engineer's written approval of the machine to be used for scarifying.

Protect adjacent traffic from flying debris generated by the scarification process as specified in item 4 of Section 6-09.3(2) and as approved by the Engineer.

Collect, contain, and dispose of all concrete debris generated by the scarification process as specified in item 4 of Section 6-09.3(2) and as approved by the Engineer.

Scarify all areas of the deck that are inaccessible to the selected scarifying machine to remove the concrete surface matrix to a maximum depth of 1/2 inch by a method accepted by the Engineer. If these areas are hand-chipped then the equipment must comply with the requirements in Section 6-09.3(1)A.

Sufficiently scarify dense, sound areas of existing bridge deck repair material must to provide 1 inch minimum clearance to the top of the fresh modified concrete overlay.

1 6-09.3(5)B TESTING OF HYDRO-DEMOLITION AND SHOT BLASTING MACHINES

2 The Engineer will designate a trial area must to test that the equipment and methods of operation are capable of
3 producing results satisfactory. The trial area must consists of 2 patches each of approximately 30 square feet, one area in
4 sound concrete and one area of deteriorated concrete as determined by the Engineer.

5 In the "sound" area of concrete, program the equipment to remove 1/2 inch of concrete.

6 Following the test over sound concrete, locate the equipment must over the deteriorated concrete and, using the same
7 parameters for the sound concrete removal, remove all deteriorated concrete. The Engineer will grant approval of the
8 equipment based on successful results from the trial area test.

9 6-09.3(5)C HYDRO-DEMOLISHING

10 Once the operating parameters of the Hydro-Demolition machine are defined by programming and calibration as
11 specified in Section 6-09.3(5)B, they must not be changed as the machine progresses across the bridge deck, to prevent the
12 unnecessary removal of sound concrete below the required minimum removal depth. Maintain a minimum production rate of
13 250 square feet per hour during the deck scarifying process.

14 All water used in the Hydro-Demolition process must be potable. Stream or lake water is not permitted.

15 All bridge drains and other outlets within 100 feet of the Hydro-Demolition machine must be temporarily plugged during
16 the Hydro-Demolition operation. When scarifying a bridge deck passing over traffic lanes, protect the traffic below by restricting
17 and containing scarifying operations, and implementing traffic control measures, as accepted by the Engineer.

18 The Contractor must provide for the collection, filtering and disposal of all runoff water generated by the Hydro-
19 Demolition process, per the Runoff Water Disposal Plan as accepted by the Engineer as specified in item 3 of Section 6-
20 09.3(2). Comply with applicable regulations concerning such water disposal.

21 6-09.3(5)D SHOT BLASTING

22 Once the operating parameters of the Shot Blasting machine are defined by programming and calibration, as specified in
23 Section; 6-09.3(5)B, they must not be changed as the machine progresses across the bridge deck, to prevent the unnecessary
24 removal of sound concrete below the required minimum removal depth. Maintain a minimum production rate of 250 square
25 feet per hour during the deck scarifying process.

26 6-09.3(5)E ROTOMILLING

27 The entire concrete surface of the bridge deck must be scarified to remove the surface matrix to a maximum 1/2-inch
28 depth of the concrete. The operating parameters of the rotary milling machine must be monitored to prevent the unnecessary
29 removal of concrete below the 1/2-inch maximum removal depth.

30 6-09.3(5)F REPAIR OF STEEL REINFORCING BARS DAMAGED BY SCARIFYING OPERATIONS

31 The Contractor must repair all reinforcing steel damaged due to the Contractor's operations. For bridge decks not
32 constructed under the same Contract as the concrete overlay, damage to existing reinforcing steel must be repaired and is
33 paid for as specified in Section 1-09.6 if the existing concrete cover is 1/2 inch or less. All other reinforcing steel damaged due
34 to the Contractor's operations must be repaired at the Contractor's sole expense.

35 Repair must be as follows or as directed by the Engineer:

- 36 1. Damage to epoxy coating, when present on existing steel reinforcing bars: as specified in Section 6-02.3(24)H.
- 37 2. Damage to bars resulting in a section loss of 20 percent or more of the bar area: by chipping out the adjacent
38 concrete and splicing a new bar of the same size. Concrete must be removed to provide a 3/4-inch minimum
39 clearance around the bars. The splice bars must extend a minimum of 40 bar diameters beyond each end of the
40 damage.
- 41 3. Any bars partially or completely removed from the deck: by removing the damaged portions and splicing with new
42 bars as outlined in item 2 above.

43 6-09.3(5)G CLEANUP FOLLOWING SCARIFICATION

44 After scarifying is completed, the lane or strip being overlaid must be thoroughly cleaned of all dust, freestanding water
45 and loose particles. Cleaning may be accomplished by using compressed air, water blasting, with a minimum pressure of
46 5,000 psi, or vacuum machines. Use vacuum cleaning when required by applicable air pollution ordinances.

47 6-09.3(6) FURTHER DECK PREPARATION

48 Once the lane or strip being overlaid has been cleaned of debris from scarifying, perform an inspection with the Engineer,
49 must of the completed work per ASTM D 4580, Method B, except as otherwise noted for concrete surfaces scarified by hydro-
50 demolition. Mark those areas of the existing bridge deck that are authorized by the Engineer for further deck preparation by the
51 Contractor. When hydro-demolition is used as the method of scarification, the inspection for further deck preparation must be a
52 visual inspection and must take place after 1 pass of the hydro demolition machine.

53 Further deck preparation will be required under any of the following conditions:

- 54 1. Unsound concrete.

- 1 2. Lack of bond between existing concrete and reinforcing steel.
- 2 3. Existing nonconcrete patches as authorized by the Engineer.
- 3 4. Additionally, for concrete surfaces scarified by rotomilling only, exposure of reinforcing steel to a depth of one-half of
- 4 the periphery of a bar for a distance of 12 inches or more along the bar.

5 Further deck preparation performed beyond the areas authorized by the Engineer will be at the Contractor's expense as
6 specified in Section 1-05.7. If the concrete overlay is placed on a bridge deck as part of the same Contract as the bridge deck
7 construction, then all Work associated with the further deck preparation must be performed at no additional expense to the
8 Contracting Agency.

9 **6-09.3(6)A EQUIPMENT FOR FURTHER DECK PREPARATION**

10 Further deck preparation must be performed using either hand operated tools conforming to Section 6-09.3(1)A, or
11 hydro-demolishing machines conforming to Section 6-09.3(1)C.

12 **6-09.3(6)B DECK REPAIR PREPARATION**

13 All concrete in the repair area must be removed by chipping, hydro demolishing, or other approved mechanical means to
14 a depth necessary to remove all loose and unsound concrete.

15 For concrete surfaces scarified by rotomilling, concrete must be removed to provide a 3/4-inch minimum clearance
16 around the top mat of steel reinforcing bars only where unsound concrete exists around the top mat of steel reinforcing bars,
17 or if the bond between concrete and top mat of steel is broken.

18 Take care in removing the deteriorated concrete to not damage any of the existing deck or steel reinforcing bars that are
19 to remain in place. All removal must be accomplished by making neat vertical cuts and maintaining square edges at the
20 boundaries of the repair area. Make cuts using sawing or hydro demolishing machines after sufficient concrete removal has
21 been accomplished to establish the limits of the removal area. In no case may the depth of the vertical cut exceed 3/4 inch or
22 to the top of the top steel reinforcing bars, whichever is less.

23 The exposed steel reinforcing bars and concrete in the repair area must be sandblasted or hydro-blasted and blown
24 clean just before placing concrete. Bridge deck areas outside the repair area or steel reinforcing bar inside or outside the
25 repair area damaged by the Contractor's operations, must be repaired at the Contractor's sole expense, and to the satisfaction
26 of the Engineer.

27 All steel reinforcing bars damaged due to the Contractor's operations must be repaired as specified in Section 6-
28 09.3(5)F.

29 **6-09.3(6)C PLACING DECK REPAIR CONCRETE**

30 Deck repair concrete for modified concrete overlays must be either modified concrete or concrete Class M as specified
31 below.

32 Before placing any deck repair concrete, the Contractor must flush the existing concrete in the repair area with water and
33 make sure that the existing concrete is well saturated. Remove any freestanding water before placing the deck repair
34 concrete. Place the deck repair concrete onto the existing concrete while it is wet.

35 Type 1 deck repairs, defined as deck repair areas with a maximum depth of one-half the periphery of the bottom bar of
36 the top layer of steel reinforcement and not to exceed 12 continuous inches along the length of the bar, may be filled during
37 the placement of the concrete overlay.

38 Type 2 deck repairs, defined as deck repair areas not conforming to the definition of Type 1 deck repairs, must be
39 repaired with concrete Class M and wet cured for 42 hours as specified in Section 6-09.3(13), before placing the concrete
40 overlay. During the curing period, all vehicular and foot traffic is prohibited on the repair area.

41 **6-09.3(7) SURFACE PREPARATION FOR CONCRETE OVERLAY**

42 Following the completion of any required further deck preparation, clean the entire lane or strip being overlaid must
43 cleaned.

44 If either a rotary milling machine or a shot blasting machine is used for concrete scarification, then the concrete deck
45 must be sandblasted or shot blasted, using equipment approved by the Engineer, until sound concrete is exposed. Take care
46 to ensure that all exposed reinforcing steel and the surrounding concrete is completely blasted. Protect bridge grate inlets,
47 expansion dams and barriers above the surface to be blasted.

48 If a hydro-demolition machine is used for concrete scarification, then the concrete deck must be cleaned by an approved
49 method of water blasting with 7,000 psi minimum pressure, until sound concrete is exposed.

50 The final surface of the deck must be free from oil and grease, rust and other foreign material that may reduce the bond
51 of the new concrete to the old. These materials must be removed by detergent-cleaning or other method as approved by the
52 Engineer followed by sandblasting.

53 After all scarifying, chipping, sandblasting and cleaning is completed, the entire lane or strip being overlaid must be
54 cleaned in final preparation for placing concrete using either compressed air or vacuum machines. Use vacuum machines
55 when warranted by applicable air pollution ordinances.

1 Scarifying with either rotary milling machines or shot blasting machines, hand tool chipping, sandblasting and cleaning in
2 areas adjacent to a lane or strip being cleaned in final preparation for placing concrete must be discontinued when final
3 preparation is begun. Scarifying and hand tool chipping must remain suspended until the concrete has been placed and the
4 requirement for curing time has been satisfied. Sandblasting and cleaning must remain suspended for the first 24 hours of
5 curing time after the completion of concrete placing.

6 If the hydro demolishing scarification process is used, scarification may proceed during the final cleaning and overlay
7 placement phases of the Work on adjacent portions of the Structure so long as the hydro demolisher operations are confined
8 to areas which are a minimum of 100 feet away from the defined limits of the final cleaning or overlay placement in progress. If
9 the hydro demolisher impedes or interferes in any way with the final cleaning or overlay placement as determined by the
10 Engineer, the hydro demolishing Work must be stopped immediately and the hydro demolishing equipment removed
11 sufficiently away from the area being prepared or overlaid to eliminate the conflict. If the grade is such that water and
12 contaminates from the hydro demolishing operation will flow into the area being prepared or overlaid, the hydro demolishing
13 operation must be stopped and must remain suspended for the first 24 hours of curing time after the completion of concrete
14 placement.

15 If, after final cleaning, the lane or strip being overlaid becomes wet, must flush the surface with high-pressure water,
16 before placement of the overlay. Remove all freestanding water before concrete placement. Concrete placement must start
17 within 24 hours of the completion of deck preparation for the portion of the deck to be overlaid. If concrete placement has not
18 begun within 24 hours, the lane or strip being overlaid must be cleaned by a light sand blasting followed by washing with the
19 high-pressure water spray or by cleaning with the high-pressure spray as approved by the Engineer.

20 Traffic except required construction equipment is not permitted on any portion of the lane or strip being overlaid that has
21 undergone final preparation for placing concrete unless approved by the Engineer. To prevent contamination, all equipment
22 allowed on the deck after final cleaning must be equipped with drip guards.

23 **6-09.3(8) QUALITY ASSURANCE**

24 **6-09.3(8)A QUALITY ASSURANCE FOR MICROSILICA MODIFIED AND FLY ASH MODIFIED CONCRETE** 25 **OVERLAYS**

26 The Engineer will perform slump, temperature, and entrained air tests for acceptance as specified in Section 6-02.3(5)D
27 and as specified in this Section after the Contractor indicates that the concrete is ready for placement. Concrete from the first
28 truckload must not be placed until tests for acceptance have been completed by the Engineer and the results indicate that the
29 concrete is within acceptable limits. Sampling and testing will continue for each load until 2 successive loads comply with all
30 applicable acceptance test requirements. Except for the first load of concrete, up to 1/2 cubic yard may be placed before
31 testing for acceptance. After 2 successive tests indicate that the concrete is within specified limits, the sampling and testing
32 frequency may decrease to 1 for every 3 truckloads. Loads to be sampled will be selected using the random selection process
33 outlined in FOP for WAQTC TM2.

34 When the results of any subsequent acceptance test indicates that the concrete does not conform to the specified limits,
35 the sampling and testing frequency will be resumed for each truckload. Whenever 2 successive subsequent tests indicate that
36 the concrete is within the specified limits, the random sampling and testing frequency of 1 for every 3 truckloads may resume.

37 The Engineer will test for slump and/or air any load of concrete the Engineer deems necessary.

38 **6-09.3(8)B QUALITY ASSURANCE FOR LATEX MODIFIED CONCRETE OVERLAYS**

39 The Engineer will perform operational control testing as the concrete is being placed. The Contractor must provide the
40 Engineer with a 1/4 cubic yard container and assistance in obtaining and handling samples. The 1/4 cubic yard container must
41 have a 9-inch minimum depth and must be placed on a level surface. A minimum of 1 test per mobile mixer per shift will be
42 conducted. The test will be conducted after 8 minutes of mixer operation.

43 The Engineer will perform slump, temperature, and entrained air tests for acceptance as specified in Section 6-02.3(5)D
44 and in this Section. The Engineer will perform slump and air tests as the concrete is being placed. The minimum number of
45 tests will be 1 slump test and 1 air test per mobile mixer, starting with the first charge and every other charge thereafter. The
46 sample will be taken after the first 2 minutes of continuous mixer operation. The concrete will be sampled as follows:

- 47 1. While concrete is being deposited onto the bridge deck, the stream will be diverted into a wheelbarrow or other
48 suitable container. Approximately 1 cubic foot of concrete will be sufficient to conduct 1 slump test and 1 air test.
- 49 2. Take the sample to the test site. The test site must be located away from the mobile mixer and off the end of the
50 bridge if practical.
- 51 3. Allow the sample to stand undisturbed. The fresh concrete sample must be protected from sunlight and wind until the
52 conclusion of the testing. Total time from discharge to time of start of slump testing will not exceed 6 1/2 minutes.

53 During the initial proportioning, mixing, placing, and finishing operations, the Engineer may require the presence of a
54 technical representative from the latex admixture manufacturer. The technical representative must be capable of performing,
55 demonstrating, inspecting, and testing all functions required for placement of the latex modified concrete as specified in
56 Section 6-09.3(11) and as approved by the Engineer. This technical representative must aid in the proper installation of the
57 latex modified concrete. Recommendations made by the technical representative on or off the Job Site, and approved by the
58 Engineer, must be adhered to by the Contractor at no additional expense to the Contracting Agency. The Engineer will advise
59 the Contractor in writing a minimum of 5 Working Days before such services are required.

1 6-09.3(9) MIXING CONCRETE FOR CONCRETE OVERLAY**2 6-09.3(9)A MIXING MICROSILICA MODIFIED OR FLY ASH MODIFIED CONCRETE**

3 Mixing of concrete is specified in Section 6-02, with the following exceptions:

- 4 1. The mixing must be done at a batch plant.
- 5 2. The volume of concrete transported by truck must not exceed 6 cubic yards per truck.

6 6-09.3(9)B MIXING LATEX MODIFIED CONCRETE

7 The equipment used for mixing the concrete must be operated with strict adherence to the procedures set forth by its
8 manufacturer.

9 A minimum of 2 mixers will be required at the overlay site for each concrete placement when the total volume of concrete
10 to be placed during the concrete placement exceeds the material storage capacity of a single mixer. Additional mixers may be
11 required if conditions require that material be stockpiled away from the Job Site. The Contractor must have sufficient mixers on
12 hand to ensure a consistent and continuous delivery and placement of concrete throughout the concrete placement.

13 Charging the mobile mixer must be done in the presence of the Engineer. Mixing capabilities must be such that the
14 finishing operation can proceed at a steady pace.

15 6-09.3(10) OVERLAY PROFILE AND SCREED RAILS**16 6-09.3(10)A SURVEY OF EXISTING BRIDGE DECK BEFORE SCARIFICATION**

17 Before starting the scarifying concrete surface finish work specified under Section 6-09.3(5), must complete a survey of
18 the existing bridge deck specified to receive modified concrete overlay for use in establishing the existing cross-section and
19 grade profile elevations.

20 The Contracting Agency will provide the Contractor with primary survey control information consisting of descriptions of 2
21 primary control points used for the horizontal and vertical control. Primary control points will be described by reference to the
22 bridge or project-specific stationing and elevation datum. The Contracting Agency will also provide horizontal coordinates for
23 the starting and ending points and for each Point of Intersection (PI) on each centerline alignment included in the project.
24 Provide the Engineer 21 Calendar Days notice in advance of scheduled concrete surface scarification work to allow the
25 Contracting Agency time to provide the primary survey control information.

26 Verify the primary survey control information furnished by the Contracting Agency and must expand the survey control
27 information to include secondary horizontal and vertical control points as needed for the project. The Contractor's survey
28 records must include descriptions of all survey control points, including coordinates and elevations of all secondary control
29 points.

30 Maintain detailed survey records, including a description of the work performed on each shift, the methods used to
31 conduct the survey, and the control points used. The document must be of sufficient detail to allow the survey to be
32 reproduced. A copy of each day's survey document must be provided to the Engineer within 3 Working Days after the end of
33 the shift. Compile the survey information in an electronic file format acceptable to the Contracting Agency (Excel spreadsheet
34 format is preferred).

35 Survey information collected must include station, offset, and elevation for each lane line and curb line. Survey
36 information must be collected at even 20-foot station intervals and also at the centerline of each bridge expansion joint. Ensure
37 a surveying accuracy to within ± 0.01 feet for vertical control and ± 0.2 feet for horizontal control. The survey must extend 100
38 feet beyond the bridge back of pavement seat.

39 Except for the primary survey control information furnished by the Contracting Agency, the Contractor is responsible for
40 all calculations, surveying, and measuring required for setting, maintaining, and resetting equipment and materials necessary
41 for the construction of the overlay to the final grade profile. The Contracting Agency may post-check the Contractor's
42 surveying, but these post-checks do not relieve the Contractor of responsibility for internal survey quality control.

43 The Contracting Agency will establish the final grade profile based on the Contractor's survey, and will provide the final
44 grade profile to the Contractor within 3 Working Days after receiving the Contractor's survey information.

45 Do not start scarifying concrete surface work specified under Section 6-09.3(5) until receiving the final grade profile from
46 the Engineer.

47 6-09.3(10)B ESTABLISHING FINISH OVERLAY PROFILE

48 The finish grade profile must be +1/4 inch to -1/8 inch from the Engineer's final grade profile. The final grade profile must
49 be verified before the placement of modified concrete overlay with the screed rails in place. The finishing machine must pass
50 over the entire surface to be overlaid and the final screed rail adjustments must be made. If the resultant overlay thickness is
51 not compatible with the finish grade profile generated by the Contractor's screed rail setup, the Contractor must make profile
52 adjustments as approved by the Engineer. After the finish overlay profile has been verified, changing the finishing machine
53 elevation controls is not allowed. The Contractor is responsible for setting screed control to obtain the specified finish grade
54 overlay profile as well as the finished surface smoothness requirements specified in Section 6.02.3(10).

1 Screed rails on which the finishing machine travels must be placed outside the area to be overlaid, as specified in item 7
2 of Section 6-09.3(2), and as approved by the Engineer. Interlocking rail sections or other approved methods of providing rail
3 continuity are required.

4 Hold-down devices shot into the concrete are not permitted unless the concrete is to be subsequently overlaid. Hold-
5 down devices of other types leaving holes in the exposed area will be allowed provided the holes are subsequently filled with
6 mortar conforming to Section 9-20.4(2) mixed at a 1:2 cement/aggregate ratio. Hold-down devices must not penetrate the
7 existing deck by more than 3/4 inch.

8 Screed rails may be removed at any time after the concrete has taken an initial set. Take adequate precautions during
9 the removal of the finishing machine and rails to protect the edges of the new surfaces.

10 **6-09.3(11) PLACING CONCRETE OVERLAY**

11 5 to 10 Working Days before modified concrete overlay placement, a pre-overlay conference must be held to discuss
12 equipment, construction procedures, personnel, and previous results. Inspection procedures must also be reviewed to ensure
13 coordination. These persons are required to attend:

- 14 1. (Representing the Contractor) The superintendent and all foremen in charge of placing and finishing the modified
15 concrete overlay, and
- 16 2. (Representing the Contracting Agency) The Project Engineer and key inspection Assistants.

17 If the project includes more than 1 bridge deck, an additional conference must be held just before placing modified
18 concrete overlay for each subsequent bridge deck.

19 Do not place modified concrete overlay until the Engineer agrees that:

- 20 a. Modified concrete overlay producing and placement rates will be high enough to meet placing and finishing
21 deadlines;
- 22 b. Finishers with enough experience have been used; and
- 23 c. Adequate finishing tools and equipment are at the Project Site.

24 Concrete placement must be as specified in Section 6-02 and the following requirements:

- 25 1) After the lane or strip to be overlaid has been prepared and immediately before placing the concrete, it must be
26 thoroughly soaked and kept continuously wet with water for a minimum period of 6 hours before placement of the
27 concrete. All freestanding water must be removed before concrete placement. During concrete placement, the lane or
28 strip must be kept moist.

29 The concrete must then be promptly and continuously delivered and deposited on the placement side of the finishing
30 machine.

31 If latex modified concrete is used, the concrete must be thoroughly brushed into the surface and then brought up to
32 final grade. If either microsilica modified concrete or fly ash modified concrete are used, a slurry of the concrete,
33 except aggregate, must be thoroughly brushed into the surface before the overlay placement.

34 Take care to ensure that the surface receives a thorough, even coating and that the rate of progress is limited so that
35 the brushed concrete does not become dry before it is covered with additional concrete as required for the final
36 grade. All aggregate which is segregated from the mix during the brushing operation must be removed from the deck
37 and disposed of by the Contractor.

38 If either microsilica modified concrete or fly ash modified concrete are used, must ensure that enough trucks are used
39 for concrete delivery to obtain a consistent and continuous delivery and placement of concrete throughout the
40 concrete placement operation.

41 When concrete is to be placed against the concrete in a previously placed transverse joint, lane, or strip, the
42 previously placed concrete must be sawed back 6 inches to straight and vertical edges and must be sandblasted or
43 water blasted before new concrete is placed. The Engineer may decrease the 6-inch saw back requirement to 2
44 inches minimum, if a bulkhead was used during previous concrete placement and the concrete was hand vibrated
45 along the bulkhead.

- 46 2) Do not start concrete placement if rain is expected. Take adequate precautions to protect freshly placed concrete if
47 rain starts during placement. Concrete that is damaged by rain must be removed and replaced by the Contractor at
48 no additional expense to the Contracting Agency, and to the satisfaction of the Engineer.
- 49 3) Do not place concrete when the temperature of the concrete surface is less than 45 °F or greater than 75 °F, when
50 the combination of air temperature, relative humidity, fresh concrete temperature, and wind velocity at the Job Site
51 produces an evaporation rate of 0.15 pound per square foot of surface per hour as determined from the Surface
52 Evaporation from Concrete figure in Section 6-02.3(6)A2, or when winds are in excess of 10 mph. If the Contractor
53 elects to Work at night to comply with these criteria, adequate lighting must be provided at no additional expense to
54 the Contracting Agency, and as approved by the Engineer.
- 55 4) If concrete placement is stopped for a period of 1/2 hour or more, the Contractor must install a bulkhead transverse to
56 the direction of placement at a position where the overlay can be finished full width up to the bulkhead. The bulkhead
57 must be full depth of the overlay and must be installed to grade. The concrete must be finished and cured per these
58 Specifications.

1 Further placement is permitted only after a period of 12 hours unless a gap is left in the lane or strip. The gap must be
 2 of sufficient width for the finishing machine to clear the transverse bulkhead installed where concrete placement was
 3 stopped. The previously placed concrete must be sawed back from the bulkhead, to a point designated by the
 4 Engineer, to straight and vertical edges and must be sandblasted or water blasted before new concrete is placed.

5 5) Do not place concrete against the edge of an adjacent lane or strip that is less than 36 hours old.

6 **6-09.3(12) FINISHING CONCRETE OVERLAY**

7 Finishing must be accomplished as specified in applicable portions of Section 6-02.3(10) and as follows. Concrete must
 8 be placed and struck-off approximately 1/2 inch above final grade and then consolidated and finished to final grade with a
 9 single pass (the Engineer may require additional passes) of the finishing machine. Hand finishing may be necessary to close
 10 up or seal off the surface. The final product must be a dense uniform surface.

11 Do not spray latex on a freshly placed latex modified concrete surface; however, a light fog spray of water is permitted if
 12 required for finishing, as determined by the Engineer.

13 As the finishing machine progresses along the placed concrete, the surface must be given a final finish by texturing with
 14 a comb perpendicular to the centerline of the bridge. The texture must be applied immediately behind the finishing machine.
 15 The comb must consist of a single row of metal tines capable of producing 1/8-inch wide striations approximately 0.015 foot in
 16 depth at approximately 1/2-inch spacing. The combs may be operated manually or mechanically, either singly or in gangs
 17 (several combs placed end to end). This operation must be done in a manner that will minimize the displacement of the
 18 aggregate particles. The texture must not extend into areas within 2 feet of the curb line. The non-textured concrete within 2
 19 feet of the curb line must be hand finished with a steel or magnesium trowel.

20 Construction dams must be separated from the newly placed concrete by passing a pointing trowel along the inside
 21 surfaces of the dams. Take care to ensure that this trowel cut is made for the entire depth and length of the dams after the
 22 concrete has stiffened sufficiently that it does not flow back.

23 After the burlap cover has been removed and the concrete surface has dried, but before opening to traffic, all joints and
 24 visible cracks must be filled and sealed with a high molecular weight methacrylate resin (HMWM). Cracks 1/16 inch and
 25 greater in width must receive 2 applications of HMWM. Immediately following the application of HMWM, the wetted surface
 26 must be coated with sand for abrasive finish.

27 **6-09.3(13) CURING CONCRETE OVERLAY**

28 As the texturing portion of the finishing operation progresses, the concrete must be immediately covered with a single
 29 layer of clean, new or used, wet burlap. The burlap must have a maximum width of 6 feet. The Engineer will determine the
 30 suitability of the burlap for reuse, based on the cleanliness and absorption ability of the burlap. Take care to ensure that the
 31 burlap is well drained and laid flat with no wrinkles on the deck surface. Adjacent strips of burlap must have a minimum
 32 overlap of 6 inches.

33 Once in place the burlap must be lightly fog sprayed with water. A separate layer of white, reflective type polyethylene
 34 sheeting must immediately be placed over the wet burlap. The concrete must then be wet cured by keeping the burlap wet for
 35 a minimum of 42 hours after which the polyethylene sheeting and burlap may be removed.

36 Traffic is not permitted on the finished concrete until the specified curing time is satisfied and until the concrete has
 37 reached a minimum compressive strength of 3,000 psi as verified by rebound number determined per ASTM C 805.

38 **6-09.3(14) CHECKING FOR BOND**

39 After the requirements for curing have been met, the entire overlaid surface must be sounded by the Contractor, as
 40 approved by and in the presence of the Engineer, to ensure total bond of the concrete to the bridge deck. Concrete in un-
 41 bonded areas must be removed and replaced by the Contractor with the same modified concrete as used in the overlay.
 42 Removal and replacement of the overlay in un-bonded areas must be performed at the expense of the Contracting Agency,
 43 except as specified in Section 6-09.3(6) when the overlay is placed on a bridge deck as part of the same Contract as the
 44 bridge deck construction. All cracks, except those that are significant enough to require removal, must be thoroughly filled and
 45 sealed as specified in Section 6-09.3(12).

46 After the curing requirements have been met, the Contractor may use compressed air to accelerate drying of the deck
 47 surface for crack identification and sealing.

48 **6-09.4 MEASUREMENT**

49 Scarifying concrete surface will be measured by the square yard of surface actually scarified.

50 Modified concrete overlay will be measured by the cubic foot of material placed. For latex modified concrete overlay, the
 51 volume will be determined by the theoretical yield of the design mix and documented by the counts of the cement meter less
 52 waste. For both microsilica modified concrete overlay and fly ash modified concrete overlay, the volume will be determined
 53 from the concrete Supplier's certificate of compliance for each batch delivered less waste. Waste is defined as the following:

- 54 1. Material not placed.
- 55 2. Material placed in excess of 6 inches outside a longitudinal joint or transverse joint.

56 Finishing and curing modified concrete overlay will be measured by the square yard of overlay surface actually finished
 57 and cured.

1 When further deck preparation is measured by volume, it will be measured by the cubic foot of material removed from the
2 deck repair locations. The depth measurement at each deck repair location will be the average depth beneath a straight edge
3 placed at the level of the existing deck surface. The area measurement at each deck repair location will be the surface area of
4 the removed concrete.

5 **6-09.5 PAYMENT**

- 6 1. **“Scarifying Conc. Surface”**, per square yard.

7 The unit Contract Price per square yard for “Scarifying Conc. Surface” will be full pay for performing the Work as
8 specified, including testing and calibration of the machines and tools used, containment, collection, and disposal of all water
9 and abrasives used and debris created by the scarifying operation, measures taken to protect adjacent traffic from flying
10 debris, and final cleanup following the scarifying operation.

- 11 2. **“Modified Conc. Overlay”**, per cubic foot.

12 The unit Contract Price per cubic foot for “Modified Conc. Overlay” will be full pay for furnishing the modified concrete
13 overlay, including the overlay material placed into Type 1 deck repairs as specified in Section 6-09.3(6)C.

- 14 3. **“Finishing and Curing Modified Conc. Overlay”**, per square yard.

15 The unit Contract price per square yard for “Finishing and Curing Modified Conc. Overlay” will be full pay for performing
16 the Work as specified, including placing, finishing, and curing the modified concrete overlay, checking for bond, and sealing all
17 cracks.

- 18 4. **“Further Deck Preparation”**, per cubic foot.

19 When “Further Deck Preparation” is measured by volume, the unit Contract price per cubic foot for “Further Deck
20 Preparation” will be full pay for performing the Work as specified, including removing and disposing of the concrete within the
21 repair area, and furnishing, placing, finishing, and curing the repair concrete.

- 22 5. **“Further Deck Preparation”**, force account.

23 When “Further Deck Preparation” is not measured by volume, payment for the Work required will be by force account as
24 specified in Section 1-09.6.

- 25 6. **“Structure Surveying”**, lump sum.

26 The lump sum Contract Price for “Structure Surveying” will be full pay to perform the Work as specified, including
27 establishing secondary survey control points, performing survey quality control, and recording, compiling, and submitting the
28 survey records to the Engineer.

29 **SECTION 6-10 CONCRETE BARRIER**

30 **6-10.1 DESCRIPTION**

31 Section 6-10 describes building precast or cast in place cement concrete barriers as required by the Contract.

32 **6-10.2 MATERIALS**

33 Materials must comply with the requirements of the following Sections:

| Material | Section |
|-------------------------|----------------|
| Portland Cement | Section 9-01 |
| Aggregates | Section 9-03 |
| Premolded Joint Fillers | Section 9-04.1 |
| Reinforcing Steel | Section 9-07 |
| Grout | Section 9-20.3 |

35
36 Wire rope must be Class 6 x 19, made of improved plow steel galvanized and preformed. Galvanizing must comply with
37 ASTM A 603. The wire rope must have right regular lay and a fiber core. It must be 5/8 inch in diameter and have a minimum
38 breaking strength of 15 tons.

39 All hardware (such as connecting pins, drift pins, nuts, and washers) must be galvanized per AASHTO M 232.

40 Connecting pins, drift pins and steel pins for Type 3 anchors must conform to Section 9-06.4(3) and be galvanized per
41 AASHTO M232. All other hardware must conform to Section 9-06.4(1) and be galvanized per AASHTO M232.

42 Grout for permanent installations of precast single slope barrier must conform to Section 9-20.3(3) and must be placed
43 as specified in Section 6-02.3(20).

6-10.3 CONSTRUCTION REQUIREMENTS

Single slope barrier must be cast-in-place or slip formed, except when precast single slope barrier is specified in the Plans or approved by the Engineer. Concrete barrier installed in conjunction with light standard foundations and sign bridge foundations, regardless of the barrier shape, must be cast-in-place using stationary forms.

Concrete barrier transition Type 2 to bridge f-shape must be precast.

Steel welded wire reinforcement deformed, conforming to Section 9-07.7, may be substituted in concrete barrier in place of deformed steel bars conforming to Section 9-07.2, subject to the following conditions:

1. Steel welded wire reinforcement spacing must be the same as the deformed steel bar spacing shown on the Standard Plans.
2. The minimum cross-sectional area for steel welded wire reinforcement must be no less than 86 percent of the cross-sectional area for the deformed steel bars being substituted.
3. Development lengths and splice lengths must conform to requirements specified in the AASHTO LRFD Bridge Design Specifications, current edition.

6-10.3(1) PRECAST CONCRETE BARRIER

The concrete in precast barrier must reach a compressive strength of at least 4,000 psi at 28 days. Do not ship concrete barrier until test cylinders made of the same concrete and cured under the same conditions show the concrete has reached this strength. Class 4000 concrete that complies with Section 6-02 will comply with this strength requirement. The Contractor may, however, change the mix and aggregate grading if:

1. The Contractor indicates the substitution as specified in Section 1-05.3(5);
2. The altered mix meets the requirement of a Contractor provided mix design; and
3. No aggregate is used that is larger than the maximum for Class 4000 concrete.

The Contractor may use Type III Portland cement at no additional cost to the Owner.

Precast barrier must be cast in steel forms. After release, the barrier must be finished to an even, smooth, dense surface, free from any rock pockets or holes larger than 1/4 inch across. Troweling must remove all projecting concrete from the bearing surface.

Precast concrete barrier must be cured as specified in Section 6-02.3(25)D except that the barrier must be cured in the forms until a rebound number test, or test cylinders cured under the same conditions as the barrier, indicate that the concrete has reached a compressive strength of at least 2,500 psi. No additional curing is required once the barrier is removed from the forms.

All barrier must be the same length, except end sections and variable length units needed for closure. All barrier must be new and unused. The manufacturer is responsible for any damage or distortion that results from manufacturing.

Only 1 section less than 10 feet long may be used in any single run of precast barrier, and it must be at least 8 feet long. It may be precast or cast in place. Hardware identical to that used with other sections must interlock such a section with adjacent precast sections.

When the barrier is being built adjacent to roadway lanes open to traffic, a terminal section must be connected temporarily to the end of the barrier built each day.

6-10.3(2) CAST IN PLACE CONCRETE BARRIER

Forms for cast in place barrier must be made of steel or of exterior plywood coated with plastic. At the Contractor's option, the barrier may be constructed by the slip form method.

The barrier must be made of Class 4000 concrete that meets the requirements of Section 6-02. The Contractor may use Portland cement Type III if it is provided at no additional cost to the Owner.

Immediately after removing the forms, the Contractor must complete any finishing work needed to produce a uniformly smooth, dense surface. The surface must not have rock pockets or holes larger than 1/4 inch across. The barrier must be cured as specified in Section 6-02.3(11)A.

The maximum allowable deviation from a 10-foot straight edge held longitudinally on all surfaces is 1/4 inch.

The Contractor may build cast in place concrete barrier by the slip form method. Concrete for slip form barrier must comply with the requirements for concrete Class 4000 as outlined in Section 6-02, except that the fine aggregate gradation may be Class 1 or Class 2. Slip form barrier must be finished and cured as specified in Section 6-02.3(11)A.

At least 3 Working Days in advance of delivery to the Project Site, the Contractor must request that the Engineer verify the concrete barrier to be free from stains, smears, and any discoloration.

6-10.3(3) REMOVING AND RESETTING CONCRETE BARRIER

The Contractor must reset concrete barrier as specified in the Contract. If resetting is impossible immediately after removal, and must store the barrier at locations approved by the Engineer.

1 6-10.3(4) JOINING PRECAST CONCRETE BARRIER TO CAST IN-PLACE BARRIER

2 The Contractor may join segments of cast in place barrier to precast barrier where transitions, split barriers, or gaps
3 shorter than 10 feet require it. At each joint of this type, the cast in place segment must include hardware that ties both its ends
4 to abutting precast sections.

5 6-10.3(5) TEMPORARY CONCRETE BARRIER

6 For temporary concrete barrier, the Contractor may use new or used precast barrier that complies with WSDOT Standard
7 Plan requirements and cross-sectional dimensions, except that:

- 8 1. It may be made in other lengths than those shown on the WSDOT Standard Plan; and
- 9 2. It may have permanent lifting holes no larger than 4 inches in diameter or lifting loops.

10 The word temporary must be visibly stamped or stencil painted on each barrier segment.

11 All barrier must be in good condition, without cracks, chips, spalls, dirt, or traffic marks. If any barrier segment is
12 damaged during or after placement, the Contractor, at no additional cost to the Owner, must immediately repair the damage to
13 a condition acceptable to the Engineer, or replace it with an undamaged section.

14 Temporary barrier no longer needed must be removed from the Project Site.

15 6-10.3(6) PLACING CONCRETE BARRIER

16 Precast concrete barrier must rest on a paved foundation shaped to a uniform grade and section. The foundation surface
17 must comply with this test for uniformity:

18 When a 10-foot straight edge is placed on the surface parallel to the centerline for the barrier, the surface must not vary
19 more than 1/4 inch from the lower edge of the straight edge. If deviations exceed 1/4 inch, the Contractor must correct them as
20 specified in Section 5-04.3(11).

21 The Contractor must align the joints of all precast segments so that they offset no more than 1/4 inch transversely and no
22 more than 3/4 inch vertically. Grouting is not permitted. If foundation grade and section are acceptable, the Engineer may
23 allow the Contractor to obtain vertical alignment of the barrier by shimming. Shimming must be done with a polystyrene, foam
24 pad (12" x 24") under the end 12 inches of bearing surface.

25 Precast barrier must be handled and placed with equipment that does not damage or disfigure it.

26 6-10.4 MEASUREMENT

27 Precast concrete barrier will be measured by the linear foot along its completed line and slope.

28 Temporary concrete barrier will be measured by the linear foot along the completed line and slope of the barrier, 1 time
29 only for each setup of barrier protected area. Any intermediate moving or resetting will not be measured.

30 Cast in place concrete barrier will be measured by the linear foot along its completed line unless the Contract specifies
31 measurement per cubic yard for concrete Class 4000 and per pound for steel reinforcing bar per Section 6-02.4.

32 Cast in place concrete barrier light standard section will be by the unit for each light standard section installed.

33 Removing and resetting existing permanent barrier will be measured by the linear foot and will be measured 1 time only
34 for removing, storage, and resetting. No measurement will be made for barrier that has been removed and reset for the
35 convenience of the Contractor.

36 Concrete Barrier transition Type 2 to bridge F-shape will be measured by the linear foot installed.

37 Single slope concrete barrier light standard foundation will be measured by the unit for each light standard foundation
38 installed.

39 Traffic barrier, traffic pedestrian barrier, and pedestrian barrier will be measured as specified for cast-in-place concrete
40 barrier.

41 6-10.5 PAYMENT

- 42 1. "Precast Concrete Barrier, Type ____", per linear foot.
- 43 2. "Cast In Place Concrete Barrier", per linear foot.
- 44 3. "Concrete Class (Strength) ____", per cubic yard.
- 45 4. "St. Reinf. Bar ____", per pound.
- 46 5. "Removing and Resetting Existing Permanent Barrier", per linear foot.

47 The Bid Item prices for "Precast Concrete Barrier, Type ____" and for "Cast In Place Concrete Barrier" include all costs
48 for the work required for excavation, forms, placement, special construction features, and all other materials, tools, equipment,
49 and labor necessary to complete the work as specified; except that when the Contract specifies, the Bid Item price per cubic
50 yard for "Concrete Class (Strength)" and the per pound Bid Item price for "Steel Reinforcing Bar" will be full pay for excavation,
51 forms, placement, special construction features, and all other materials, tools, equipment, and labor necessary to complete the
52 work as specified.

- 53 6. "Cast In Place Concrete Barrier Light Standard Section", per each.

1 7. "Temporary Concrete Barrier", per linear foot.

2 The Bid Item prices for "Cast In Place Concrete Barrier Light Standard Section" and for "Temporary Concrete Barrier"
 3 include all costs for the work required to furnish, install, connect, anchor, maintain, temporary storage, and final removal of the
 4 temporary barrier. Contractor furnished barrier must remain the property of the Contractor.

5 Payment for transition sections between different types of barrier will be made at the Bid Item price for the type of barrier
 6 indicated on the Drawings for each transition section.

7 **SECTION 6-11 REINFORCED CONCRETE WALLS**

8 **6-11.1 DESCRIPTION**

9 Section 6-11 describes constructing reinforced concrete retaining walls, including those shown on the WSDOT Standard
 10 Plans, L walls, and counterfort walls.

11 **6-11.2 MATERIALS**

12 Materials must comply with the requirements of the following Sections:
 13

| Material | Section |
|--|-------------------|
| Cement | Section 9-01 |
| Aggregates for Portland Cement Concrete | Section 9-03.1 |
| Gravel Backfill | Section 9-03.10 |
| Premolded Joint Filler | Section 9-04.1(2) |
| Steel Reinforcing Bar | Section 9-07.2 |
| Epoxy-Coated Steel Reinforcing Bar | Section 9-07.3 |
| Concrete Curing Materials and Admixtures | Section 9-23 |
| Fly Ash | Section 9-23.6 |
| Water | Section 9-25 |

14
 15 Other required materials as specified.

16 **6-11.3 CONSTRUCTION REQUIREMENTS**

17 **6-11.3(1) SUBMITTALS**

18 The Contractor must submit all excavation shoring plans to the Engineer for approval as specified in Section 2-09.3(3)D.
 19 Submit all falsework and formwork plans to the Engineer for approval as specified in Sections 6-02.3(16) and 6-02.3(17).
 20 If the Contractor elects to manufacture and erect precast concrete wall stem panels, the following information must be
 21 submitted to the Engineer for approval as specified in Sections 6-01.8 and 6-02.3(28)A:

- 22 1. Working drawings for fabrication of the wall stem panels, showing dimensions, steel reinforcing bars, joint and joint
 23 filler details, surface finish details, lifting devices with the manufacturer's recommended safe working capacity, and
 24 material Specifications.
- 25 2. Working drawings and design calculations for the erection of the wall stem panels showing dimensions, support
 26 points, support footing sizes, erection blockouts, member sizes, connections, and material Specifications.
- 27 3. Design calculations for the precast wall stem panels, the connection between the precast panels and the cast-in-
 28 place footing, and all modifications to the cast-in-place footing details as shown on the Drawings or Standard Plans.

29 Do not start excavation and construction operations for the retaining walls until receiving the Engineer's approval of the
 30 above submittals.

31 **6-11.3(2) EXCAVATION AND FOUNDATION PREPARATION**

32 Excavation must conform to Section 2-09.3(3), and to the limits and construction stages shown on the Drawings.
 33 Foundation soils found to be unsuitable must be removed and replaced as specified in Section 2-04.3(1)I.

34 **6-11.3(3) PRECAST CONCRETE WALL STEM PANELS**

35 The Contractor may manufacture precast concrete wall stem panels for construction of Standard Plan Retaining Walls.
 36 Precast concrete wall stem panels may be used for construction of non-Standard Plan retaining walls if allowed by the
 37 Drawings or Special Provisions. Precast concrete wall stem panels must conform to Section 6-02.3(28), and must be cast with
 38 Class 4000 concrete. If self-consolidating concrete is used, the concrete must conform to Sections 6-02.3(27)B and 6-
 39 02.3(27)C.

40 The precast concrete wall stem panels must be designed per the following codes:

- 1 1. For all loads except as otherwise noted: AASHTO LRFD Bridge Design Specifications, latest edition and current
2 interims. The seismic design must use the acceleration coefficient and soil profile type as specified in the Drawings.
3 2. For all wind loads: AASHTO Guide Specifications for Structural Design of Sound Barriers, latest edition and current
4 interims.

5 The precast concrete wall stem panels must be manufactured per the dimensions and details shown on the Drawings,
6 except as modified in the Shop Drawings as approved by the Engineer.

7 The precast concrete wall stem panels must be manufactured full height, in widths of 8, 16, and 24 feet.

8 The construction tolerances for the precast concrete wall stem panels are:
9

| Wall Stem Panel Component | Tolerance |
|--|--------------------------|
| Height | ± 1/4 inch |
| Width | ± 1/4 inch |
| Thickness | + 1/4 inch - 1/8 inch |
| Concrete cover for steel reinforcing bar | + 3/8 inch - 1/8 inch |
| Width of precast concrete wall stem panel joints | ± 1/4 inch |
| Offset of precast concrete wall stem panels | ± 1/4 inch |

10 NOTE: Deviation is from a straight line extending 5 feet on each side of the panel joint.
11

12 The precast concrete wall stem panels must be constructed with a mating shear key between adjacent panels. The shear
13 key must have beveled corners and must be 1-1/2 inches thick. The width of the shear key must be 3 1/2 inches minimum and
14 5 1/2 inches maximum. The shear key must be continuous and of uniform width over the entire height of the wall stem.

15 Provide the specified surface finish as noted, and to the limits shown, in the Drawings to the exterior concrete surfaces.
16 Special surface finishes achieved with form liners must conform to Sections 6-02.2 and 6-02.3(14) as supplemented in the
17 Special Provisions. Do not use rolled on textured finishes. Precast concrete wall stem panels must be cast in a vertical position
18 if the Drawings call for a form liner texture on both sides of the wall stem panel.

19 The precast concrete wall stem panel must be rigidly held in place during placement and curing of the footing concrete.

20 The precast concrete wall stem panels must be placed a minimum of 1 inch into the footing to provide a shear key. The
21 base of the precast concrete wall stem panel must be sloped 1/2 inch per foot to facilitate proper concrete placement.

22 To ensure an even flow of concrete under and against the base of the wall panel, a form must be placed parallel to the
23 precast concrete wall stem panel, above the footing, to allow a minimum 1-foot head to develop in the concrete during
24 concrete placement.

25 The steel reinforcing bars must be shifted to clear the erection blockouts in the precast concrete wall stem panel by 1-1/2
26 inches minimum.

27 All precast concrete wall stem panel joints must be constructed with joint filler installed on the rear (backfill) side of the
28 wall. The joint filler material must extend from 2 feet below the final ground level in front of the wall to the top of the wall. The
29 joint filler must be a nonorganic flexible material and must be installed to create a waterproof seal at panel joints.

30 The soil bearing pressure beneath the falsework supports for the precast concrete wall stem panels must not exceed the
31 maximum design soil pressure shown on the Drawings for the retaining wall.

32 6-11.3(4) CAST-IN-PLACE CONCRETE CONSTRUCTION

33 Cast-in-place concrete for concrete retaining walls must be formed, reinforced, cast, cured, and finished as specified in
34 Section 6-02, and the details shown on the Drawings. All cast-in-place concrete must be Class 4000.

35 The Contractor must provide the specified surface finish as noted, and to the limits shown, in the Drawings to the exterior
36 concrete surfaces. Special surface finishes achieved with form liners must conform to Sections 6-02.2 and 6-02.3(14) as
37 supplemented in the Special Provisions.

38 Cast-in-place concrete for adjacent wall stem sections (between vertical expansion joints) must be formed and placed
39 separately, with a minimum 12 hour time period between concrete placement operations.

40 Premolded joint filler, 1/2 inch thick, must be placed full height of all vertical wall stem expansion joints as specified in
41 Section 6-01.12.

42 6-11.3(5) BACKFILL, WEEPHOLES, AND GUTTERS

43 Unless the Drawings specify otherwise, backfill and weepholes must be placed as shown on the Standard Plans and
44 specified in Section 6-02.3(22).

45 Cement concrete gutter must be constructed as shown on the Standard Plans.

1 **6-11.3(6) TRAFFIC BARRIER AND PEDESTRIAN BARRIER**

2 When shown on the Drawings, traffic barrier and pedestrian barrier must be constructed as specified in Sections 6-
3 02.3(11)A and 6-10.3(2), and the details shown on the Drawings and Standard Plans.

4 **6-11.4 MEASUREMENT**

5 Concrete Class 4000 for retaining wall will be measured as specified in Section 6-02.4.

6 Steel reinforcing bar for retaining wall and epoxy-coated steel reinforcing bar for retaining wall will be measured as
7 specified in Section 6-02.4.

8 Traffic barrier and pedestrian barrier will be measured as specified in Section 6-10.4 for cast-in-place concrete barrier.

9 **6-11.5 PAYMENT**

10 1. **“Conc. Class 4000 For Retaining Wall”**, per cubic yard.

11 All costs in connection with furnishing and installing weep holes and premolded joint filler are included in the unit Contract
12 price per cubic yard for “Conc. Class 4000 for Retaining Wall”.

13 2. **“St. Reinf. Bar For Retaining Wall”**, per pound.

14 3. **“Epoxy-Coated St. Reinf. Bar For Retaining Wall”**, per pound.

15 4. **“Traffic Barrier”**, per linear foot.

16 5. **“Pedestrian Barrier”**, per linear foot.

17 The unit Contract price per linear foot for “___ Barrier” will be full pay for constructing the barrier on top of the retaining
18 wall, except that when these Bid Items are not included in the Proposal, all costs in connection with performing the Work as
19 specified are included in the unit Contract price per cubic yard for “Conc. Class 4000 For Retaining Wall”, and the unit Contract
20 price per pound for “___ Bar For Retaining Wall”.

21

22

23

END OF DIVISION

1 DIVISION 7 STORM DRAIN, SANITARY AND COMBINED SEWERS, WATER MAINS AND RELATED STRUCTURES**2 SECTION 7-01 SUBSURFACE DRAINS****3 7-01.1 DESCRIPTION**

4 Section 7-01 describes Work consisting of constructing subsurface drains as specified in the Contract. This Work
 5 includes installation of solid, slotted (see Standard Plan 291), and perforated pipe; filter Material; and filter fabric (geotextile).
 6 Subsurface drains must be constructed of gravel filter Material and may include perforated pipe and filter fabric as shown on
 7 the Drawings.

8 7-01.2 MATERIALS

9 Materials must comply with the requirements of the following Sections:
 10

| Material | Section |
|----------------------------|--------------------|
| Gravel Backfill for Drains | Section 9-03.10(4) |
| Pipe and Tubing | Section 9-05 |
| Geotextiles | Section 9-37 |

11

12 Corrugated polyethylene drainage tubing drain pipe must be limited to less than 10 inches.

13

13 Corrugated polyethylene drain pipe must be limited to 12 inches minimum to 36 inches maximum.

14

14 PVC subsurface drain pipe must be limited to 6 inches minimum to 10 inches maximum.

15

15 Unless indicated otherwise in the Contract the above pipe sizes are inside diameter.

16

16 All reference to filter fabric means a geotextile Material as specified in Section 9-37. Class to be specified in Contract.

17

17 7-01.3 CONSTRUCTION REQUIREMENTS

18

18 7-01.3(1) EXCAVATION

19

19 Trenching is subject to the provisions of Section 2-04. Backfill and compaction is subject to the provisions of Section 2-10
 20 and Section 2-11.

21

21 Work in excavation over 4 feet deep is subject to the provisions of Section 2-07.

22

22 Excavate trenches to the grade, line, and dimensions shown on the Drawings.

23

23 7-01.3(2) PLACING PIPE AND FILTER MATERIAL

24

24 See Section 2-15.3 for construction requirements except subsurface drains.

25

25 The filter Material for pipe must be damp when placed in the trench and be deposited uniformly on both sides of the pipe
 26 for the full width of the trench and to the springline of the pipe. Tamp the Material in 4-inch lifts to provide thorough compaction
 27 under and on each side of the pipe. Deposit succeeding lifts of gravel in 8-inch lifts and thoroughly compact to the depth
 28 shown on the Drawings.

29

29 Place the geotextile in the manner and at the locations as specified in the Contract. The surface to receive the geotextile,
 30 and the trench into which the geotextile is to be placed, must be free of obstructions and debris.

31

31 Should the geotextile be damaged during construction, repair the torn or punctured section by placing a piece of
 32 geotextile of sufficient size to cover the damaged area including a minimum 12-inch overlap with all surrounding geotextile. In
 33 places where the trench width is less than 1 foot, the minimum overlap must be the trench width.

34

34 Subsurface drains, as specified in Section 9-05, must be located as specified in the Contract.

35

35 Maintain clearances between drains and other utilities as specified in Section 1-07.17(2).

36

36 Install all drain pipe with the bell or larger end upstream. Drain pipe must be open, clean, clear of debris, and free
 37 draining.

38

38 7-01.3(3) JOINTS

39

39 Polyvinyl chloride drain pipe must be installed upstream with the bell end upstream, or solvent welded per manufacturer's
 40 instructions. Corrugated polyethylene drain pipe must be jointed with snap on, screw on, or wraparound coupling bands as
 41 recommended by the pipe manufacturer.

42

42 7-01.4 MEASUREMENT

43

43 Measurement for "Filter Material, (Type)" will be per cubic yard based on the neat line cross-section shown on the
 44 Drawings.

45

45 Measurement for geotextile will be as specified in Section 2-15.4.

1 Measurement for "Pipe, Subsurface Drain, (Material), (Size)" will be by the linear foot measured along the centerline of
 2 the pipe from pipe end to pipe end.

3 **7-01.5 PAYMENT**

4 1. "Pipe, Subsurface Drain, (Material), (Size)", per linear foot

5 The Bid Item price for "Pipe, Subsurface Drain, (Material), (Size)" includes all costs for the work required to furnish and
 6 install the pipe, excavate the pipe trench, backfill, compact and haul and dispose of excess excavated Material.

7 2. "Filter Material, (Type)", per cubic yard

8 The Bid Item price for "Filter Material, (Type)" includes all costs for the work required to furnish, install, and compact the
 9 Mineral Aggregate filter Material shown on the Drawings, and also includes, when the subsurface drain is constructed of only
 10 gravel filter Material, the costs of the work required to excavate the trench and to haul and dispose of excess excavated
 11 Material.

12 3. **Other payment information**

13 Any part of the trench excavated below grade or to a greater width than specified in the Contract must be backfilled with
 14 filter Material as specified in the Contract at the Contractor's sole expense.

15 Payment for geotextile will be as specified in Section 2-15.5.

16 Payment for protective systems will be as specified in Section 2-07.5.

17 **SECTION 7-02 RESERVED**

18 **SECTION 7-03 RESERVED**

19 **SECTION 7-04 RESERVED**

20 **SECTION 7-05 MAINTENANCE HOLES, CATCH BASINS, INLETS, JUNCTION BOXES AND BRIDGE DRAINS**

21 **7-05.1 DESCRIPTION**

22 Section 7-05 describes Work consisting of constructing maintenance holes, catch basins, inlets, junction boxes, bridge
 23 drains, and the rebuilding or rechanneling of existing maintenance holes as specified in the Contract.

24 This Work also includes excavation, backfilling, and compaction as specified in Section 2-04, Section 2-10 and Section 2-
 25 11.

26 Work in excavations over 4 feet deep must comply with Section 2-07.

27 **7-05.2 MATERIALS**

28 Maintenance holes, catch basins, inlets, junction boxes, appurtenances, and related are specified in Section 9-12.

29 Maintenance holes, catch basins, and inlets must be constructed per the following Standard Plans:

| Drainage Structure | Standard Plan |
|--------------------|---------------------------------------|
| Maintenance Holes | 204a through 212b |
| Catch Basins | 240 through 243b and 260a through 261 |
| Inlets | 250 and 252 and 260a and 260b |
| Junction Boxes | 277 |
| Bridge Drains | 290 |

31
 32 Deviations from Standard Plans, except Material substitutions allowed in Section 9-12, require a Shop Drawing submitted
 33 by the Contractor and approval by the Engineer as specified in Section 1-05.3. Substitutions in Materials shown on the
 34 Standard Plans and allowed in Section 9-12 must comply with the requirements in Section 1-06.1. Concrete masonry units or
 35 concrete masonry rings may be used for adjustment of the casting to final street grade.

36 Joints between maintenance hole components must be rubber gaskets, conforming to ASTM C443.

37 The concrete mix for maintenance hole channels must be Class 3000, see Section 6-02.

38 Concrete for maintenance hole, catch basin, and inlet Structures must be Class 4000, see Section 6-02.

39 Precast maintenance hole components must conform to ASTM C 478 except as modified in Section 7-05.

1 **7-05.3 CONSTRUCTION REQUIREMENTS**

2 **7-05.3(1) MAINTENANCE HOLE**

3 **7-05.3(1)A FOUNDATION PREPARATION**

4 **7-05.3(1)A1 DEWATERING**

5 Dewatering of maintenance hole and catch basin excavations must be as specified in Section 2-08.

6 **7-05.3(1)A2 FOUNDATION PREPARATION**

7 The foundation preparation for maintenance holes, catch basins and inlets is specified in Section 2-09.

8 **7-05.3(1)B BEDDING AND FOUNDATION SUPPORT**

9 Maintenance holes and catch basins constructed with precast base sections must be placed to grade on a 6-inch
10 minimum thickness of Mineral Aggregate Type 9 per Section 9-03 mixed with 4 sacks of Portland cement per cubic yard of
11 Mineral Aggregate, with sufficient water added to form a stabilized foundation. The mixed Material must be placed across the
12 area of the excavation for the base to a minimum distance beyond the face of the maintenance hole as shown on the Standard
13 Plans and must be graded to provide uniform bearing support with the precast base section.

14 All cast in place bases for maintenance holes and catch basins must be poured to grade on a properly prepared
15 foundation as shown on the Standard Plans. Imported Mineral Aggregate Type 2, when required in the Contract, must be
16 placed and compacted to the same limits specified in the paragraph above. The concrete base must comply with the
17 requirements shown on the Standard Plans.

18 **7-05.3(1)C REINFORCED CONCRETE**

19 **7-05.3(1)C1 CONCRETE MIXTURE**

20 Concrete must comply with the requirements of Section 9-12.1.

21 **7-05.3(1)C2 CURING**

22 Upon completion of concrete casting, the precast components must be protected and cured in a moist atmosphere
23 maintained by injection of steam for the requisite length of time and at the required temperature to develop the compressive
24 strength required for maintenance hole components.

25 Precast components may also be water cured by any approved method that keeps the components continuously moist
26 during the curing period. Type III Portland cement concrete must be cured for at least 3 Days. All other cast in place
27 components must be moist cured for at least 7 Days.

28 A pigmented membrane curing compound may be applied instead of moist curing with prior approval of the Engineer.

29 **7-05.3(1)D BASE SLAB**

30 **7-05.3(1)D1 GENERAL**

31 Base slab thickness and reinforcement of the base slab must be per Standard Plan 204a through 212b.

32 **7-05.3(1)D2 PRECAST BASE**

33 The base section must be carefully placed on the prepared bedding so as to be fully and uniformly supported in true
34 alignment and ensuring that all entering pipes can be inserted on proper grade.

35 All lift holes must be thoroughly wetted and then completely filled with mortar and smoothed both inside and out to
36 ensure water tightness.

37 Reinforcement for precast base slab with integral risers must extend into the wall of the maintenance hole section and be
38 tied to the longitudinal steel.

39 **7-05.3(1)D3 CAST IN PLACE BASE**

40 When the Drawings call for cast-in-place base, or the Contractor elects a cast-in-place base, the Contractor must submit
41 a Shop Drawing of the reinforcing mat that meets the requirements of the Standard Plans.

42 Do not pour concrete before inspection by the Engineer.

43 **7-05.3(1)E PRECAST WALL SECTIONS**

44 Precast wall sections must comply with the requirements of ASTM C478.

45 All joints between precast sections must be rubber-gasketed and comply with the requirements of ASTM C443.

46 Place and align precast sections so as to provide vertical sides and vertical alignment of the ladder rungs.

47 The completed maintenance hole must be rigid, true to dimension, and water tight. No more than 2 lift holes must be cast
48 into each section. Locate holes so as to not damage reinforcing or expose it to corrosion. All lift holes must be thoroughly
49 wetted and then completely filled with mortar and smoothed both inside and out to ensure water tightness. At the
50 manufacturer's option, steel loops may be provided for handling instead of lift holes. When loops have been provided instead

1 of lift holes, the loops must be removed flush with the inside wall surface. No sharp cutoff protrusion is permitted. If concrete
2 spalling occurs as a result of the loop removal, restore the spalled area to a uniform smooth surface with mortar.

3 **7-05.3(1)F PRECAST CONES**

4 Precast cone sections must comply with the requirements of the Standard Plans, ASTM C478 and Section 7-05.3(1)E.

5 Precast cones must provide reduction in diameter within a range of height from not less than 18 inches to a maximum 36
6 inches.

7 Jointing of a cone section to the riser sections must be similar to jointing between riser sections, but the top surface of
8 the cone section must be flat and at least 5 inches wide radially, to receive adjustment bricks or precast risers.

9 **7-05.3(1)G TOP SLAB**

10 Top slabs must be as shown on the Standard Plans, including details of opening location and reinforcing.

11 **7-05.3(1)H T TOP PIPE MAINTENANCE HOLES**

12 T Top pipe maintenance holes must conform to the Drawings and be provided with foundation and bedding.

13 **7-05.3(1)I JOINTS**

14 Joints between precast maintenance hole components must be rubber gasketed as similar to pipe joints conforming to
15 ASTM C 443. Submit Shop Drawings of joint details and end details in conformance with Standard Plans 204a - 212b to the
16 Engineer for approval at least 5 Working Days before manufacture. Completed joints must not show visible leakage and must
17 conform to the dimensions of ASTM C 478.

18 **7-05.3(1)J MAINTENANCE HOLE CHANNELS**

19 All maintenance holes must be channeled unless otherwise specified in Contract.

20 Maintenance hole channels must conform to the curvature of the connecting pipes. Maintenance hole channel slopes
21 must conform accurately to the Sewer grade and be brought together smoothly with well-rounded junctions. Where pipe
22 connections have differing grades, differing invert elevations, or differing inside diameters, a smooth transition in channel
23 grade or side is required. Channel sides for each pipe must be carried up vertically from the inside diameter at the springline to
24 the crown elevation of the pipe. The concrete shelf between channels must be smoothly finished and warped evenly with
25 slopes to drain.

26 Channel must be Class 3000 concrete or prepack concrete mix as approved by the Engineer.

27 **7-05.3(1)K MAINTENANCE HOLE PIPE CONNECTIONS**

28 All pipes, except corrugated metal pipe, entering or leaving the maintenance hole must have flexible joints within 1/2 of a
29 pipe inside diameter or 12 inches, whichever is greater, from the outside face of the maintenance hole structure and must be
30 placed on firmly compacted bedding, particularly within the area of the maintenance hole excavation which normally is deeper
31 than that of the Sewer trench. Openings surrounding pipes entering the maintenance hole must be completely filled with a
32 non-shrink cement sand grout and be finished flush with the remaining maintenance hole concrete wall surfaces to ensure
33 water tightness. PVC pipe connecting to maintenance hole must have a maintenance hole adapter, complete with gasket and
34 approved by the Engineer.

35 **7-05.3(1)L MAINTENANCE HOLE GRADE ADJUSTMENT**

36 The Contractor is responsible for selecting the appropriate precast concrete maintenance hole components, allowing for
37 a maximum height of 2'-2" from the top of the cone section or top slab to the finished surface grade for installation of the
38 maintenance hole frame and cover including 8 inches minimum for leveling or adjustment brick, or concrete collar. The surface
39 grade for frame and cover on unimproved roadways must match the adjacent existing roadway surface.

40 Final elevation and slope of the frame and cover must conform to the restored and adjacent street surface. No warping of
41 grades instead of maintenance hole frame adjustment will be allowed. All joints in the brick or ring adjustment must be filled
42 with mortar to a thickness of 1/4 inch minimum to 1/2 inch maximum, and the casting must be seated in mortar a thickness of
43 1/4 inch minimum to 1/2 inch maximum placed on the top brick course. Lay bricks in a running bond pattern. When the frame
44 is circular, use radial bricks or concrete grade rings. Install a 3/8-inch thick mortar lining inside and outside the adjustment
45 section to provide a smooth, water tight finish.

46 **7-05.3(1)M LADDER, STEPS AND HANDHOLDS**

47 The Contractor must submit to the Engineer for approval at least 5 Working Days in advance, the single Material of
48 choice for step, handhold, and ladder from Section 9-12.2, and must consistently use this single chosen Material in every
49 maintenance hole. Steps, handholds, and ladder made of copolymer polypropylene plastic manufactured by Lane International
50 Corp., M. A. Industries or approved equal will be accepted. Should the Contractor request a different Material between or
51 among different maintenance holes, then the submittal must clearly identify which Material is used in each maintenance hole.

52 Ladders, steps, and handholds must be as shown on Standard Plans 232a and 232b and provide regular 1'-0" vertical
53 spacing, except for: up to 1'-6" spacing is allowed between the top step or handhold and the rim; and up to 1'-4" spacing is
54 allowed between the bottom step and the channel shelf.

1 The minimum horizontal clear opening, measured at the shortest dimension, must be 1'-6".

2 Penetrations of the precast wall sections to attach steps, handholds, and ladders must be kept clear of the joints by 2
3 inches minimum.

4 Install vertical handholds 4 feet above the channel shelf when described in the plan view of Standard Plans 204b - 212b
5 or on the Drawings.

6 Where a concentric cone section is required, provide an additional step on the side opposite the ladder steps at mid-
7 height of the cone section.

8 **7-05.3(1)N FRAME AND COVER**

9 The casting must be as shown on Standard Plan 230.

10 Where Standard Plan 230 casting is located within the concrete pavement or within the rigid concrete pavement base,
11 reinforcing in the concrete pavement slab must be installed as specified in Section 5-05.3(9) and per Standard Plan 406.
12 Standard Plan 230 casting located across, or located within 18 inches of a concrete pavement joint as measured from the
13 casting barrel (not the flange), does not require Section 5-05.3(9) pavement reinforcing.

14 Total height of casting and leveling brick must not exceed 26 inches.

15 **7-05.3(1)O CONNECTIONS TO EXISTING MAINTENANCE HOLES**

16 The Contractor must verify invert elevations before construction. Discrepancies in invert elevations must be immediately
17 brought to the attention of the Engineer. The crown elevation of lateral pipes must be the same as the crown elevation of the
18 existing incoming pipe. Reshape the existing base to provide a channel as specified in Section 7-05.3(1)P.

19 Excavate completely around the maintenance hole to prevent unbalanced loading. Keep the maintenance hole in
20 operation at all times, and take all necessary precautions to prevent debris or other Material from entering the Sewer. This
21 includes building a tight pipeline sewage bypass as required.

22 The Contractor must core drill, line drill, or wall saw an opening to match the size of pipe to be inserted. Where line
23 drilling is the method used, the method of drilling holes must prevent overbreakage. All openings must provide a minimum and
24 a maximum clearance around the outside circumference of the pipe as shown on the Standard Plans. Place upstream pipes
25 penetrating the walls of maintenance holes with the bell facing out. Pipe leaving or entering maintenance holes must have a
26 flexible joint within 1/2 of a pipe inside diameter, or 12 inches, whichever is greater from the outside wall of the maintenance
27 hole. After pipes have been placed in their final position, the surface area around the opening in the maintenance hole and the
28 surface of the pipe must be cleaned of all dirt, dust, grease, oil and other contaminants and then roughened and wetted with
29 water. Grout the opening between pipe and broken out concrete as specified in Section 7-05.3(1)K.

30 **7-05.3(1)P RECHANNEL EXISTING MAINTENANCE HOLE**

31 Rechanneling of an existing maintenance hole includes all necessary work such as; excavating shelf and maintenance
32 hole bottom, filling existing channels with concrete, installing the new channels, constructing new pipe opening or openings,
33 and finishing the channel and shelves. It also includes the work of connecting the pipe to the maintenance hole as specified in
34 Section 7-05.3(1)O. Rechanneling must comply with the requirements specified in Section 7-05.3(1)J.

35 **7-05.3(1)Q REBUILD EXISTING BRICK MAINTENANCE HOLE**

36 Where noted on the Drawings, the Contractor must rebuild the existing brick maintenance hole per Standard Plan 220 to
37 accommodate a new maintenance hole frame and cover meeting the requirements of Standard Plan 230. Work required to
38 rebuild an existing brick maintenance hole includes excavation around the maintenance hole, removal and salvage of the
39 existing maintenance hole frame and cover, removal of leveling or adjustment bricks or rings, and removal of the upper portion
40 of the cone section to a depth yielding an opening of inside diameter as shown on Standard Plan 220. Rebuild the cone
41 section using a running bond pattern with leveling bricks or rings, new maintenance hole steps and handholds, and a new
42 frame and cover installed as specified in Section 7-05.3(1)N.

43 Salvage is specified in Section 2-02.3(7).

44 **7-05.3(2) CATCH BASINS AND INLETS**

45 **7-05.3(2)A GENERAL**

46 Construction requirements for catch basins and inlets must be as specified in Section 7-05.3(1) for maintenance holes
47 and maintenance hole pipe connections.

48 Catch basins must be installed as indicated on Standard Plan 240 through 242 and 260a and 260b unless the Contract
49 indicates otherwise. Establish staking points at the centerline of grate at the face of curb for drainage Structures along a curb
50 line.

51 Make connections to the catch basin only at either the predrilled holes or the concrete knockouts provided in the walls of
52 the catch basin. To meet this requirement, determine beforehand the approximate elevation of the proposed inflow and outflow
53 pipes by taking into account the length of inlet connection pipe, the throw in the roadway, including drainage transition zone,
54 and any existing utilities or obstructions that may interfere with installing the inlet connection or catch basin connection pipe.
55 All these items have a bearing on the depth of the pipes at the catch basin and the bottom elevation of the catch basin.

7-05.3(2)B PIPE CONNECTIONS FOR CATCH BASINS AND INLETS

All new catch basins must be provided with openings or concrete knockouts for insertion of pipe connections and with a trap for the outlet pipe. When connections will be made to existing catch basins with no available hole or knockout, or where a knockout of adequate size is not provided, provide for pipe connections by core drilling, line drilling, or wall sawing. All openings must provide a minimum of 1-1/2 inch and a maximum of 2-1/2 inches clearance around the circumference of the pipe. Where line drilling is the method used, the method of drilling holes must prevent overbreakage. After pipes have been placed in position, grout the opening between pipe and wall of catch basin or inlet as specified in Section 7-05.3(1)K. See Sections 7-08.3(4) and 7-08.3(5) for additional pipe connection requirements.

Locate the outlet trap and the frame and grate as shown on the Standard Plans and align it vertically to allow reasonable access for removal and replacement of the outlet trap for vector cleaning maintenance operations.

Furnish and install new outlet traps for relocated and rebuilt catch basins.

7-05.3(2)C CATCH BASIN GRADE ADJUSTMENT

The Contractor is responsible for selecting the appropriate precast concrete catch basin components, allowing for a maximum and minimum height of the leveling bricks or riser as shown on the Standard Plan for the catch basin type.

Final elevation and slope of the grate or cover must conform to the restored and adjacent street surface and drainage transition zone; see Standard Plan 260a and Section 7-20.3(1). Warping of grades instead of catch basin frame adjustment is not allowed. On projects calling for regrading and pavement improvements, determine grades and perform surveying as specified in Sections 1-05.4 and 1-05.5.

7-05.3(2)D INLET GRADE ADJUSTMENT

Place the inlet frame on a minimum 4-inch thick leveling brick or precast risers. It must not, in any case, be mortared to final grade until the final elevation of the pavement in which it is to be placed has been established and permission has been provided by the Engineer to mortar the frame in place. Location of inlet will be established by the Engineer. Slope the bottom of the inlet to drain level with the invert of the outlet pipe.

Final elevation and slope of the frame and cover must conform to the restored and adjacent street surface and account for the drainage transition zone as shown on Standard Plans 260a and 260b and specified in Section 7-20.3(1). Warping of grades instead of inlet frame adjustment is not allowed.

Adjust existing Type 164 inlets as shown on Standard Plan 268 with new grate as shown on Standard Plan 266 only for pavement resurfacing projects.

7-05.3(2)E RELOCATE EXISTING CATCH BASIN OR INLET

Work required for relocation of existing catch basin or inlet includes necessary excavation to remove without damage the existing catch basin or inlet and its frame and grate or cover, and transporting and installing the components at the new location. Grade adjustment is specified in Sections 7-05.3(2)C or 7-05.3(2)D.

Furnish and install new outlet traps, see Section 7-05.3(2)B for outlet trap location requirements.

7-05.3(2)F REBUILD EXISTING CATCH BASIN

Where noted on the Drawings, the Contractor must rebuild existing catch basin to accommodate a new frame and grate or cover as specified in the Contract. Work required to rebuild catch basin includes excavation; the removal of the existing frame and grate or cover, leveling or adjustment bricks, and upper portion of catch basin chamber; and installing a new concrete section, leveling or adjustment bricks, and new frame and grate or cover. Excavation, backfill, and compaction must conform to the applicable portions of Section 7-17. Salvage is specified in Section 2-02.3(7). Grade adjustment is specified in Sections 7-05.3(2)C.

Furnish and install new outlet traps as specified in Section 7-05.3(2)B .

7-05.3(3) JUNCTION BOX

Install junction boxes as shown on the Drawings. See Standard Plan 277 and Sections 9-12.4 and 9-04.3(2)B. Fill the bottom of the structure to match the invert of the lowest pipe and slope to drain.

7-05.3(4) BRIDGE DRAIN

Locate and install bridge drains as shown on the Drawings. See Standard Plan 290 and Section 7-08.3(9).

Furnish bridge drains with vaned grates as shown on Standard Plan 265. The grate must be fitted to the frame and ground to rest evenly and without rocking.

Furnish bridge drains with 6-inch diameter standard weight galvanized steel pipe, shop welded to bridge drain box.

The assembled bridge drain must be galvanized per ASTM A53, Black and Hot-Dipped Zinc-Coated Welded and Seamless Steel Pipe for Ordinary Uses. Coat the assembled and galvanized bridge drain inside and outside with an asphaltic base, black dipping paint. The asphaltic coating must extend to cover all welds.

When encased in concrete, the drain pipe must be fully encased in a sponge rubber compound 1/2 inch thick and meeting the requirements of ASTM D 1752, Type No. 1. The color requirement is waived.

1 The Contractor must submit to the Engineer at least 5 Working Days in advance of delivering the bridge drain to the
 2 Project Site, a combined Shop Drawing of the bridge drain and bridge downspout per Section 7-08.3(9) and connection
 3 details.

4 **7-05.4 MEASUREMENT**

5 Measurement for "Extra Depth (Type) Maintenance hole" will be by the vertical foot for all depth in excess of 10 feet
 6 measured from the invert of the outlet pipe to the top of the casting.

7 Measurement for Extra Depth for the type of maintenance holes which are built on top of and are fully supported by large
 8 diameter pipe, will be by the vertical foot for extra depth in excess of the 10 feet measured from the springline of the
 9 "supporting" pipe to the top of the maintenance hole casting.

10 Measurement for "Extra Excavation" will be as specified in Section 2-04.4.

11 **7-05.5 PAYMENT**

12 1. "Maintenance Hole, (Type)", per each

13 The Bid Item price for "Maintenance Hole, (Type)" includes all costs for the work required to furnish and install the
 14 maintenance hole complete to finish grade, including excavation, bedding, mortar, non-shrink grout, brick, block, castings,
 15 channeling, ladder, steps, connections to pipelines, and haul, stockpile and or disposal of soil, backfill and compaction with
 16 suitable native Material for a maintenance hole depth up to and including 10 feet.

17 2. "Extra Depth, (Type) Maintenance Hole", per vertical foot

18 The Bid Item price for "Extra Depth, (Type) Maintenance Hole" includes all costs for the work required to construct the
 19 portion of a maintenance hole excavation in excess of 10 vertical feet.

20 3. "Rechannel Maintenance Hole", per each

21 The Bid Item price for "Rechannel Maintenance Hole" includes all costs for the work required to complete the
 22 maintenance hole rechanneling work as specified in Section 7-05.3(1)P and of core drilling openings for new pipes to the
 23 maintenance hole when performed in an existing maintenance hole.

24 If connecting a new pipe to an existing maintenance hole requires rechanneling of the maintenance hole, the work
 25 involved in connecting such pipe to the maintenance hole is incidental to "Rechannel Maintenance hole", per each, and will be
 26 performed as specified in Section 7-05.3(1)P. If the work involves only the cutting of an opening and connecting the pipe
 27 without rechanneling, then this work is considered included in the Bid Item price for installation of the pipe and no other
 28 payment will be made.

29 4. "Catch Basin, (Type)", per each

30 The Bid Item price for "Catch Basin, (Type)" includes all costs for the work required to furnish and install the catch basin
 31 including trap, excavation, haul, stockpile and or disposal of soil, backfill and compaction, adjustment brick and blocks, mortar,
 32 non-shrink grout, plaster, and castings.

33 5. "Inlet, (Type)", per each

34 The Bid Item price for "Inlet, (Type)" includes all costs for the work required to furnish and install the inlet including
 35 excavation, haul, stockpile and or disposal of soil, backfill and compaction, brick, block, mortar, grout, and castings.

36 6. "Junction Box, (Type)", per each

37 The Bid Item price for "Junction Box, (Type)" includes all cost for the work required to furnish and install the junction box
 38 complete to finish grade including but not limited to excavation, mortar, grout, brick, block, castings, haul, stockpile and or
 39 disposal of soil, backfill and compaction with suitable native material.

40 7. "Bridge Drain", per each

41 The Bid Item price for "Bridge Drain" includes all costs for the work required to furnish and install drain, including outlet
 42 pipe through the bridge deck, reducer, if needed, and grate to structure complete. All costs in connection with maintaining and
 43 cleaning of bridge drains is considered incidental to the construction of the bridge drain.

44 8. "Rebuild (Item)", per each

45 The Bid Item price for "Rebuild (Item)" includes all costs for the work required, including the new casting, to completely
 46 rebuild the existing item to finished street grade as specified in Sections 7-05.3(1)Q or 7-05.3(2)F as applicable.

47 9. "Relocate (Item)", per each

48 The Bid Item price for "Relocate (Item)" includes all costs for the work required to relocate the catch basin or inlet
 49 including furnishing and installing new outlet trap, excavation, haul, stockpile and or disposal of soil, backfill and compaction
 50 with native Material, adjustment brick and blocks, mortar, non-shrink grout, plaster and castings as specified in Section 7-
 51 05.3(2)E.

52 10. Other payment information

53 When Mineral Aggregate Type 17, or other mineral aggregate type designated by the Engineer, is used as backfill,
 54 payment will be as specified in Section 1-09.4.

55 Payment for "Extra Excavation", will be as specified in Section 2-04.5.

56 Foundation Material will be paid as "Mineral Aggregate, (Type)", as specified in Section 4-01.5.

1 When it is determined by the Engineer that the existing foundation is unsuitable and where foundation Material is not
2 specified in the Contract and no Bid Item for "Mineral Aggregate, (Type)" of the type required by the Engineer is included in the
3 Bid Form, payment will be made as specified in Section 1-04.1(2).

4 Final adjustment of the casting for new construction of maintenance hole, catch basin, and inlet is considered incidental
5 to and included in the Bid Item price for the maintenance hole, catch basin, and inlet.

6 Payment for protective systems, when applicable, will be as specified in Section 2-07.5.

7 **SECTION 7-06 RESERVED**

8 **SECTION 7-07 CLEANING EXISTING DRAINAGE STRUCTURES**

9 **7-07.1 DESCRIPTION**

10 Section 7-07 describes Work consisting of cleaning and removing all debris and obstructions from existing Culvert pipes,
11 sanitary Sewer pipes, combined Sewer pipes, drains, inlet Structures, maintenance holes, box culverts, grates, trash racks, or
12 other drainage features in conjunction with the Work within the Project Site.

13 **7-07.2 RESERVED**

14 **7-07.3 CONSTRUCTION REQUIREMENTS**

15 Existing drainage facilities connecting to new work must be cleaned as a first order of Work to enhance drainage off and
16 through the Project Site. These facilities must be kept clean up to the Physical Completion Date.

17 Clean all existing pipes and drainage Structures connecting to new work by flushing, or by rodding, or by such manner as
18 may be necessary as approved by the Engineer to provide unobstructed drainage. All catch basin sumps, maintenance holes,
19 inlet and outlet Structures, and debris racks must also be freed of all dirt, rock, and debris.

20 **7-07.4 MEASUREMENT**

21 Work described in Section 7-07 will not be measured for payment.

22 **7-07.5 PAYMENT**

23 All work described in Section 7-07 is considered incidental to the various Bid Items comprising the Work.

24 **SECTION 7-08 MISCELLANEOUS PIPE CONNECTIONS**

25 **7-08.1 DESCRIPTION**

26 Section 7-08 describes Work consisting of excavation, foundation preparation, bedding, backfilling and compacting for
27 the construction of miscellaneous Sewer and drain pipe connections except those described in Section 7-01, Section 7-17,
28 and Section 7-18.

29 **7-08.2 MATERIALS**

30 Materials must comply with the requirements in Section 9-04 and Section 9-05.

31 **7-08.3 CONSTRUCTION REQUIREMENTS**

32 **7-08.3(1) EXCAVATION, FOUNDATION PREPARATION, BEDDING, AND BACKFILL**

33 Work in trench excavations over 4 feet deep is subject to the provisions of Section 2-07.

34 Trench excavation, backfill, and compaction is specified in Section 2-04, Section 2-10, and Section 2-11.

35 **7-08.3(2) CONNECTIONS TO EXISTING SANITARY SEWERS**

36 When making a connection to an existing Sewer line or maintenance hole, excavate and expose the existing facility
37 where shown on the Drawings. In the event there is no existing tee or wye, refer to Section 7-17.3(2)C3. See Section 7-
38 05.3(1)O for connections to existing maintenance holes.

39 **7-08.3(3) PIPE INSTALLING, JOINTING, AND TESTING**

40 Pipe installing, bedding, jointing, and pipe connections must conform to the applicable requirements of Section 7-17.

41 **7-08.3(4) CATCH BASIN CONNECTIONS**

42 Catch basin connections are pipe lines connecting outlets of catch basins to a Storm Drain or other facility. Install catch
43 basin connections up-grade from Storm Drain or other originations. Catch basin connection slopes must be at least 2 percent
44 but less than 50 percent within 1 foot of the catch basin, nor more than 100 percent.

45 Alignment must be as shown on Standard Plan 261. Type 240A, 240B, and 241 catch basin connections must be straight
46 with the exception of maintaining clearances as specified in Section 1-07.17(2), or to meet the slope requirement of not more

1 than 50 percent within 1 foot of the catch basin. Type 240C, 240D, 242A, and 242B catch basin connections must be aligned
2 so that the outlet is at the narrow end and directly below the frame opening to allow for tool insertion.

3 Maximum bends are 22.5 degrees. Between each bend, install a minimum 1 foot section of straight pipe, or an equivalent
4 manufactured sweep.

5 When the catch basin connection Material is ductile iron pipe and is connecting to a mainline by core tap and an inserted
6 tee, connection must include a 1 foot long plain end by plain end section of ductile iron pipe inserted into the bell end of the tee
7 manufactured to accept ductile iron pipe. Connect the 1 foot section to the upstream pipe using a flexible gasketed coupling
8 with stainless steel shielding as specified in Section 9-05.18.

9 Do not connect to the catch basin outlet pipe until the excavation around the catch basin has been backfilled and
10 compacted to an elevation which provides support for pipe bedding and the connection pipe. Bedding for catch basin
11 connection pipe must be Class B bedding.

12 Furnish and install a new outlet trap to the new outlet of the existing catch basin. See Section 7-05.3(2)B for outlet trap
13 location and catch basin pipe connection requirements.

14 Television inspections in conformance with Section 7-17 are required for catch basin connections.

15 **7-08.3(5) INLET CONNECTIONS**

16 Inlet connections are pipe connections from drainage inlets to catch basins or other approved outlets. Install inlet
17 connections up-grade from catch basin openings or other originations. Inlet connection slopes must be at least 5 percent but
18 less than 50 percent.

19 Where a straight alignment or a uniform slope is not possible and curves are necessary, change the alignment either by
20 deflecting each pipe into a smooth curve, or with fittings.

21 When using deflection, submit the manufacturer's pipe joint deflection criteria to the Engineer for approval. Such
22 deflection must be water tight and allow rodding the pipe in a relatively easy manner. Under no circumstances will deflection or
23 change of direction be allowed by cutting or trimming the end of the pipe on a bias or an angle. All pipe ends must be normal
24 angle.

25 When using fittings, maximum bends are 22.5 degrees. Between each bend, install a minimum 1 foot section of straight
26 pipe , or an equivalent manufactured sweep.

27 Do not connect to the catch basin or other approved outlet until the excavation around the catch basin has been
28 backfilled and compacted to an elevation which provides support for pipe bedding and the inlet connection pipe. Bedding for
29 inlet connection pipe must be Class B bedding.

30 See Section 7-05.3(2)B for inlet pipe connection requirements.

31 **7-08.3(6) DROP CONNECTIONS**

32 Inside and outside drop connections to allow for abrupt drop in elevation of the inflow must be constructed as shown on
33 Standard Plan 233a and 233b, and at locations shown on the Drawings. The invert elevation of the outside drop connection
34 are shown on the Drawings. The crown elevation of the inside drop connection must match the crown elevation of the
35 maintenance hole outlet pipe.

36 **7-08.3(7) VERTICAL CONNECTIONS**

37 Vertical connections must be constructed per Standard Plan 234, and at locations shown on the Drawings.

38 **7-08.3(8) DETENTION PIPE OUTLET CONNECTIONS**

39 Detention pipe outlet connections must be constructed as shown on the Drawings. Install pipe up-grade from Storm Drain
40 or other originations. When connection is to an existing maintenance hole on the mainline, rechannel the maintenance hole.
41 Where a straight alignment and uniform slope is not feasible, changes to the alignment can be made using fittings with written
42 acceptance from the Engineer. Maximum bends are 22.5 degrees. Between each bend, install a minimum 1 foot section of
43 straight pipe , or an equivalent manufactured sweep.

44 Do not connect to the flow control structure until the excavation around the flow control structure has been backfilled and
45 compacted to an elevation which provides support for pipe bedding and the detention pipe outlet connection pipe. Bedding for
46 detention pipe outlet connection must be Class B bedding.

47 **7-08.3(9) BRIDGE DOWNSPOUTS**

48 The Contractor furnish and install standard weight steel pipe or ductile iron pipe bridge downspouts, whichever is shown
49 on the Drawings. Inside diameter must be 6-inch minimum.

50 The bridge downspout must be full length pipe section in all straight runs. The Contractor may propose types of couplings
51 and fittings except grooved couplings and fittings, provided they are equal performance and are included in the submittal
52 specified in the last paragraph of this Section.

53 Drain pipe encased in concrete must be fully encased in a sponge rubber compound 1/2 inch thick and meeting the
54 requirements of ASTM D 1752, Type No. 1. The color requirement is waived.

1 All pipe bends, whether encased in concrete or not and whether they are fittings or bent steel pipe, must have a bend
2 radius of at least 4 feet. All straight run pipe must have a minimum slope of 10 percent.

3 Verify all downspout lengths by field measurements before fabrication and determine the exact lengths of pipe and
4 hangers required for each bridge downspout.

5 Install pipe hangers per the Manufacturer's written direction.

6 When the Contract requires clean outs, they must be of the size and type specified, and be installed as shown on the
7 Drawings.

8 The Contractor must submit to the Engineer at least 5 Working Days in advance of delivering the bridge downspout to
9 the site, a combined Shop Drawing of the bridge downspout and bridge drain per Section 7-05.3(4) and connection details.
10 Shop Drawings must show each downspout pipe layout including size of pipe and fittings; spacing and type of pipe hangers;
11 manufacturer's directions on hanger installation; concrete inserts; radius of bends; and details of pipe connections to receiving
12 pipe or drainage structure, cleanouts, slopes of straight run pipe, and bridge drain.

13 **7-08.4 MEASUREMENT**

14 Measurement for "Pipe, Catch Basin Connection, (Material), (Class), (Size)" will be by the linear foot of pipe installed
15 between the tee or wye in the receiving Sewer and the inside face of the catch basin.

16 Measurement for "Pipe, Inlet Connection, (Material) (Class), (Size)" will be by the linear foot of pipe installed between the
17 inside face of the inlet, and the inside face of the catch basin.

18 Measurement for "Drop Connection, Outside, (Size)" will be by the vertical foot from the invert of the bend connection at
19 the maintenance hole, to the invert at the upstream end of the tee as shown on Standard Plan 233a.

20 Measurement for "Drop Connection, Inside, (Size)" will be by the vertical foot from surface grade to the crown elevation
21 at the end of the pipe elbow in the maintenance hole as shown on Standard Plan 233b.

22 Measurement for "Vertical Connection, (Size)" will be from surface grade to the crown elevation of the connecting pipe.

23 Measurement for "Pipe, Detention Pipe Outlet Connection, (Material), (Class), (Size)" when the pipe is an outlet pipe
24 from a flow control Structure will be measured from the inside wall of the flow control Structure to either the inside face of a
25 maintenance hole or to tee.

26 Measurement for "Bridge Downspout, (Material), (Class), and (Size)" will be by the linear foot along the center line of the
27 pipe through fittings.

28 **7-08.5 PAYMENT**

29 1. "Pipe, Catch Basin Connection, (Material), (Class), (Size)", per linear foot

30 2. "Pipe, Inlet Connection, (Material), (Class), (Size)", per linear foot

31 The Bid Item prices for "Pipe, Catch Basin Connection, (Material), (Class), (Size)" and for "Pipe, Inlet Connection,
32 (Material), (Class), (Size)" include all costs for the work required to furnish and install the pipe, including connections to catch
33 basins or inlets, excavation, haul, stockpile and or disposal of soil, backfill, and compaction.

34 3. "Drop Connection, (Type), (Size)", per vertical foot

35 The Bid Item price for "Drop Connection, (Size)" includes all costs for the work required to furnish and install the
36 complete inside or outside drop connection as shown on Standard Plan 233a and 233b.

37 4. "Vertical Connection, (Size)", per vertical foot

38 The Bid Item price for "Vertical Connection, (Size)" includes all costs for the work necessary to furnish and install the
39 vertical connection as shown on Standard Plan 234.

40 5. "Pipe, Detention Pipe Outlet Connection, (Material), (Class), (Size)", per linear foot

41 The Bid Item prices for "Pipe, Detention Pipe Outlet Connection, (Material), (Class), (Size)" include all costs for the work
42 required to furnish and install the pipe, including connections to existing maintenance holes, pipe, and flow control Structures,
43 excavation, haul, stockpile and or disposal of soil, backfill, and compaction.

44 6. "Bridge Downspout, (Material), (Class), (Size)", per linear foot

45 The Bid Item price for "Bridge Downspout, (Material), (Class), (Size)" includes all costs for the work required to furnish
46 and installing bridge downspouts, including field measurement and adjustment, galvanizing where required, and other items
47 necessary to make a complete construction as specified.

48 7. **Other payment information**

49 The cost for furnishing and installing new outlet trap when installing catch basin connection pipe to existing catch basin
50 will be included in the Bid Item price for "Pipe, Catch Basin Connection, (Material), (Class), (Size)".

51 Payment for bedding will be as specified in Section 7-17.5.

52 Payment for television inspection will be as specified in Section 7-17.5.

53 Payment for protective systems, when applicable, will be as specified in Section 2-07.5.

54 Payment for CDF bedding will be as specified in Section 7-17.5.

1 **SECTION 7-09 RESERVED**2 **SECTION 7-10 RESERVED**3 **SECTION 7-11 PIPE INSTALLATION FOR WATER MAINS**4 **7-11.1 DESCRIPTION**

5 Section 7-11 describes Work consisting of installing Water Main pipe per the manufacturer's printed specifications and
6 instructions and with the AWWA standards for installing the type of pipe proposed.

7 Join pipe sections so as not to damage the lining or coating. The method of pulling or jacking the pipe home must allow
8 for both vertical and horizontal movement of the pipe for protection of the gasket.

9 Do not proceed with Water Main installation until line and grade hubs have been set and measurements for connection
10 fittings have been made as specified in Section 7-11.3(4).

11 Maintain clearances between Water Mains and other utilities as specified in Section 1-07.17(2).

12 Install water distribution main, water transmission main, water services, and fire hydrant and connection pipe at least 5
13 feet clear of any tree measured horizontally from the edge of the vault/pipe to a vertical plane projected down from the tree's
14 outer bark surface at ground level.

15 Provide and maintain clear access to fire hydrants, water valves, water meters, water vaults, and related water Structures
16 at all times unless the Contract specifies otherwise.

17 This Work includes excavation, backfilling, and compaction as specified in Section 2-04, Section 2-10, and Section 2-11.

18 Work in excavations over 4 feet deep must comply with Section 2-07.

19 **7-11.2 MATERIALS**20 **7-11.2(1) GENERAL**

21 Materials must comply with the requirements of the following Sections:
22

| Material | Section |
|--|-----------------|
| Pipe and Pipe Coatings | Section 9-30.1 |
| Fittings | Section 9-30.2 |
| Valves, Valve Boxes, and Valve Chambers | Section 9-30.3 |
| Hydrants | Section 9-30.4 |
| Service Connections and Service Pipe or Tubing | Section 9-30.5 |
| Bedding, Foundation Material and Gravel | Section 9-30.6 |
| Joint Bond Cable | Section 9-30.7 |
| Thermite Weld Materials | Section 9-30.8 |
| Electrolysis Test Station | Section 9-30.9 |
| Turbine Meters (sizes 2" – 12") | Section 9-30.10 |
| Locating Wire | Section 9-30.11 |
| Coating for Bolts and Shackle Rods | Section 9-30.12 |
| Backflow Prevention Assemblies | Section 9-30.13 |
| Mineral Aggregates | Section 9-03 |

23
24 Materials listed are not considered equal or generally interchangeable for all applications. The Engineer will determine
25 from the Materials listed, those that are suitable for the project and will so specify in the Contract.

26 The Engineer must have free access to all testing and records pertaining to Materials to be delivered to the site. The
27 Engineer may elect to be present at any or all Material testing operations.

28 **7-11.2(2) PRE-INSTALLATION TASTE AND ODOR RATING TEST**

29 All Water Main manufactured of any material and all Water Main lining material must:

- 30 1. Satisfactorily pass an Engineer conducted SPU taste and odor rating test; or
- 31 2. Be a product of a Materialperson pre-approved by the Engineer per SPU's taste and odor rating test program.

32 The Contractor must allow for taste and odor rating testing as follows:
33

| Material | Time for Testing and Reporting Results |
|----------------------------|--|
| Water Main | Up To 30 Working Days |
| Water Main Lining Material | Up to 30 Working Days |

1 NOTE: This time can be reduced to as little as 10 Working Days if:

- 2 1. A test on a section of pipe, either with or without lining Material, can be done as a bench scale test and not by a full
- 3 scale test with a pipe manifold; and
- 4 2. A retest is not required.

5
6 Time for testing and reporting results is based on the day the Material is received by the Engineer to the day the results
7 are available to the Engineer.

8 Water Main pipe Material will be sampled for testing at the rate of 1 for each lot of 100 or fewer, for each diameter size
9 pipe.

10 Water Main lining Material will be sampled for testing.

11 No taste and odor rating test will be required for service connection pipe.

12 A list of Materialpersons with taste and odor rating test Program pre-approved Water Main and Water Main lining material
13 can be obtained by contacting (206) 684-7834.

14 Materialpersons can obtain cost information on the taste and odor rating test Program pre-approval process for Water
15 Main and Water Main lining material by contacting (206) 684-7834.

16 **7-11.2(3) POST INSTALLATION TASTE AND ODOR RATING TESTS**

17 The Engineer may perform post installation taste and odor rating tests on any portion of the Work before or after
18 connection to existing Water Main. Such retesting may be performed as part of bacteriological sampling and testing during
19 flushing and testing specified in Sections 7-11.3(12)J and 7-11.3(12)K, and may include sampling and testing of mortar and
20 lining materials. Post-installation taste and odor rating testing requires a minimum 48 hours contact time in the Water Main
21 assembly under test. Depending on the extent of the testing required, results will be made available in 15 Working Days or
22 fewer.

23 If results of additional taste and odor rating tests are determined unacceptable, make timely correction as determined by
24 the Engineer.

25 Failure of the system or portion of the system to pass the taste and odor rating test will result in the rejection of all new
26 Water Main under test.

27 **7-11.3 CONSTRUCTION REQUIREMENTS**

28 **7-11.3(1) TRENCH DEWATERING, EMBANKMENT FILL AND PIPE BEDDING**

29 **7-11.3(1)A DEWATERING OF TRENCH**

30 In addition to the requirements of Section 2-08, where water is encountered in the trench, remove the water during pipe
31 installation operations and maintain trench dewatering until the ends of the pipe are sealed and provisions are made to prevent
32 floating of the pipe. Trench water or other deleterious materials must not enter the pipe at any time.

33 **7-11.3(1)B INSTALLING PIPE IN EMBANKMENT FILL**

34 Where the Drawings show pipe is to be installed above existing ground surface, make and compact an embankment fill
35 as shown on the Drawings, and excavate the Water Main trench therein. Compact that portion of the embankment below the
36 bottom of the pipe with rollers or mechanical compactors under controlled moisture conditions as specified in Method B of
37 Section 2-11.3(1).

38 **7-11.3(1)C BEDDING RIGID PIPE**

39 **7-11.3(1)C1 GENERAL**

40 All distribution Water Main must have Class B bedding with either of Mineral Aggregates Type 6 or Type 7. All
41 transmission Water Main must have Class B bedding with Mineral Aggregate Type 9. See Standard Plan 350.

42 All classes of bedding must provide uniform support along the entire pipe barrel, without load concentrations at pipe bells
43 and fittings.

44 Prevent damage to the pipe, to any protective coating, and to any electrolysis monitoring system.

45 **7-11.3(1)C2 BEDDING FOR POLYETHYLENE ENCASED, MULTI-LAYERED POLYETHYLENE TAPE COATING,
46 THERMOPLASTIC POWDER COATED, OR SPECIAL COATED PIPE**

47 Class B bedding Material for specially protected or coated pipe must be Mineral Aggregate either Type 6 or Type 7 as
48 specified in Section 9-03. Class B bedding consisting of Mineral Aggregate Type 6 or Type 7 must be compacted by tamping.

49 Bedding of specially protected pipe must prevent damage to the protective coating or wrap.

1 Placing of Class B bedding around wrapped, coated, or specially protected pipe must prevent damage to the protective
2 coating or wrap. The Contractor is solely responsible for repairing any damage to the special protection, coating, or wrap,
3 including all costs of repair.

4 **7-11.3(1)C3 SAND BEDDING AT TRENCH CROSSINGS**

5 See Standard Plan 350 for protective sand bedding requirements. When trenching exposes the metal pipe, protect the
6 pipe from exposure to cementitious materials placed in the trench by:

- 7 1. After excavation, wrapping the existing metal pipe in 8 mil polyethylene wrap.
- 8 2. Bringing controlled density fill or fluidized thermal backfill, as required in the Contract, to an elevation 1 foot below the
9 existing metal pipe.
- 10 3. Bedding the exposed pipe in 1 foot, bottom, sides and above, as specified in Section 7-11.3(1)C1. Bedding Material
11 must be Mineral Aggregates Type 6 or Type 7, or sand approved by Seattle City Light for heat dispersion if required
12 in the Contract.
- 13 4. Backfilling above as specified in the Contract.

14 **7-11.3(1)D BEDDING FLEXIBLE PIPE**

15 Bedding for flexible pipe, when flexible pipe is permitted for use, must be Class B with Mineral Aggregate Type 22 placed
16 in lifts as shown on Standard Plan 350. Use care in installing flexible pipe to prevent vertical pipe deflection.

17 The first bedding lift thickness must be placed, spread, and compacted across the width and length of the trench bottom
18 at the required grade to support the pipe, allowing for pipe bells and any other fitting. Install pipe and place and compact the
19 next lift of bedding Material evenly along both sides of the pipe up to the crown. Do not displace the pipe from its set line and
20 grade. Once the bedding is completed to the crown of the pipe, and the pipe shows no visible misalignment, place the final
21 bedding lift over the pipe.

22 **7-11.3(2) HANDLING OF PIPE**

23 **7-11.3(2)A GENERAL**

24 All types of pipe must be handled in a manner that prevents damage to the pipe and pipe lining or coating. Load and
25 unload pipe and fittings using hoists and slings as to avoid shock or damage. Pipe and fittings must not be dropped, skidded,
26 or rolled against other pipe. Damaged pipe will be rejected, and the Contractor must immediately place all damaged pipe apart
27 from the undamaged pipe and remove the damaged pipe from the Project Site within 24 hours.

28 Protect threaded pipe ends using couplings or other means until the pipe is installed.

29 Inspect the pipe and fittings for defects.

30 Ductile iron and cast iron pipe, while suspended above grade, must be rung with a light hammer to detect cracks.
31 Prevent dirt or other foreign material from entering the pipe or pipe joint during handling or installing operations. Any pipe or
32 fitting installed with dirt or foreign material in it must be removed, cleaned, and reinstalled. Use a clean whisk broom for this
33 purpose and for brushing to remove foreign matter before joining pipe ends. When pipe installation is not in progress, close the
34 open ends of the pipe with a water tight plug or other approved means to ensure cleanliness inside the pipe.

35 Stack pipe in a way that prevents damage to the pipe, prevents dirt and debris from entering the pipe, and prevents any
36 movement of the pipe. Keep the bottom tiers of the stack off the ground on timbers, rails, or similar supports. Alternate pipe on
37 succeeding tiers by bell and plain end. Place timbers 4" x 4" in size between tiers and place chocks at each end to prevent
38 movement. Stack each size of pipe separately.

39 **7-11.3(2)B HANDLING SPECIAL COATED PIPE**

40 Handling and shipping of enameled or multilayered polyethylene tape coated or thermoplastic powder coated ductile iron
41 pipe while being transported and in the field must be per AWWA C214, and as specified.

42 Always handle pipe with equipment such as stout wide canvas slings and wide padded skids designed to prevent
43 damage to the coating. Bare cables, chains, hooks, metal bars, or narrow skids are not permitted to come in contact with pipe
44 lining or coating. When shipped by rail, all pipe must be carefully loaded on properly padded saddles not less than 12 inches
45 wide. Separate pipe sections so that they do not bear against each other and securely fasten the whole load together and to
46 the cars to prevent movement in transit.

47 In truck shipments, support the pipe in wide cradles of suitable padded timbers hollowed out on the supporting surface to
48 fit the curvature of pipe. All chains, cables, or other equipment used for fastening the load must be carefully padded.

49 The Engineer will inspect the pipe and coating after delivery to the Project Site before installation by the Contractor. Allow
50 for inspection of the coating on the underside of the pipe while suspended from the sling before the pipe is lowered into the
51 trench.

52 Support pipe stored along the trench side with padded wooden timbers placed under the pipe to hold the pipe off the
53 ground, or by other acceptable means not damaging to the pipe and pipe coating.

54 Repair of multi layered polyethylene tape coating must be per AWWA C214 and Section 7-11.3(6)C. Repair of
55 thermoplastic powder coated pipe must be per manufacturer's written instructions. The Contractor must submit the
56 manufacturer's recommendations for thermoplastic coating repair at least 3 Working Days in advance of the scheduled repair.

1 7-11.3(3) CUTTING PIPE

2 Whenever it becomes necessary to cut a length of pipe, make the cut using an abrasive saw or a special pipe cutter. All
3 pipe ends must be square with the longitudinal axis of the pipe. The outside of slip joint pipes must be beveled and smoothed
4 so that good connections can be made without damage to the gasket. Threads must be cleanly cut. Torch cutting of ductile
5 iron pipe is not allowed.

6 Cut restrained joint pipe per the pipe manufacturer's recommendations. The Contractor must submit at least 3 Working
7 Days in advance the pipe manufacturer's recommendation for cutting restrained joint pipe, including a manufacturer's
8 certificate of compliance stating the cutting process does not adversely impact the pipe material or integrity of the joint.

9 7-11.3(4) GRADE AND ALIGNMENT**10 7-11.3(4)A GENERAL**

11 Trenches for pipe must be opened per the lines and grades shown on the Drawings, and to a depth that maintains the
12 minimum required depth of cover unless specified otherwise in the Contract.

13 The grade and alignment must be taken from points established by the Engineer.

14 7-11.3(4)B VERIFICATION OF LOCATION

15 After marking underground facilities as specified in Sections 1-07.17(1) and before any pavement cutting or removal or
16 excavation for pipe installation, verify in the presence of the Engineer the locations of existing Water Mains. Arrange to
17 establish Water Main depths at points where connections will be made. After excavation, verify the dimensions, type,
18 condition, and roundness (16-inch diameter and larger) of the exposed Water Main. The excavation for pipes 16 inches and
19 larger in diameter must provide access all around the pipe for measurement of the outside diameter by the Engineer. Should a
20 condition be discovered that materially differs from that specified in the Contract, immediately notify the Engineer. When
21 necessary, adjust the profile as directed to prevent abrupt changes in grade and alignment of Water Main and connection.

22 7-11.3(4)C MINIMUM DEPTH OF COVER

23 The depth of trenching for distribution Water Mains must provide a minimum depth of cover as indicated on Standard
24 Plan 030. The depth of trenching for transmission Water Main must provide the minimum depth of cover as specified in the
25 Contract. Where profile of Water Main and ground surface is shown on the Drawings, install the Water Main to the elevation
26 shown on the Drawings, regardless of depth of cover for distribution Water Main indicated on Standard Plan 030. Deeper
27 excavation may be required due to localized breaks in grade or due to installing the new distribution Water Main under existing
28 underground facilities. Excavate to such depth that the cover over the valve operating nut is at least 1 foot.

29 7-11.3(4)D INSTALLING PIPE ON CURVES

30 On long radius curves, either horizontal or vertical, pipe may be installed with standard pipe by deflecting the joints. If the
31 pipe is shown curved on the Drawings and no special fittings are shown, the Contractor can assume that the curves can be
32 made by deflecting the joints with standard lengths of pipe. If shorter lengths are required, the Drawings will indicate maximum
33 lengths that can be used. The amount of deflection at each pipe joint when pipe is installed on a horizontal or vertical curve
34 must not exceed 50 percent of the manufacturer's printed recommended deflections. Submit to the Engineer the pipe
35 manufacturer's joint deflection recommendations indicating deflections are within allowable AWWA specification tolerances
36 before pipe installation.

37 Where field conditions require deflection or curves not anticipated on the Drawings, the Engineer will determine the
38 methods to be used.

39 When rubber gasketed pipe is installed on a curve, the pipe must be jointed in a straight alignment and then deflected to
40 the curved alignment. Widen trenches on curves for this purpose.

41 Where pipe installation on curves requires the use of special fittings, use concrete blocking per Section 7-11.3(13).

42 Where restrained joint pipe is installed on a curve, submit the pipe manufacturer's recommendations to the Engineer for
43 approval.

44 7-11.3(5) CLEANING AND ASSEMBLING JOINTS

45 All parts of the pipe ends, couplings, fittings, and appurtenances must be cleaned to remove oil, grit, or other foreign
46 matter from the joint, taking care to keep the joint from contacting the ground.

47 Pipe not furnished with a depth mark must be marked before assembly to ensure visual observation of the Work.

48 7-11.3(6) INSTALLING AND JOINTING PIPE**49 7-11.3(6)A INSTALLING AND JOINTING DUCTILE IRON PIPE AND APPURTENANCES**

50 The installation of ductile iron pipe and appurtenances must be per AWWA C600.

51 Except where restrained joint systems are required, mechanical or slip joints may be used.

1 7-11.3(6)B INSTALLING AND JOINTING POLYETHYLENE ENCASED (FILM WRAPPED) PIPE

2 Install pipe with polyethylene (film wrap) encasement per AWWA C105. The method used for encasing the pipe must be
3 approved by the Engineer. The Contractor is solely responsible for repairing all damage to the polyethylene encasement,
4 including all costs of repair. Bedding, backfill, and compaction is specified in Section 7-10.3(9), Section 2-10, and Section 2-
5 11.

6 7-11.3(6)C INSTALLING AND JOINTING MULTI LAYERED POLYETHYLENE TAPE COATED PIPE

7 Hoist pipe from the trench side into the trench using a wide canvas or leather sling. Use of chains, cables, tongs, or other
8 equipment likely to cause damage to the lining or to the coating of the pipe is not permitted. Dragging or skidding the pipe is
9 not permitted. The Contractor must allow inspection of the coated pipe while suspended from the sling, and must repair any
10 damage to the coating to the specified requirements before the pipe is lowered into the trench. Follow bedding, backfill and
11 compaction as specified in Sections 7-11.3(1)C, Section 2-10, and Section 2-11.

12 At all times during construction of the Water Main, prevent damage to the protective coating on the pipe. Do not permit
13 metal tools or heavy objects to come in contact with the finished coating. Workers are permitted to walk on the coating only
14 when necessary, and must wear shoes with rubber or composition soles and heels when walking on the coating. This applies
15 to all surfaces whether bare, primed, or coated. The Contractor is solely responsible for repairing any damage to the protective
16 coating from any cause, before final acceptance of the Water Main, including all costs of repair.

17 Cutbacks on the spigot end must be 6 inches or less and made with a cutting device that is guided from the end of the
18 pipe to ensure a straight, uniform cutback. Do not make cutbacks on the bell end of the pipe.

19 Following the application of the outerwrap, electrically test the coating for holidays using a pulse tape holiday detector.
20 The detector voltage range for this coating is 7000 to 9800 volts. The testing must conform to NACE RP 02 74.

21 All holidays detected in the field must be repaired by removing the outerwrap and primary coating from the damaged
22 area, cleaning the exposed surfaces thoroughly and applying a suitable primer and tape to the exposed area as specified by
23 the manufacturer. If required by the Engineer, the repaired area must be outerwrapped after patching.

24 If the outerwrap is damaged and a holiday is not found in this area, repair the damaged outerwrap area by applying a
25 patch as recommended by the manufacturer and approved by the Engineer.

26 If the outerwrap is damaged and a holiday is found, remove the damaged outerwrap taking care not to damage the inner
27 coating. Before new outerwrap is placed, apply a holiday detector to the exposed innerwrap to determine if it has been
28 damaged during removal of the outerwrap. Install the outerwrap as recommended by the manufacturer and approved by the
29 Engineer.

30 After electrical bonds are installed and tested, protect the entire pipe joint and electrical bond strap with a heat shrink
31 joint sleeve as specified in Section 9-30.1(4)E.

32 7-11.3(6)D INSTALLING RESTRAINED JOINT PIPE

33 Install restrained joint Water Main as shown on the Drawings and the lay plan. Submit a Water Main lay plan and the
34 manufacturer's recommendations to the Engineer at least 20 Working Days before pipe installation. This includes all
35 equipment necessary to complete the Work.

36 Fully extend the restrained joint Water Main by pulling on the joint after the installation of the pipe segments as
37 recommended by the manufacturer of the restrained joint pipe, unless stated otherwise in the Drawings or Specifications.
38 When newly installed Water Main is pressurized, bending or buckling is not allowed.

39 Where adjustment of the Water Main line and grade is required to avoid existing or planned facilities, mechanically
40 jointed fittings may be used with Wedge Restraint Glands to make the needed changes. All Wedge Restraint Glands must be
41 wax tape encased as specified in Section 9-30.2(4). Submit change requests to the Engineer for approval before installation.

42 7-11.3(7) INSTALLING STEEL PIPE**43 7-11.3(7)A THREADED STEEL PIPE LESS THAN 4 INCHES IN DIAMETER**

44 Connect steel pipe in sizes up to and including 3-1/2 inches with malleable iron screwed couplings. Couplings must be
45 galvanized. Use unions or flanges at all equipment and valves. Cut ends must be reamed and threads cleanly cut. Brush coat
46 exposed threads, after jointing, with an asphalt varnish, Royston Roskote Mastic R28 or approved equal. In wet conditions,
47 use 3-component wax tape wrap consisting of primer, wax tape, and fiberglass overwrap per Section 7-11.3(8)A.

48 7-11.3(7)B COUPLED PIPE 4 INCHES IN DIAMETER AND LARGER

49 Steel pipe 4 inches and larger for use in underground services must be coupled as specified in the Contract.

50 Any welding of steel pipe must be per AWWA C206.

51 Before assembly, thoroughly clean bell and spigot joints and brush a lubricant suitable for potable water meeting the
52 approval of NSF on the inside of the bell.

1 7-11.3(7)C STEEL CASING PIPE**2 7-11.3(7)C1 GENERAL**

3 Where shown on the Drawings, install steel casing pipe for the Water Main. Where trenchless construction is shown on
4 the Drawings, see Section 7-17.3(2)H for installation Specifications, and if by directional drilling, see Section 2-16.

5 All joints must be welded by operators who are qualified by testing as prescribed by the AWS in Standard Qualifications
6 Procedure and are certified to perform the type of work required. The quality of welding must conform to the current edition
7 AWS D1.1 Structural Welding Code, Section 3, Workmanship.

8 7-11.3(7)C2 SEALS AND SPACERS BETWEEN CASING AND WATER MAIN

9 Casing end seals must comply with the requirements of Section 9-30.2(12)A, completely seal the annular space at each
10 end of the casing pipe, and be installed per the manufacturer's instruction.

11 Casing spacers must electrically isolate the outer casing pipe from the inserted Water Main. The spacers (also known as
12 casing insulators, crossing insulators, and casing isolators) must comply with the requirements of Section 9-30.2(12)B. There
13 must be a minimum of 2 spacers per length of pipe, and the spacing between any 2 spacers must not exceed 10 feet. For 4
14 inch through 12 inch diameter pipe, each spacer must have at least 4 runners. For 14 inch through 36 inch diameter pipe,
15 each spacer must have at least 6 runners. At least 2 runners must be located on the upper half of the spacer for all diameter
16 Water Main. At least 2 runners must be located on the lower half of the spacer for 4 inch through 12 inch diameter Water Main,
17 and at least 4 runners must be located on the lower half of the spacer for 14 inch through 36 inch diameter Water Main. Actual
18 locations of runners on the spacer per the manufacturer's recommendations. Casing spacers must be installed first on the
19 Water Main and then the Water Main inserted in the casing pipe must be per the manufacturer's instructions.

20 Submit the spacer and end seal manufacturer's catalog cuts and installation instruction to the Engineer at least 5
21 Working Days in advance of this work.

22 7-11.3(8) FIELD APPLIED COATINGS**23 7-11.3(8)A WAX TAPE COATING**

24 Wax tape coating, see Section 9-30.1(4)F, must be field applied to Water Main including pipe, fittings, valves, couplings,
25 bolts, flanges, shackle rods, other appurtenances, and as specified in the Contract.

26 Preparation for wax tape coating:

- 27 1. On Water Main without a coating, clean the surfaces with wire brush, cleaning products, duct tape dust and particle
28 pickers, and similar means and Supplies to remove all rust, dirt, oil, and other deleterious material. Use sandblasting
29 methods if necessary for stubborn rust and other deleterious coating removal. The surface must be dry, have no
30 loose particles of any kind, and be in a prepared condition as recommended by the wax tape Supplier.
- 31 2. On Water Main with a coating, clean the surfaces with Supplies and means that do not injure or harm the existing
32 coating and produce a prepared surface as recommended by the wax tape Supplier. Water Main with existing coating
33 and type of coating will be identified in the Contract.

34 Coverage by wax tape coating must have full contact with all Water Main Material and no voids. Where voids, or gaps, or
35 irregular surfaces and transitions in the Water Main exist, apply joint filler compatible with the wax tape coating product as
36 recommended by the wax tape Supplier. Wax tape coating must be complete before outerwrapping.

37 Extend coverage to a minimum 1 pipe diameter length beyond the wax tape limits specified in the Contract, up to 18
38 inches.

39 Coverage thickness must be a minimum 70 mil. Spiral wraps must overlap by 1 inch and the ends of the wax tape
40 circumferential segments overlap 6 inches.

41 Wax tape application on prepared surfaces includes:

- 42 a. Initial coating with a petroleum primer,
- 43 b. Wrapping with wax tape, and
- 44 c. Outer wrapping with fiberglass mesh.

45 All products in the wax tape application must be compatible with each other and with the Water Main prepared surfaces.
46 The Supplier may recommend an alternate component to provide an acceptable protective coating.

47 The Contractor must submit to the Engineer for approval at least 10 Working Days in advance, the Supplies and method
48 proposed for preparing the Water Main, the wax tape coating system and how it is applied, any alternate component and the
49 reason for use, Supplier recommendations with sufficient detail indicating an acceptable finished product, and Supplier contact
50 information.

51 7-11.3(9) CONNECTIONS**52 7-11.3(9)A CONNECTIONS TO EXISTING WATER MAINS**

53 Do not operate any valve on an existing Water Main.

54 SPU Water Operations will make all connections to charged Water Mains and will operate all valves to accomplish
55 shutdowns and subsequent reactivation. Draining of existing Water Mains will be done by Water Operations staff. The

1 Contractor must match the grade and alignment of the new Water Main to the existing Water Main. The excavation must be
2 sufficiently large to accommodate connection work as approved by the Engineer.

3 Verify connection points as specified in Section 7-11.3(4)B.

4 Provide the Engineer 2 Working Days advance notice for scheduling inspections for approval of Water Main installations
5 for connection. Within 2 Working Days after the inspection, the Contractor will be provided with written approval or with a list of
6 items to be corrected. Items to be corrected will be reinspected. The notification requirement and reinspection response times
7 are the same as the initial inspection.

8 Approval is contingent on the Water Main and appurtenances being completely installed and tested per Contract but
9 does not require completion of street, sidewalk and planting strip restorations. Water Main and appurtenances include all pipe,
10 fittings, blocking except temporary blocking, hydrants, hydrant pads, blowoff assemblies, valves, flowmeters, chambers,
11 corrosion protection, and coating systems.

12 Newly installed Water Main must be pressure tested and must be acceptable as specified in Sections 7-11.3(11) and 7-
13 11.3(12) before making any connection. When required, newly installed Water Main must pass the taste and odor rating test
14 as specified in Sections 7-11.2(2) and 7-11.2(3) before and/or after making any connection.

15 After all tests, flushing, and disinfection have been completed and the installed Water Main and appurtenances, including
16 hydrants and valves, have been approved by the Engineer, it is the Contractor's responsibility to request the Engineer to
17 schedule the shutdown and connection. In general, the Contractor's request for shutdown and connection must be submitted
18 to the Engineer at least 5 Working Days in advance of the desired date of the connection, per Section 1-07.28. However, the
19 Contractor is encouraged to communicate and coordinate with the Engineer as early in the project as possible regarding the
20 scheduling of these connections as SPU Water Operations' shutting down and starting up portions of the water system will
21 take into consideration:

- 22 1. Size of Water Main and total system impacts.
- 23 2. Coordination with Fire Department.
- 24 3. End user needs and coordination.
- 25 4. SPU Water Operation's workforce availability.
- 26 5. Notifications of the scheduled shutdown will be made by SPU Customer Service / Inspection Services personnel to
27 the affected consumers a minimum of 2 Working Days in advance of the shutdown.
- 28 6. Connections must be made within 2 weeks (14 days) after Flushing and Disinfection of the pipes.

29 The Contractor's scheduling of connections requires the Engineer's approval on the following items:

- 30 a. Verification of existing Water Main grade and alignment per Section 7-11.3(4)B.
- 31 b. Contractor's written list of materials being supplied.
- 32 c. Verification and inspection of Contractor's supplied materials.

33 After approval by the Engineer, the Contractor may submit a request for a shutdown to the Engineer. This notice must
34 allow for at least 5 Working Days for SPU staff to prepare for the shutdown date and notify customers.

35 The excavation for the connection must be completed, shored, and dewatered, and all required materials and equipment
36 supplied by the Contractor must be available on the Project Site during shutdown. SPU will furnish connection fittings to
37 existing Water Mains, unless otherwise specified. The Contractor must furnish and install the connection fitting on new Water
38 Mains (see Standard Plan 300a, 300b, and 300c). In addition, before and after connection of the new Water Main, SPU Water
39 Operations will:

- 40 1) Deactivate and dewater the Water Main.
- 41 2) Cut, remove, and dispose of pipe sections as necessary to install the new Materials, with Contractor assistance.
- 42 3) Dewater existing pipe, as required, to perform connections.
- 43 4) Swab all connecting pipe and fittings with chlorine solution (5 to 6 percent Cl₂).
- 44 5) Perform the connection work.
- 45 6) Reactivate and flush the Water Main.

46 The Contractor must furnish all fittings and other Materials and equipment required to complete the connection not
47 specifically called out in the Contract as being furnished by SPU Water Operations.

48 Coat, wrap, and joint bond the connection to conform with the requirements of the new Water Main.

49 Make all necessary excavation, protective measures, and backfill, and provide any equipment and operators required to
50 move and lower the component parts of the connection into position. The Contractor must do all temporary and permanent
51 blocking.

52 In addition to those connections shown on the Drawings, segments of a new Water Main may be placed in service before
53 completion of the entire Water Main. All connections between the charged and uncharged segments of the new Water Main
54 will be done by SPU Water Operations.

55 Locations of connections between segments of new Water Main are dependent on Contractor's operations and are not
56 shown. The Contractor must furnish all Materials for such connections.

1 7-11.3(9)B MAINTAINING SERVICE

2 Where existing services are transferred from old to new Water Mains, the Contractor must plan and coordinate the Work
3 with that of SPU Water Operations so that service is resumed with the least possible inconvenience to customers.

4 To supply customers with water during the construction of a project, where any section of pipe has passed the required
5 hydrostatic and bacteriological tests, SPU Water Operations may tap corporation stops into a section of a new Water Main and
6 install corporation stops and service connections at such locations as SPU Water Operations deems necessary, at no expense
7 to the Contractor. The attaching of any such service connections by the SPU Water Operation's does not constitute any
8 acceptance by the Owner of any part of the Work required under the Contract.

9 7-11.3(9)C WATER SERVICE CONNECTIONS

10 See Section 7-15.

11 7-11.3(9)C1 INSULATED COUPLINGS AND FLANGE KITS

12 Install insulated couplings and flange kits to electrically isolate the Water Main from other Structures. Locate insulated
13 joints as shown on the Drawings.

14 Carefully align and install insulating couplings and flange kits according to the manufacturer's recommendations to avoid
15 damaging insulating Materials. Coat all exposed surfaces of insulating flange, including fasteners, with petroleum impregnated
16 wax tape as specified in AWWA C217. Submit the manufacturer's installation recommendations to the Engineer for review at
17 least 3 Working Days before use.

18 7-11.3(9)D TEMPORARY WATER MAINS AND SERVICES

19 When called for in the Contract, SPU Water Operation's will install and maintain temporary Water Mains and services in
20 such a manner as to provide constant adequate water supply to consumers and to avoid impeding traffic and access to
21 abutting properties.

22 The Contractor's critical path schedule must allow adequate time for SPU Water Operations to install these facilities.
23 Provide the Engineer a minimum of 2 weeks advance written notice for scheduling of the temporary Water Main and service
24 work.

25 Support SPU Water Operations by performing all required excavation, backfill, and compaction. SPU Water Operations
26 will furnish the necessary equipment and pipe for temporary Water Mains, unless otherwise noted on the Drawings and Project
27 Manual.

28 All temporary Water Mains will be disinfected, flushed, and sampled for bacteriological testing by the SPU Customer
29 Service / Inspection Services. When found acceptable, the temporary Water Mains will be placed in service.

30 7-11.3(9)E TEMPORARY PRIVATE WATER SERVICE LATERALS

31 The Contractor is solely responsible for maintaining private water service laterals in service. When it is necessary to
32 provide temporary water supply, the Contractor is responsible for providing temporary services on the private side of the water
33 service. Should construction activity damage or disrupt private water service laterals or appurtenances, immediately notify the
34 Engineer of any such damage or disruption, start repairs immediately as directed by the Engineer, and work continuously until
35 the condition the water service lateral is restored.

36 7-11.3(10) LOCATING WIRE

37 Install locating wire 6 inches directly above the centerline of all nonmetallic pipe, except that the locating wire must be
38 bonded by exothermic welds to all metallic fittings, valves and valve boxes to form an electrically continuous system.

39 7-11.3(11) HYDROSTATIC PRESSURE TEST

40 All Water Mains and appurtenances must be hydrostatically pressure tested. Once the new Water Main has passed the
41 hydrostatic pressure test, the Water Main must be flushed, disinfected, and bacteriologically sampled as specified in Section 7-
42 11.3(12), and may be required to pass additional post-installation taste and odor rating test as specified in Section 7-11.2(3).

43 The Contractor will furnish and/or operate all labor, equipment, pumps, gauges, plugs, saddles, corporation stops,
44 miscellaneous hose and piping, a 1/4-inch F.I.P.T. connection for pressure recorder, and as necessary for performing the test.

45 Pressure recorders and charts used to record the tests will be furnished and operated only by the Engineer.

46 Before notifying the Engineer to witness and record the pressure test, the Contractor must have set up and performed
47 the pressure test to make certain that the pipe is in acceptable condition. The Contractor must then notify the Engineer at least
48 2 Working Days before recording and conducting the test.

49 Furnish and install temporary blocking as required for pressure testing. Upon successful testing, remove temporary
50 blocking.

51 To protect existing Water Mains from contamination by backflow of test water during filling operations, temporarily install
52 a Washington State Department of Health approved reduced pressure principle backflow prevention assembly between the
53 test and supply Water Main. See Section 1-07.28 item 7D for notification requirements regarding BPA inspection. Provide a
54 current BPA performance test report, which must be on the Project Site for the assembly being used. Install the temporary
55 backflow protection and isolate the Water Main under test from the supply Water Main before hydrostatic testing.

7-11.3(11)A TEST PRESSURE FOR FIELD TESTING WATER MAIN PIPE

Field hydrostatic testing of various diameter ductile iron Water Main pipes and appurtenances must be per the following table:

| Diameter Pipe (inches) | Test Pressure (psi) |
|------------------------|---------------------|
| 4 | 300 |
| 6 | 300 |
| 8 | 300 |
| 10 | 300 |
| 12 | 300 |
| 16 and larger | 250 |

Test pressure for pipe except ductile iron is specified in the Contract.

The indicated test pressure must be taken at the lowest elevation of the section of Water Main being tested. All air in the pipe must be vented before test.

Maintain the hydrostatic test pressure until the Engineer determines that the section of pipe, valves, and fittings are water tight. If there are no visible leaks and the test pressure is maintained without pumping for 15 minutes with a pressure drop of less than 15 psi, the Water Main will be accepted as a water tight installation. When testing lengths of Water Main pipe less than 18 feet long, or when testing hydrant pipe, maintaining the test pressure without pumping for 5 minutes with less than 5 psi drop in pressure will be considered evidence of an acceptable test.

Sections to be tested are limited to 1,500 feet or less. The Engineer may require that the first section of pipe, not less than 1,000 feet in length, installed by each of the Contractor's crews, be tested to qualify the crew and the Material. Do not continue pipe installation more than an additional 1,000 feet until the first section has been tested.

Perform hydrostatic tests on every completed section of Water Main between valves. The pressure differential across closed valves must not exceed the rated operating pressure of the valve.

All tests must be made with the hydrant auxiliary gate valves open and with pressure exerted against the closed hydrant inlet valve. After the test has been completed, test gate valves by closing each one in turn and relieving the pressure beyond. This test of the gate valve will be acceptable if no immediate loss of pressure is registered on the gauge when the valve is being checked. Verify that the pressure differential across the valve does not exceed the rated test pressure of the valve.

Correct any visible leakage detected regardless of the allowable leakage specified above. Should the tested section fail to meet the pressure test as specified, the Contractor is solely responsible for locating and repairing the defects and retesting the Water Main.

The Contractor must replace and remedy defective Materials or workmanship discovered as a result of a hydrostatic field test as specified in Section 1-05.7. Whenever it is necessary to replace defective Material or correct the workmanship, the hydrostatic test will be rerun until an acceptable test is obtained.

7-11.3(11)B TESTING EXTENSIONS FROM EXISTING WATER MAINS

When an existing Water Main is extended over 18 feet, the section of new pipe installed to the existing Water Main will be made by SPU Water Operations with pretested, predisinfected pipe, and no hydrostatic test is required. Notify SPU Customer Service for approval at least 3 Working Days in advance if predisinfected pipe is proposed for installation. When the required hydrostatic tests are conducted in the new Water Main section beyond the installed new valve in the closed position, the normal pressure of the existing Water Main may be present against the other side of the new valve.

Where the distance between the end of an existing Water Main pipe extension to the new valve is more than 18 feet, do not connect the new pipe to existing pipe until after hydrostatic tests have been made to the required pressure in both directions against the new valve. Use a temporary cap or plug installed on the end of the new pipe, beyond the new valve, as close as possible to the existing pipe for testing purposes. Where a new valve is not part of the Work, notify the Engineer at least 10 Working Days in advance to coordinate other arrangements for hydrostatic testing.

Apply the required test pressure to the short length of pipe between the temporary cap or plug end with the new valve in the closed position, with no hydrostatic pressure active on the opposite side of the valve. Conduct the same test against the other side of the new valve when that section of pipe is tested with no hydrostatic pressure active in the short section of pipe toward the existing Water Main pipe. The final connection to the existing Water Main will be made by the SPU Water Operations with pretested, prechlorinated pipe, and no hydrostatic test is required.

7-11.3(11)C TESTING SECTION WITH HYDRANTS INSTALLED

When hydrants are included with the section of Water Main pipe to be tested, the testing must be conducted in 3 separate tests:

| Test | Process |
|--------|--|
| Test 1 | Water Main gate valves and hydrant auxiliary gate valves closed, with the hydrant operating stem valves and hose ports wide open. |
| Test 2 | Water Main gate valves and the hydrant operating the stem valves tightly closed but the hydrant auxiliary gate valves and hose ports wide open. |
| Test 3 | Each hydrant tested to 200 psi with the hydrant auxiliary gate valve and hose ports closed and the hydrant operating stem valve wide open. 25 pounds per square inch in the supply Water Main beyond the hydrant auxiliary gate valve when testing a hydrant singly. |

1

2 **7-11.3(11)D TESTING HYDRANTS INSTALLED ON EXISTING WATER MAINS**

3 For hydrants installed and connected to an existing Water Main, the hydrant connection including hydrant tee, connection
4 pipe, and auxiliary gate valves must be installed with pretested Materials.

5 Before the hydrant connection is made to the existing Water Main, subject the hydrant installation to the hydrostatic Test
6 3 as specified in Section 7-11.3(11)C. Following an acceptable hydrostatic test, hydrants installed and connected to an
7 existing Water Main must have a bacteriological sample obtained and tested for acceptable results before connection the
8 Water Main.

9 **7-11.3(12) FLUSHING AND DISINFECTION OF WATER MAINS**

10 **7-11.3(12)A GENERAL**

11 Before being placed in service, all newly installed pipe, valves, hydrants, and appurtenances must be flushed,
12 disinfected, kept clean, and sampled for acceptable bacteriological analysis. Additional taste and odor rating testing may be
13 required, see Section 7-11.2(3).

14 Newly installed Water Main will have a sample taken from every 500-foot interval, and at each end. For each hydrant
15 lateral over 18 feet in length, a sample will be taken at the hydrant end. Hoses for sampling are not allowed. On new Water
16 Main without hydrant, temporary sampling taps must be provided and then removed and plugged after the Engineer notifies
17 the Contractor of acceptable bacteriological results. Fit the hydrant used for sampling with a sampling tap acceptable to the
18 Engineer.

19 Coordinate with the Engineer for the location of sampling taps. All bacteriological analysis will be performed by the SPU
20 Water Quality Laboratory. Written notice of the results of sample analysis will be returned to the Contractor 2 Working Days
21 after the sampling. Analysis of any sample indicating unacceptable results requires the remedy specified in Section 7-
22 11.3(12)K. Analysis of any sample indicating acceptable results requires the new Water Main be connected to existing Water
23 Main within 14 Calendar Days of the Date of written notice. Failure to make the connection within this time frame requires
24 additional disinfection, flushing, and additional sampling and testing for acceptable results. The Engineer may perform
25 additional bacteriological sampling and testing at any time.

26 **7-11.3(12)B PREDISINFECTION FLUSHING**

27 Sections of pipe smaller than 24-inch diameter to be disinfected by methods except those found in Section 7-11.3(12)D,
28 Method 1, must first be flushed to remove any solid or Contaminated Material. If Method 1 is used, the 2-1/2 fps flushing must
29 be done after disinfection is complete, see Section 7-11.3(12)J. If no hydrant is installed at the end of the new pipe, provide a
30 tap large enough to develop a velocity of at least 2-1/2 fps in the pipe. Flushing period must be at least 5 minutes for every 150
31 feet of new pipe but in no case less than 30 minutes. One 2-1/2-inch hydrant opening will, under normal pressure of 40 psi,
32 provide this velocity in pipe sizes up to and including 12 inches. For pipe sizes exceeding 12-inch diameter, flushing taps size
33 requirements are:

34

35

REQUIRED FLOW AND OPENING TO FLUSH WATER MAINS

| Pipe Diameter (inches) | Flow Required to Produce 2-1/2 feet per second (fps) Velocity in Water Main (gpm) | Number - Size (inch) of Taps Required for a 2-1/2 fps Flush |
|------------------------|---|---|
| 14 | 1200 | 3 - 2", or 1 - 3" |
| 16 | 1600 | 4 - 2", or 1 - 4" |
| 20 | 2500 | 6 - 2", or 3 - 3", or 2 - 4" |
| 24 | 3600 | 4 - 3", or 2 - 4", or 1 - 6" |
| 30 | 5625 | 4 - 4", or 2 - 6", or 1 - 8" |
| 36 | 8100 | 2 - 6", or 1 - 8" |
| 42 | 11025 | 3 - 6", or 1 - 10" |

| Pipe Diameter (inches) | Flow Required to Produce 2-1/2 feet per second (fps) Velocity in Water Main (gpm) | Number - Size (inch) of Taps Required for a 2-1/2 fps Flush |
|------------------------|---|---|
| 48 | 14400 | 4 - 6", or 1 - 12" |

The Contractor must furnish and install taps required for chlorination, flushing, or temporary or permanent release of air, which are incidental to the construction of Water Mains. When a hose bib faucet is installed for bacteriological sampling, locate it upstream from the flushing point. Taps on existing Water Mains required for chlorination or flushing will be furnished and installed by SPU's Water Operations Division.

As an alternative to 2-1/2 fps flushing, sections of pipe 24 inches or larger diameter may be prepared for disinfection by mechanical cleaning methods approved by the Engineer.

The Contractor is responsible for disposing of treated water flushed from the Water Mains as acceptable to State and local authorities. Neutralize water to 0.1 parts per million chlorine, or less, before disposal into any natural drainage channel. Maintain an air gap equal to twice the discharge pipe/hose diameter (but not less than 12 inches) between the discharge outlet and the overflow rim of the receiving waters.

7-11.3(12)C REQUIRED CONTACT TIME

Before placing into service, disinfect all newly installed pipe so that a chlorine residual of not less than 10 mg/L remains in the water after the retention period. Keep treated water in the pipe at least 24 hours. If the water temperature is less than 41 °F (5 °C), the water must remain in the pipe for at least 48 hours. After the retention period, test chlorine residual at all extremities of the pipe. The measured chlorine residual must be at least 10 mg/L. If a measurement of less than 10 mg/L is obtained repeat disinfection is required.

7-11.3(12)D FORM OF APPLIED CHLORINE

Apply chlorine by one of 3 methods to provide a dosage of at least 25 mg/L of available chlorine:

Method 1: Dry Calcium Hypochlorite

As each length of pipe is installed, place sufficient high test calcium hypochlorite (65 to 70 percent chlorine) in the pipe to yield a dosage of not less than 25 mg/l available chlorine, calculated on the volume of the water to be contained in the pipe and appurtenances. This method may only be used if the pipes and appurtenances are kept clean and dry during construction.

The number of ounces of 65 percent test calcium hypochlorite required for a 20-foot length of pipe equals $0.004216d^2$ in which "d" is the pipe diameter in inches.

Method 2: 100 percent Gas Chlorine

Apply a chlorine gas water mixture using a solution feed chlorinating device. Chlorinating devices for feeding solutions of the chlorine gas must provide means for preventing the backflow of water into the chlorine supply. See Section 1-07.28 item 7D regarding BPA notification and testing requirements.

Method: 3 Sodium Hypochlorite

Sodium Hypochlorite, commercial grade (12.5 percent Cl_2) or in the form of liquid household bleach (5 to 6 percent Cl_2), may be substituted for the chlorine gas water mixture. This liquid chlorine compound may be used full strength or diluted with water and injected into the Water Main with fill water in correct proportion to produce a mixture of at least 25 mg/l Cl_2 .

7-11.3(12)E CHLORINE DOSAGE

The amounts of chlorine required to provide 25 mg/l for 100-foot lengths of various diameters of pipe are:

AMOUNTS OF CHLORINE REQUIRED FOR 25 MG/L DOSAGE

| Pipe Size (inch) | Volume of Water per 100 ft. Length (gallons) | Cl_2 100% | Household Bleach 5-1/4% Cl_2 (gallons) | Commercial Bleach 12-1/2% Cl_2 (gallons) |
|------------------|--|-------------|--|--|
| 4 | 65.3 | .014 | .03 | .013 |
| 6 | 146.5 | .031 | .07 | .03 |
| 8 | 261.0 | .054 | .13 | .053 |
| 10 | 408.0 | .085 | .2 | .08 |
| 12 | 588.7 | .121 | .3 | .12 |
| 14 | 799.6 | .167 | .4 | .16 |
| 16 | 1044.4 | .22 | .5 | .21 |
| 20 | 1631.9 | .34 | .8 | .33 |
| 24 | 2349.9 | .49 | 1.1 | .47 |

| Pipe Size (inch) | Volume of Water per 100 ft. Length (gallons) | Cl ₂ 100% | Household Bleach 5-1/4% Cl ₂ (gallons) | Commercial Bleach 12-1/2% Cl ₂ (gallons) |
|------------------|--|----------------------|---|---|
| 30 | 3671.7 | .77 | 1.8 | .75 |
| 36 | 5287.3 | 1.1 | 2.5 | 1.1 |
| 42 | 7196.6 | 1.5 | 3.5 | 1.44 |
| 48 | 9399.0 | 2.0 | 4.6 | 1.6 |

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7-11.3(12)F POINT OF APPLICATION FOR LIQUID/GAS DISINFECTION

The preferred point of application of the chlorinating agent is at the start of the Water Main extension or any valved section of it and through a corporation stop inserted in the horizontal axis of the pipe. The water injector for delivering the chlorine bearing water into the pipe must be supplied from a tap on the pressure side of the gate valve controlling the flow into the Water Main extension. Alternate points of application may be used when approved by the Engineer.

7-11.3(12)G BACKFLOW PREVENTION REQUIREMENT

To prevent contaminated water from the new Water Main from entering the existing distribution system, use a disinfected Washington State Department of Health approved reduced pressure backflow assembly on the line supplying the water. An approved reduced pressure backflow assembly is sufficient backflow protection only for filling and flushing of the new Water Main. During the hydrostatic pressure test, remove the temporary connection between the new Water Main and the existing distribution system. See Section 1-07.28 item 8D for backflow prevention assembly notification and testing requirements.

7-11.3(12)H RATE OF APPLICATION

Water from the existing distribution system, or other approved supply source, must be controlled for very slow flow into the newly installed Water Main during chlorine application. The rate of chlorine gas-water mixture or dry gas feed must be in such proportion to the rate of water entering the newly installed pipe that the dosage applied to the water is at least 25 mg/l. Sodium hypochlorite, commercial grade (12.5 percent Cl₂) or in the form of liquid household bleach (5-6 percent Cl₂) may be substituted for the chlorine gas water mixture. This liquid chlorine compound may be used full strength or diluted with water and injected into the Water Main in correct proportion to the fill water so that dosage applied to the water is at least 25 mg/l.

7-11.3(12)I DISINFECTION OF CONNECTIONS TO EXISTING WATER SYSTEMS

All connections must be disinfected per the requirements of AWWA C651 section titled Disinfection Procedures When Cutting into or Repairing Existing Main. Swab or spray all pipe and fittings with a chlorine solution at least as strong as liquid household bleach (5-6 percent Cl₂).

7-11.3(12)J FINAL FLUSHING AND TESTING

Following chlorination, flush all treated water from the pipe until the replacement water treated throughout its lengths shows an absence of chlorine. If chlorine is normally used in the source of supply, tests must show a residual not in excess of that carried in the system.

Where dry calcium hypochlorite has been used for disinfection, flushing velocity must be at least 2-1/2 feet per second in the Water Main. Flushing period must be at least 5 minutes for every 150 feet of new Water Main but in no case less than 30 minutes.

See Section 7-11.3(12)A for bacteriological sampling and testing, and see Section 7-11.2(3) for post installation taste and odor rating testing when required by the Engineer.

All hydrants on the new Water Main must be flushed to remove excess chlorine from the hydrant and hydrant branch.

7-11.3(12)K REPETITION OF FLUSHING AND TESTING

Based on any unacceptable bacteriological sample results, as specified in Section 7-11.3(12)A, the new Water Main or hydrant connection over 18 feet must be either flushed and resampled, or redisinfecting, flushed, and resampled. The Contractor must repeat these procedures until acceptable bacteriological sample results are obtained.

7-11.3(12)L PREFLUSHING AND DISINFECTION OF WATER MAINS BY SPU (SPECIAL CASE)

SPU may determine that installation of preflushed pipe is in the best interest of the City and its customers. This will be a case-by-case determination by the Engineer. When preflushing, follow this flushing and disinfection of pipe for Water Main connection procedure:

1. Deliver to SPU the required pipe, of proper diameter and material for connection, at least 5 Working Days before the installation date.
2. SPU will flush, disinfect, reflush, and obtain bacteriological sampling and testing of pipe.
3. SPU will bag the ends of the pipe as it is removed from the cleaning and testing rack and will deliver it to site.
4. SPU will install pipe connection.

1 7-11.3(13) CONCRETE THRUST BLOCKING

2 Place concrete thrust blocking as shown on Standard Plans 330a - 331b at bends, tees, dead ends, and crosses as
3 shown on the Drawings. Blocking must be Class 3000, as specified in Section 6-02, concrete mix poured in place or the
4 Engineer may approve the use of ecology blocks as a substitute.

5 Concrete blocking must bear against solid undisturbed earth at the sides and bottom of the trench excavation and be
6 shaped so as not to obstruct access to the joints of the pipe or fittings.

7 Provide the Engineer at least 1 Working Day advance notice before pouring concrete thrust blocking or placing ecology
8 blocks and 1 Working Day advance notice for inspection and approval of all concrete blocking or placement of ecology blocks
9 before backfilling. Protect all metallic components of thrust blocks from corrosion by a wax tape system or another method
10 approved by the Engineer.

11 Unacceptable concrete blocking and corrosion protection must be replaced at the Contractor's expense.

12 7-11.3(14) BLOWOFF ASSEMBLIES

13 Construct Water Main blowoff assemblies as shown on the Drawings or Standard Plans 340a and 340b. Install a
14 standard meter box in non-traffic bearing areas and use a Type 361 frame and cover for all other installations subject to
15 vehicular traffic. Take care in locating the meter box or frame and cover such that it is not in any water course or in any other
16 location subject to drainage or sewerage contamination. Set tops to conform to finished grade. Backfill and compact as
17 specified in Section 2-10 and Section 2-11.

18 The Contractor must perform drilling and tapping into the Water Main except in the event of installation on a charged (in
19 use) Water Main, in which case SPU Water Operations will make the connection.

20 7-11.3(15) ELECTROLYSIS MONITORING SYSTEM**21 7-11.3(15)A GENERAL**

22 Where called out on the Drawings, the Water Main Contractor furnishing the pipe must:

- 23 1. Install electrical continuity bonds. Furnish and install electrical joint bonds, as specified, at all mechanical coupling
24 non-insulated flange joints and all rubber gasket joints. Take special precautions to avoid disturbing existing bonds,
25 electrical cables, and wires for test stations and other cathodic protection equipment connected to, or installed near
26 the Water Main.
- 27 2. Install electrolysis test stations. Where shown on the drawings, the Contractor must furnish and install the Electrolysis
28 Test Stations.

29 7-11.3(15)B ELECTRICAL JOINTS FOR PIPE AND FITTINGS**30 7-11.3(15)B1 GENERAL**

31 Where shown on the Drawings, each length of pipe in the Water Main and each hydrant run must be electrically bonded
32 together, and each mechanical joint must be bonded to the pipe as shown on Standard Plan 362. Perform adhesion tests of all
33 bonds and bonded joints in the presence of the Engineer. Any bonded joint that fails to meet the adhesion test must be re-
34 bonded until an acceptable test is obtained. Bonding cable is specified in Section 9-30.7.

35 7-11.3(15)B2 JOINT BOND CABLE CONNECTIONS FOR PIPE

36 Before making any bond connection to metal, remove a 2" x 2" section of coating materials from the pipe surface to make
37 the connection. Remove paint, primer, and coating material from the pipe surface with clean rags and solvent before preparing
38 the metal surface. Clean the metal surface to white metal by sandblasting, grinding, or filing before welding the conductor. Do
39 not use resin base grinding disks. Ceramic base disks are acceptable. Weld joint bonding cable to the pipe or fitting by the
40 exothermic process with a copper sleeve fitted over the exposed conductor. Remove only sufficient insulation from the
41 bonding cable to allow placing of the welding mold. After the weld is completed it must be tested and capped as specified in
42 Section 7-11.3(15)D.

43 Remove and replace defective welds.

44 Cover exposed metal surfaces around the exothermic weld, including the end of the copper conductor and the weld itself,
45 with coating material as shown on the Drawing or as specified in Section 9-30.8(3).

46 Provide the Engineer 3 Working Days notice so that all connections to pipe obtain inspection and approval before
47 covering. Bond connections not receiving Engineer approval before cover or backfill will be rejected.

48 7-11.3(15)B3 TESTING ELECTROLYSIS TEST STATION

49 Provide the Engineer written notice 3 Working Days in advance, to perform a functional test of the electrolysis test
50 station before backfilling.

51 7-11.3(15)C ELECTROLYSIS TEST STATION**52 7-11.3(15)C1 GENERAL**

53 Install Electrolysis Test Stations as shown on Standard Plan 360 and 365.

7-11.3(15)C2 ZINC REFERENCE ELECTRODES

Place reference electrode within the Water Main trench excavation 6" horizontally from the Water Main at or just below the springline. An exception is where Water Main crosses any other metallic pipe in which the electrode is to be placed between the Water Main and the other pipe. Backfill reference electrodes with suitable Material. Terminate wires in the test stations.

7-11.3(15)C3 TEST STATION

The test station must consist of a molded test station box installed inside a conventional cast iron water meter box for non-traffic areas or inside a Type 230 frame and cover for traffic areas. The cover must have the letters "WATER" cast into it.

7-11.3(15)C4 TEST WIRES

Wire location, connections to pipe, size, insulation color, and crimp-on wire connectors must be as shown on Standard Plan 363 and 365.

7-11.3(15)D TESTING AND CAPPING EXOTHERMIC WELD CONNECTIONS

7-11.3(15)D1 GENERAL

Two methods of testing, a manual test using a hammer blow, or an electronic method that measures bond resistance, may be required. Also, when required in the Contract, identify a cathodic protection specialist to oversee installation of joint bonds and testing for electrical continuity. The Contractor's cathodic protection specialist must prepare a Shop Drawing and procedures for testing the pipe and maintaining records. The procedure must, at a minimum, require the cathodic protection specialist to monitor testing of bonded joints for the first 2 days of testing. The Contractor must complete testing of the remaining joint bonds and prepare records of the testing results on a test form that includes:

1. Description and location of the pipeline tested.
2. Starting location and direction of test.
3. Date of test.
4. Joint type.
5. Test current and voltage drop across each joint and calculated bond resistance (calculated resistance method as described in Section 7-11.3(15)D3 .
6. Measured joint bond resistance (digital low-resistance ohmmeter method).
7. Review of test records by the Contractor's cathodic protection specialist.

7-11.3(15)D2 CAPPING EXOTHERMIC WELD CONNECTIONS

Insulate each bond connection thoroughly with a Royston Handy Cap or approved equal. The cap must completely cover the cleaned area and provide insulation of the bond connection from the soil environment. Attach the cap with a bonding cement or primer. The cap must contain an elastomeric Material under a plastic dome. The elastomeric Material must mold completely around the bond wire and weld area. The cap must be a minimum of 4 inches by 4 inches by 125 mils thick. Caps are not required when the connection is covered by heat shrink joint wrapping.

7-11.3(15)D3 TESTING EXOTHERMIC WELD CONNECTIONS

After the exothermic weld has cooled, remove slag and test the weld with a glancing blow from a 16 ounce hammer to assure proper metallurgical bond.

When required in the Contract, test each joint bond connection for resistance using a digital low resistance ohmmeter. Before backfilling, test each bond in the presence of the Engineer and prepare a record of the testing results. Any joint bond that exceeds the maximum allowable resistance must be replaced by the Contractor and retested. Any defective joint bond discovered during energizing and testing must be located, uncovered and repaired at the Contractor's sole expense.

The following electrical continuity test equipment or approved equal must be stored at the Project Site, maintained in accurate working condition, and be available to the Engineer for testing:

1. One Biddle Model No. 247001 digital low-resistance ohmmeter.
2. One set of duplex helical current and potential hand spikes, Biddle Model No. 241001, cable length as required.;
3. One calibration shunt rated at 0.001 ohms, 100 amperes, Biddle Model No. 249004.

Testing must measure the resistance of joint bonds with the low-resistance ohmmeter per the manufacturer's written instructions. The helical hand spikes will contact the pipe on each side of the joint, without touching the exothermic weld, cap, or bond wire. Clean the contact area to bright metal by filing or grinding and without any surface rusting or oxidation.

Joint bond continuity will be acceptable if tested resistance values are less than or equal to:

Maximum Allowable Resistance in ohms

| Joint Type | 3 bonds/joint | 1 bond/joint |
|-----------------------|----------------------|---------------------|
| Push-on or Mechanical | 0.000110 | 0.000325 |

| Joint Type | 3 bonds/joint | 1 bond/joint |
|-----------------------|---------------|--------------|
| Flexible Coupling | 0.000145 | 0.000425 |
| Push-on or Mechanical | 0.000110 | 0.000325 |

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2 **7-11.3(15)E SACRIFICIAL ANODE BONDED TO PIPE INSTALLATION DETAILS**

3 Sacrificial anode bonded to pipe must be installed as shown on Standard Plan 364.

4 **7-11.3(16) ELECTRICAL INSULATION OF WATER MAIN**5 **7-11.3(16)A GENERAL**6 Install the Water Main to maintain electrical insulation from dissimilar pipe material, other water Structures, and other
7 underground installations.8 **7-11.3(16)B TESTING OF INSULATING COUPLINGS OR INSULATING FLANGE KITS**9 Insulating couplings or insulating flange kits must be located and installed as shown on the Drawings. Install an
10 electrolysis test station at each insulating device. Notify the Engineer at least 72 hours in advance for the SPU corrosion
11 engineer to perform a functional test of the insulating couplings and flange kits. All damaged or defective insulating devices will
12 be replaced at the Contractor's sole expense.13 **7-11.4 MEASUREMENT**

14 Measurement for "Bedding, (Class), (Size) Pipe" for Water Main will be as specified in Section 7-17.4.

15 Measurement for "Pipe, Water Main, (Material), (Class), (Size), including Fittings" and "Pipe, Water Main, (Material),
16 (Class), (Size), including Fittings, (Trenchless Construction Method)", will be per linear foot based on the distance from point to
17 point. The point of starting or ending of measurement in any particular run of pipe will be either with the vertical intersection of
18 the center line of the intersecting pipe, or with the starting or ending of any new pipe installed. No deductions will be made for
19 the linear length of fittings, valves, or couplings contained within the measured length. At changes in pipe size connected by a
20 reducer, the point of measurement will be taken as the midpoint of the reducer.

21 Measurement for "Blocking, Cement Concrete" will be by the cubic yard of concrete placed as computed by the Engineer.

22 Measurement for "Blocking, Ecology Block" will be per each.

23 Measurement for "Blowoff Assembly, (Size)" will be per each complete blowoff assembly installed, including up to 10 feet
24 of blowoff connection pipe in excess of what is shown on the Drawings.

25 Measurement for "Steel Casing Pipe, (Class), (Size), (Construction Method)" will be as specified in Section 7-17.4.

26 Measurement for "Station, Electrolysis Test" will be per each installed complete.

27 Measurement for "Sacrificial Anode Bonded to Pipe" will be per each.

28 **7-11.5 PAYMENT**

29 1. "Pipe, Water Main, (Material), (Class), (Size), (Coating), including Fittings", per linear foot

30 The Bid Item price for "Pipe, Water Main, (Material), (Class), (Size), (Coating), including Fittings" includes all costs for the
31 work required as follows:

- 32 a. Costs required for excavating, installing and joining pipe, backfilling and compacting native material, and
33 disposing of and/or placing excess native material elsewhere.
- 34 b. Cost of Materials, including but not limited to, the pipe, fittings and pipe supports, locating wire, special coatings,
35 and other items called for in the Contract. Where required, the costs of sand or foam cushioning between the
36 Water Main and other pipes are also included.
- 37 c. Costs for the work required to furnish and install mechanical joint sleeves and pipe supports, including pipe
38 hanger rods with nuts, single pipe rolls, steel angles, reinforcing bars, nuts, bolts, washers, mastic, and
39 galvanizing.
- 40 d. Costs required to perform the taste and odor rating test procedures, procedures for hydrostatic pressure testing,
41 and procedures for flushing, disinfection and bacteriological sampling of new Water Mains.
- 42 e. Costs necessary for installing pipe on curves as shown on the Drawings, including field changes involving
43 standard lengths of pipe deflected at the joints.
- 44 f. Costs of all Material, labor and equipment associated with making pipe connections unless otherwise specified.
45 and
- 46 g. Costs of furnishing and installing service connecting tees 4 inches and larger.

47 Special fittings used but not called for on the Drawings will be paid for at the Supplier's invoice cost plus 15 percent for
48 overhead and profit. Special fittings called for on the Drawings but not used will be deducted from the Contractor's final
49 estimate based on the current cost to the Supplier of fittings used on the improvement.

1 If the pipe, its lining, or its coating is damaged, the Contractor will be required, at the Contractor's sole expense, to repair
2 the damage to an acceptable condition before installation.

3 Payment for protective systems will be as specified in Section 2-07.5.

4 Defective Material or workmanship discovered as a result of tests will be addressed as specified in Section 1-05.7.

5 2. **"Blocking, Cement Concrete"**, per cubic yard

6 The Bid Item price for "Blocking, Cement Concrete" includes all costs for the work required as follows:

- 7 a. Costs of placing concrete blocking including: excavation, turnbuckles, shackle rods, steel plates, corrosion
8 protection of all metallic components, concrete form work, finishing, removal and disposal of material not required
9 for backfill.
- 10 b. Other work that may be necessary for constructing the blocking in place as specified.

11 3. **"Blocking, Ecology Block"**, per each

12 The Bid Item price for "Blocking, Ecology Block" includes all costs for the work required as follows:

- 13 a. Costs of furnishing and installing the Ecology Block including: excavation, turnbuckles, shackle rods, steel plates,
14 corrosion protection of all metallic components, and removal and disposal of material not required for backfill.
- 15 b. Other work that may be necessary for constructing the blocking in place as specified.

16 4. **"Blowoff Assembly, (Size)"**, per each

17 The Bid Item price for "Blowoff Assembly, (Size)" includes all costs for the work required as follows:

- 18 a. Costs for furnishing and installing the complete assembly including corporation, fittings, pipes, valve, meter box or
19 ring and cover, excavation, backfill with native material, and compaction;
- 20 b. Costs to furnish and install the pipe between the corporation and the blowoff assembly including fittings.
- 21 c. If the location of the blowoff assembly differs from that shown on the Drawings and requires an increase of more
22 than 10 feet of connection pipe, the excess of pipe over 10 feet will be paid for as specified in Section 1-09.4.

23 5. **"Steel Casing Pipe, (Class), (Size), (Construction Method)"**, per linear foot

24 Payment for "Steel Casing Pipe, (Class), (Size), (Construction Method)" is specified in Section 7-17.5.

25 Payment for directional drilling installation is specified in Section 2-16.5.

26 6. **"Pipe, Water Main, (Material), (Class), (Size), (Coating), including fittings, (Trenchless Construction Method)"**,
27 per linear foot

28 The Bid Item price for "Pipe, Water Main, (Material), (Class), (Size), (Coating), including fittings, (Trenchless Construction
29 Method)" includes all costs for the work required to furnish and install the pipe, including spacers, end seals, and placing the
30 designated fill in the annular space when applicable.

31 Payment for directional drilling installation will be as specified in Section 2-16.5.

32 7. **"Station, Electrolysis Test"**, per each

33 The Bid Item price for "Station, Electrolysis Test" includes all costs for the work required as follows:

- 34 a. Cost of furnishing and installing water meter box, test box, terminal blocks, wires to pipes and zinc reference
35 electrodes, zinc reference electrodes, removal and restoration of sidewalks.
- 36 b. All other Materials and labor required to complete this construction.

37 8. **"Bedding, Water Main, (Class), (Size) Pipe"**, per linear foot

38 Payment for "Bedding, Water Main, (Class), (Size), Pipe" is specified in Section 7-17.5.

39 9. **"Sacrificial Anode Bonded to Pipe"**, per each.

40 The Bid item price for "Sacrificial Anode Bonded to Pipe" includes all costs for the work required as follows:

- 41 a. Costs of furnishing and installing sacrificial anode, wire connection to pipe or electrolysis test station, anode
42 backfill, conduit, native backfill, thermite weld, and red "Caution" or "Danger" tape; and
- 43 b. All other materials, labor, and incidentals required to complete this construction.

44 10. **Other payment information**

45 No separate payment will be made for electrical joint bonds, capping, testing and recording test results. Costs for labor,
46 material and equipment required to acceptably bond and test across mechanical couplings and across rubber gasket joints,
47 and all incidentals required to provide acceptable and complete bonding will be included in the Bid Item price for "Pipe, Water
48 Main, (Material), (Class), (Size), including Fittings" or the Bid Item price for "Pipe, Water Main, (Material), (Class), (Size),
49 including Fittings, (Trenchless Construction Method)".

50 Joint bonding Material includes all required cables, bolts, molds, cold applied tape coatings and heat shrink sleeves.

1 SECTION 7-12 VALVES FOR WATER MAINS**2 7-12.1 DESCRIPTION**

3 Section 7-12 describes Work consisting of furnishing and installing Water Main valves and valve accessories as specified
4 in the Contract, and supplying materials, tools, and appurtenances needed to complete the installation.

5 7-12.2 MATERIALS

6 Materials must comply with the requirements of Section 9-30.3.

7 Valves for Water Mains must be suitable for ordinary waterworks service and are intended to be installed in a normal
8 position on buried Water Mains for water distribution and water transmission systems.

9 7-12.3 CONSTRUCTION REQUIREMENTS**10 7-12.3(1) GENERAL**

11 Do not operate any valve on an existing Water Main.

12 Inspect all valves upon delivery in the field to ensure proper working condition before installation and to verify they are
13 free of rust and dirt. Set and join the valves to the pipe per the AWWA Standards, unless indicated otherwise in the Contract,
14 for the type of connecting ends furnished. Carefully inspect the valves for damage to the outer protective coating and verify the
15 valves are damage free before installation.

16 Furnish and install an operating nut extension when the ground surface is more than 30 inches above the valve operating
17 nut. In standard valve boxes, which contain valves 12-inch and smaller, the operating nut extension must extend into the top
18 section of the standard valve box as shown on Standard Plans 315a and 315b. In vaults that contain valves greater than 12
19 inch, the operating nut extension must extend into the upper section of the vault and clear the bottom of the lid within a range
20 of 24 to 30 inches.

21 Upon delivery at the Project Site, all valves must be opened to prevent the collection of water in the valve. Clean valve
22 interiors of all foreign matter and inspect in both open and closed position before installation. Set valves perpendicular to the
23 Water Main. Place valve boxes over the 12-inch and smaller valve or valve operator and any extension in a manner that the
24 valve box makes no contact with the valve assembly or extensions and does not transmit shock or stress to the valve
25 assembly or Water Main, see Section 7-12.3(4). Install the lower casting of the valve box first, so as to be supported by backfill
26 and a polyethylene foam collar not less than 2 inches in thickness. The casting must not rest directly on the body of the valve
27 or on the Water Main. Carefully tamp backfill around the valve box to a distance of 3 feet on all sides or to the undisturbed face
28 of the trench if it is closer. Set the cast iron valve box cover flush to finished grade.

29 Install the combination air release/air vacuum valves as shown on the Drawings. All piping must be sloped to allow
30 escape of any entrapped air. Backfilling and compaction is specified in Section 2-10 and Section 2-11.

31 After installation, test and disinfect all valves as specified in Sections 7-11.3(11) and 7-11.3(12). The Contractor is
32 responsible for correcting any defects in design, Materials installation, or workmanship that appear during these tests to an
33 acceptable condition.

34 7-12.3(2) VALVE CHAMBERS**35 7-12.3(2)A GENERAL**

36 Where shown on the Drawings, valve must be enclosed in a valve chamber.

37 Valve chambers must be either precast or cast in place. The use of solid concrete blocks or concrete brick is allowed
38 only when specified in the Contract.

39 Valve chambers and the casting assembly for valves larger than 12-inch must not make contact with the valve assembly
40 or extension where surface shock or stress can be transmitted to the valve assembly or Water Main.

41 7-12.3(2)B PRECAST VALVE CHAMBERS

42 The concrete base must be poured in place or precast. Poured in place base must be allowed to attain sufficient strength
43 to support the chamber, usually 2 or 3 Days, as approved by the Engineer. Set precast chambers on the concrete base in
44 cement mortar. The vault chamber must have adequately sized and located openings for chamber installation adequately clear
45 of the Water Main.

46 Wrap the Water Main with 2-inch thick plastic foam Material at those areas where the Water Main intersects the chamber
47 walls. The plastic foam Material must cover the Water Main the full width of the chamber wall. Fill any remaining space
48 between the chamber wall and the plastic foam Material with cement mortar, and when the opening is large enough, brick and
49 mortar. Do not allow the Water Main to rest on the chamber wall.

50 7-12.3(2)C CHAMBERS MADE WITH PRECAST CONCRETE BLOCKS

51 Circular or rectangular chambers may be made with solid precast concrete blocks. First, pour the base in place. After the
52 base has reached sufficient strength (usually 2 or 3 Days), the walls may be constructed of concrete blocks with water tight
53 cement mortar joints.

1 Construct circular chambers with curved maintenance hole blocks. Taper the chamber top as shown on the Standard
2 Plans, unless the Contract specifies otherwise.

3 Chambers must have a cast in place or precast concrete top slab suitable for H20 traffic loading unless greater loading is
4 required by the Contract.

5 **7-12.3(2)D CAST IN PLACE CHAMBERS**

6 Cast in place chambers may be constructed by using forms and poured concrete. Finishing of walls is not required
7 except the patching of porous spots, rock pockets, and bolt holes. Forms must be removed for inspection of concrete.

8 **7-12.3(3) SETTING FRAME AND COVER**

9 Set the cast iron frame and cover (see Standard Plan 361) to grades furnished by the Engineer. Provide for future
10 adjustment of frame to changes in grade by constructing a minimum of 2 courses of brick with mortar joints between the top of
11 the chamber and the bottom of the casting. Brick for this purpose must be standard concrete brick 2-1/4 inches thick. When
12 the casting is in concrete pavement or in rigid concrete base, reinforcement within the concrete pavement slab is specified in
13 Section 5-05.3(9).

14 **7-12.3(4) SETTING VALVE BOX**

15 Position cast iron valve boxes during backfilling operations to be in vertical alignment with the gate valve operating stem.
16 Support the lower casting of the unit with a plastic foam collar not less than 2 inches thick, held in place by carefully
17 compacted backfill. The casting must not rest directly on the body of the gate valve, operating nut extension, or on the Water
18 Main. The upper casting of the valve box must be placed in the plane of and flush with the finished grade, and when installed
19 on slopes may both need to be tilt adjusted and adequately offset to provide valve and extension clearances meeting the
20 requirements of Section 7-12.3(1) and allow straight and direct access to the operating stem.

21 Backfill and compaction is specified in Section 2-10 and Section 2-11.

22 **7-12.3(5) VALVES INSTALLED ON SPECIALLY COATED PIPE**

23 Valves installed on Water Mains that are polyethylene encased, tape coated, or special coated, must be polyethylene
24 encased, epoxy coated, or special coated the same as the Water Main.

25 **7-12.3(6) LADDERS**

26 See Section 7-05.3(1)M.

27 **7-12.3(7) PAINTING OF VALVES**

28 **7-12.3(7)A PAINTING AT FACTORY**

29 After the factory test and inspection, all ferrous parts of the valves except finished or bearing surfaces must be painted
30 inside and out with 2 coats of asphalt varnish, Federal Specification TT V 51A or approved equal.

31 **7-12.3(7)B PAINTING IN THE FIELD**

32 Carefully inspect the valve for injury to the outer protective coatings. At all places where the coating has been ruptured or
33 scraped off, thoroughly clean the damaged area to expose the iron base, and then recoat the cleaned area with the
34 manufacturer's recommended primer and 2 or more coats of Royston Roskote R28, or approved equal, per the manufacturer's
35 instructions. In wet conditions, use 3-component wax tape wrap consisting of primer, wax tape, and fiberglass overwrap per
36 Section 7-11.3(8)A.

37 **7-12.3(8) THERMOPLASTIC POWDER COATING**

38 Valves and attachments to be installed on Water Mains where the Contract specifies thermoplastic powder coating for
39 the Water Main, must also have an equivalent coating such as fusion bonded epoxy, polyurethane, or approved equal.

40 All bolts, nuts, followers, and similar must be wax tape coated, see Section 9-30.1(4)F.

41 Substitute Material requires the Contractor to submit sufficient information and a manufacturer's certificate of compliance
42 stating that the proposed substitute Material will perform at least as well as that specified.

43 **7-12.4 MEASUREMENT**

44 Bid Items of Work completed under the Contract will be measured as provided in Section 1-09.1 unless otherwise
45 provided for by individual measurement paragraphs in this Section.

46 **7-12.5 PAYMENT**

- 47 1. "Valve, Gate, (Size)", per each
- 48 2. "Valve, Butterfly, (Size)", per each

49 The Bid Item price for "Valve, (Type), (Size)" includes all costs for the work required to furnish and install the valve,
50 including painting, jointing, disinfecting, hydrostatic testing, operating nut and extensions.

1 When the valve is to be polyethylene encased or coated as specified in the Contract, the cost for furnishing and installing
2 the coating as specified in Section 7-12 will be included in the Bid Item price for "Valve, (Type), (Size)".

3 3. "Valve Chamber, (Type), (Size)", per each

4 The Bid Item price for "Valve Chamber, (Type), (Size)" includes all costs for the work required to furnish and install the
5 precast concrete, brick and block, or cast in place chamber, including foundation, adjustment brick, castings and lid, ethafoam
6 cushion, mortar plastering, valves, support piers, water proofing Materials and steps or ladders.

7 4. "Valve Box, Cast Iron", per each

8 The Bid Item price for "Valve Box, Cast Iron" includes all costs for the work required to furnish and install the valve box,
9 including plastic foam cushion.

10 **SECTION 7-13 RESERVED**

11 **SECTION 7-14 HYDRANTS**

12 **7-14.1 DESCRIPTION**

13 See Section 2-12 regarding hydrant use.

14 These Specifications are to be used in conjunction with the AWWA Standard C502 for dry barrel hydrants for ordinary
15 water works service.

16 Section 7-14 describes work consisting of furnishing, installing, and setting the hydrant, hydrant tee, auxiliary valve,
17 restraint system and shackles, gravel drain, concrete blocks, shear block, bleeder, hydrant connection, connection pipe,
18 marker posts, retaining wall and rock facing, coating, painting, excavation, backfilling, furnishing and installing hydrant markers
19 and quick connect adapters when required, flushing, hydrostatic pressure testing, disinfection, and other pertinent Work as
20 specified in other Sections of this Specification.

21 **7-14.2 MATERIAL**

22 Materials must comply with the requirements of Section 9-30.

23 **7-14.3 CONSTRUCTION REQUIREMENTS**

24 **7-14.3(1) SETTING HYDRANTS**

25 Check and tighten any loose bolts on the hydrant before installation.

26 Where shown on the Drawings, install hydrants per the detail shown on Standard Plans 310a - 314. Do not install
27 hydrants within 3 feet of a traveled roadway. In addition, provide a minimum 4-foot radius unobstructed working area around
28 all hydrants. The bottom surface of the breakaway flange must be set 2 inches minimum and 7 inches maximum above the
29 concrete shear block finished grade.

30 For each hydrant requiring vertical adjustment, see Section 7-14.1.

31 All barrel adjustment risers are to be positioned between the hydrant foot assembly and the barrel section provided with
32 the hydrant. The companion extension for the hydrant main stem must be positioned on the valve stem immediately below the
33 stem section contained within the hydrant curb stand or discharge section.

34 After installation, hydrants must be subjected to a hydrostatic test as specified in Section 7-11.3(11).

35 The hydrant excavation must be backfilled and compacted when installation and testing are complete and accepted by
36 the Engineer.

37 Construct a concrete shear block with rebar, as shown by the hydrant details on Standard Plan 310a through 311b, for all
38 hydrants. Construction, Materials, and finishing of the concrete shear block must conform to Section 8-14. The shear block
39 must be set flush with the immediately surrounding finish grade.

40 Flush, test, and disinfect hydrant assemblies as specified in Section 7-11.3. After all installation and testing is completed,
41 paint the hydrants as specified in Section 7-14.3(8).

42 Identify any hydrants not in service by covering with a burlap or plastic bag.

43 **7-14.3(2) HYDRANT CONNECTIONS**

44 **7-14.3(2)A GENERAL**

45 Hydrant laterals must consist of a section of 6-inch ductile iron pipe from the Water Main to the hydrant and must include
46 an auxiliary gate valve set vertically and placed in the line as shown on the Standard Plans.

47 **7-14.3(2)B HYDRANT RESTRAINT**

48 Hydrant assemblies constructed with ductile iron pipe must be restrained with mechanical joint restraint gland such as
49 EBAA Iron Megalug Series 1100 or approved equal.

50 Hydrant assemblies that change existing cast iron hydrant branch pipe must be restrained with two 3/4-inch diameter
51 steel shackle rods as shown on Standard Plans 310a and 311a.

1 Cut threads at the ends or where rod couplers are needed. Slip joint pipe and fittings are not allowed.
2 Completely coat shackle rods, nuts, washers, and couplers as specified in Section 9-30.12.

3 **7-14.3(2)C AUXILIARY GATE VALVE AND VALVE BOX**

4 Install auxiliary gate valves and boxes as specified in Section 7-12. When an auxiliary valve per Standard Plan 311b is to
5 be installed within an area subject to lawful vehicle parking, use a second auxiliary valve in place of the mechanical joint by
6 flange adapter at the inlet of the hydrant. See Standard Plan 310b and 311b for additional hydrant valve requirements.

7 **7-14.3(3) RESETTING EXISTING HYDRANTS**

8 Resetting hydrants, or moving an existing hydrant closer to or farther away from a Water Main on an existing hydrant
9 connection, will be performed by SPU Water Operations.

10 When the Contract specifies the resetting of an existing hydrant, reset the hydrant without disturbing the location of the
11 hydrant lateral tee at the Water Main.

12 Shackle the hydrant as specified in Section 7-14.3(2)B.

13 This work is specified in Section 7-14.3(1).

14 **7-14.3(4) RELOCATING EXISTING HYDRANTS**

15 Relocating hydrants, or moving an existing hydrant and connection pipe to a new location, will be done by SPU Water
16 Operations crews.

17 **7-14.3(5) HYDRANT BARREL EXTENSIONS**

18 The minimum requirements for hydrant barrel extensions, operating stems, and flanged adapters must conform to
19 AWWA C502 in design, Material, and workmanship. The drilling of the flanges on the extensions must match the drilling of the
20 flange that joins the hydrant foot section to the factory-supplied barrel section on the hydrant. All bolts used with barrel
21 connection flanges must engage the flanges through drilled bolt holes. Use slotted bolt holes only on above-grade breakaway
22 flange connections when the function of the breakaway feature requires their use.

23 **7-14.3(6) RETAINING WALLS FOR HYDRANTS**

24 Where indicated on the Drawings, the Contractor must furnish and place a rock facing wall around hydrants per Standard
25 Plan 313 and Standard Plan 141.

26 **7-14.3(7) HYDRANTS ON WATER MAINS THAT ARE POLYETHYLENE ENCASED, MULTI-LAYERED
27 POLYETHYLENE ENCASED, OR SPECIALLY COATED**

28 Unless the Contract specifies otherwise, hydrants installed on special coated Water Mains, such as polyethylene
29 encased, multi-layered polyethylene encased, thermoplastic coated, or other special pipe coating per Contract, require:

- 30 1. Hydrant connections up to and not including the hydrant, see Section 7-14.3(2), must have the same coating as the
- 31 Water Mains to which they are connected, and have Class B bedding as specified in Section 7-10.3(9).
- 32 2. Hydrant barrels below ground must have the same special coating as the Water Main to which they are connected
- 33 with the exception of thermoplastic coating.
- 34 3. Hydrants connected to thermoplastic coated Water Mains must have the hydrant barrel below ground polyethylene
- 35 encased. Thermoplastic coating of the hydrant is not allowed.
- 36 4. Hydrant connection must be installed as specified in Section 7-11.3(6).

37 **7-14.3(8) HYDRANT FIELD PAINTING**

38 **7-14.3(8)A BELOW GROUND COATING**

39 Following hydrant installation and before backfill, any damaged coating on the below ground portion of the hydrant must
40 be repaired with the same coating as recommended by the coating manufacturer and approved by the Engineer.

41 **7-14.3(8)B ABOVE GROUND COATING**

42 After construction of the concrete shear block, the hydrant curb stand section including all exposed surfaces of the
43 sidewalk flange must receive 2 coats of Kelly Moore Luxlite, or approved equal, in Caterpillar yellow. Based on the elevation of
44 the hydrant within the surrounding pressure zone, if the maximum static pressure at the hydrant is less than 60 psi, the engine
45 port cap on the hydrant must be painted with 2 coats of Kelly Moore Luxlite, or approved equal, as indicated by the notes on
46 Standard Plans 310a and 311a.

47 **7-14.4 MEASUREMENT**

48 Measurement for rock facing walls will be as specified in Section 2-13.4 as for the Bid Item "Rock Facing".

49 Measurement for hydrant and hydrant connection will be per each.

50 Measurement for Mineral Aggregate for hydrant walls will be by the ton.

7-14.5 PAYMENT**1. "Hydrant, 6 Inch Connection (Type)", per each**

The Bid item price for "Hydrant, 6-Inch Connection (Type)" includes all costs for the work required to furnish and install on new Water Main (or existing Water Main with existing tee) a complete Type 310 or Type 311 hydrant assembly including but not limited to hydrant, hydrant tee, auxiliary valve, valve box, restraint system and shackles, barrel extension, gravel drain, concrete blocks, shear block, bleeder, hydrant connection, connection pipe, marker posts, retaining wall and rock facing, coating, painting, excavation, backfilling and compaction, disposal, of material furnishing and installing hydrant markers and quick connect adapters when required, flushing, hydrostatic pressure testing, and disinfection.

2. Other payment information

Payment for rock facing will be as specified in Section 2-13.5.

Payment for Mineral Aggregate will be as specified in Section 4-01.5. All costs related to furnishing and installing coatings and field painting as specified in Section 7-14 will be included in the hydrant Bid Item price.

Payment for bedding for polyethylene encased, multi layered polyethylene encased, or special tape coated hydrant connection pipe will be as specified in Section 7-11.5.

All costs associated with installing and removing temporary blocking, and removing existing blocking when specified in the Contract are incidental to the various Bid Items and no separate or additional payment will be made.

SECTION 7-15 WATER SERVICE CONNECTION TRANSFERS**7-15.1 RESERVED****7-15.2 RESERVED****7-15.3 CONSTRUCTION REQUIREMENTS**

Provide the Engineer at least 10 Working Days advance notice when transfer of existing water service is required.

Service transfers may not be done until the new Water Main has been tested and accepted, and then connected.

For service transfers:

1. SPU will, at no cost to the Contractor, mark the exact field locations of service taps and tees on services 2 inches and smaller. Locations of services larger than 2 inches will be identified on the Drawings.
2. The Contractor must make all excavations for the water service connections, including shoring and dewatering.
3. The Contractor must furnish and compact backfill including furnishing and placing temporary pavement patch.

Do not remove or abandon existing pipe until either all existing service connections have been transferred to the new Water Main or temporary service has been provided, and the Engineer approves. Maintain the temporary pavement patch until completion of all work by SPU Water Operations. During construction, make adequate provisions for the care and protection of both Water Mains and water services in use.

Actual scheduling of water service connections and related work will be addressed at the preconstruction conference to take into account the actual number of connections required, least inconvenience to existing water service customers, sequencing of work, and other operation and construction activity needs.

Furnish and install tees, valves, plugs, and valve boxes for 4-inch, 6-inch, or 8-inch service connections. A 3-inch water service is considered a 4-inch water service. The tees must be mechanical joint (MJ) x mechanical joint x flange (FLG). Valves must be MJ x FLG, and removable plugs must be MJ for the service connection. The MJ plugs will be returned to the Contractor after SPU Water Operations completes the service connections.

If existing water service material to be reconnected to the new Water Main is considered substandard material, such as plastic, cast iron, or galvanized iron pipe, SPU will replace it with copper, for 2-inch and smaller, or ductile iron for, 3-inch and larger, from the water service union to the new Water Main.

Upon completion of work by SPU Water Operations, make all final adjustments of valve boxes, water meter boxes, and rings and covers to final grade at no cost to the Owner, and then make the final surface restorations as specified in the Contract.

7-15.4 RESERVED**7-15.5 PAYMENT**

All costs associated with water service connection transfers will be included in the Bid Item prices for the applicable Bid Items and no separate or additional payment will be made.

SECTION 7-16 FLOW CONTROL STRUCTURE AND DETENTION PIPE**7-16.1 DESCRIPTION**

Section 7-16 describes Work consisting of a flow control structure and detention pipe for storm water storage. The flow control structure consists of maintenance hole structure with a flow control device assembly.

1 **7-16.2 MATERIALS**

2 Materials must comply with the requirements of the following Sections:

| Material | Section |
|--|-------------------|
| Flow Control Structure, Conduit, Fittings, and Related | Section 9-05 |
| Maintenance Hole Components | Section 9-12 |
| Non-Shrink Cement Sand Grout | Section 9-04.3(2) |

4
5 Corrugated metal pipe (CMP) flow control systems and detention systems are not allowed in any landslide prone area as
6 defined in SMC 25.05.908, or underneath buildings.

7 Corrugated metal detention pipe and flow control systems per Standard Plan 271a through 271d are for private
8 ownership and maintenance as approved by SDCI. Corrugated metal detention pipe must be aluminized. Do not construct or
9 place galvanized materials in the Storm Drain system.

10 Detention pipe to be owned, or to be maintained, by the City must be reinforced concrete, ductile iron, polypropylene, or
11 steel reinforced polyethylene pipe.

12 **7-16.3 CONSTRUCTION REQUIREMENTS**

13 **7-16.3(1) GENERAL**

14 All work including bedding, pipe installing, and jointing for the construction of detention pipe and flow control Structure is
15 specified in Section 7-05 and Section 7-17.

16 Excavation, backfill, and compaction is specified in Section 2-04, Section 2-10 and Section 2-11.

17 Work in trench excavations over 4 feet deep is subject to the provisions of Section 2-07.

18 **7-16.3(2) FLOW CONTROL DEVICES**

19 **7-16.3(2)A FLOW CONTROL DEVICE ASSEMBLY**

20 Flow control device assembly must be as shown on Standard Plans 272a and 272b. The flow control device assembly
21 and all control elevations must be shown on the Drawings. The limit of variance at each orifice or weir elevation must not
22 exceed ± 0.03 foot.

23 (PVC pipe must be per ASTM D1785, Schedule 40.

24 The PVC orifice plate must be fusion welded to the PVC cross or tee and elbow with an orifice of the diameter indicated
25 on the Drawings in its center.

26 The top of PVC pipe is the overflow weir and its elevation must be shown on the Drawings. The v-notch weir must be
27 dimensioned per the Drawings.

28 Shear gates must be as specified in Section 7-16.3(2)B.

29 **7-16.3(2)B PVC SHEAR GATE**

30 PVC shear gate per Standard Plan 272b must be constructed as part of the flow control device assembly within public
31 flow control Structures within the Right of Way.

32 Locate the lift handle to allow operation of the shear gate by reaching from the surface without entering the flow control
33 structure. Offset the orifice 2 elbow to provide clear operation of the lift handle and orient so it will not interfere with use of the
34 ladder to enter the structure.

35 **7-16.3(3) CORRUGATED METAL DETENTION PIPE**

36 Seams in pipes and bands must be gasketed per AASHTO M 196.

37 The end plate must be welded to the end of the detention pipe with a water tight continuous weld.

38 The end of the detention pipe inside the flow control structure must be ground smooth of all burrs and sharp edges.

39 Aluminum that is to be in contact with a Portland cement product (CDF, concrete, grout, mortar, and other similar
40 products) must be protected as specified in Section 9-05.7(1).

41 See Section 7-16.2 regarding limitations on uses of several Materials.

42 Bedding for the aluminized corrugated metal detention pipe must be Class B, using Mineral Aggregate Type 22 as
43 indicated on the Drawings.

44 Coupling bands for steel detention pipes must comply with the Drawings, Specifications, or the WSDOT Standard Plans.

1 **7-16.3(4) TEE CONNECTION TO CORRUGATED PIPE**

2 Drainage pipes connected to corrugated detention pipe must be made through a shop fabricated tee as shown on the
3 Drawings and installed as specified in Section 7-17.3(2)C2. Tee must be made to conform to the size of detention pipe and
4 drawn to accept only rubber joint pipe.

5 **7-16.3(5) TESTING**

6 Testing of flow control structure and detention pipe for leakage is specified in Section 7-17.3(3)B.

7 Test all detention systems as specified in Section 7-17.3(3)B. Approval will not be given unless the detention system
8 passes this test. Notify the Engineer at least 5 Working Days in advance of testing.

9 **7-16.3(6) TEE CONNECTION TO STEEL REINFORCED POLYETHYLENE**

10 Drainage pipes connected to steel reinforced polyethylene detention pipe must be made only at a prefabricated tee at
11 locations shown on the Drawings. Installation must be in accordance to Section 7-17.3(2)C2 except that cut-in tees are not
12 allowed.

13 **7-16.4 MEASUREMENT**

14 Measurement for "Flow Control Device Assembly" will be by each device complete in place.

15 Measurement for the "Pipe, Detention, (Material) (Size)" will be by linear foot for the actual length of pipe installed from
16 inside face of flow control Structure to center of upstream maintenance hole.

17 Measurement for "Detention Pipe Outlet Connection" is as specified in Section 7-08.4.

18 Measurement for the Maintenance Holes required for the flow control structure or system is as specified in Section 7-
19 05.4.

20 Measurement for protective systems is as specified in Section 2-07.4.

21 **7-16.5 PAYMENT**

22 1. "Flow Control Device Assembly", per each

23 The Bid Item price for "Flow Control Device" includes all costs for the work required to furnish and construct the flow
24 control device, all orifice and weirs, shear gate and lift handle, making the connection with outlet pipe, and flexible adapter
25 coupling.

26 2. "Pipe, Detention, (Material), (Size)", per linear foot

27 The Bid Item price for "Pipe, Detention, (Material), (Size)" includes all costs for the work required to furnish, install, and
28 test for leakage the detention pipe and all applicable work listed for the Bid Item "Pipe, (Use), (Material), (Class), (Size)" of
29 Section 7-17.5.

30 3. Other payment information

31 The outlet pipe of the flow control device will be paid as "Pipe, Detention Pipe Outlet Connection (Material), (Class),
32 (Size)" as specified in Section 7-08.5.

33 The maintenance hole required for the flow control structure or system will be paid as specified in Section 7-05.5.

34 Tees required outside the flow control structure will be paid as specified in Section 7-17.5.

35 Payment for protective systems will be as specified in Section 2-07.5.

36

37 **SECTION 7-17 STORM DRAINS AND SANITARY SEWERS**

38 **7-17.1 DESCRIPTION**

39 Section 7-17 describes Work consisting of foundation preparation, bedding, cut-in tees, pipe installing, jointing, and
40 testing for the construction of Storm Drain, and sanitary and combined Sewer.

41 All reference to "Sewer" in Section 7-17 applies equally to construction of sanitary Sewer, combined Sewer, and Storm
42 Drain. Side Sewer is addressed in Section 7-18.

43 This Work also includes excavation, backfilling and compaction as specified in Section 2-04, Section 2-10, and Section 2-
44 11.

45 Work in excavations over 4 feet deep must comply with Section 2-07.

46 **7-17.2 MATERIALS**

47 **7-17.2(1) GENERAL**

48 Pipe Material used for sanitary Sewers, combined Sewers, and Storm Drains must be as shown on the Drawings and
49 may be one or more of the following:

50

| Flexible Pipe Material | Rigid Pipe Material |
|---------------------------------------|---------------------|
| Polyvinyl Chloride (PVC) | All Concrete |
| Acrylonitrile butadiene styrene (ABS) | Ductile Iron |
| Corrugated Metal | Vitrified Clay |
| Spiral Rib | |
| Polyethylene (PE) | |
| Polypropylene (PP) | |
| Steel Reinforced Polyethylene | |

It is not intended that Materials listed be considered equal or generally interchangeable for all applications. The Materials suitable for the project are specified in the Contract.

Pipe must have flexible gasketed joints unless otherwise specified in the Contract.

Materials must comply with the requirements of the following Sections:

| Material | Section |
|--|--------------|
| Joint Materials and Non-Shrink Cement Sand Grout | Section 9-04 |
| Pipe | Section 9-05 |
| Pipe Bedding & Trench Backfill | Section 2-10 |

All pipe must be clearly marked with the name of the manufacturer, class of pipe, date of manufacture, and location of manufacturing facility. Concrete pipe must also be marked with the wall thickness of the pipe. Lettering must be legible and permanent under normal conditions of handling and storage. Concrete pipe with elliptical reinforcement must be clearly marked on the inside and outside of the pipe along the minor axis to identify top and bottom.

After installation, test pipe as specified in Section 7-17.3(3).

7-17.2(2) PROOF TESTS (PREQUALIFICATION)

The intent of this requirement is to prequalify a joint system, components of which comply with the above requirements, as to the water tightness of that joint system. This proof test applies to all pipes that will be tested for water tightness before acceptance. Materials and test equipment for proof testing must be provided by the manufacturer. When approved by the Engineer, internal hydrostatic pressure may be applied by a suitable joint tester. See test requirements in Section 9-04.

7-17.2(3) MATERIAL CERTIFICATION

The manufacturer or fabricator must furnish a manufacturer’s certificate of compliance based on manufacturer’s routine quality control tests that confirms the pipe meets or exceeds the requirements of the pertinent ASTM or ANSI specification.

7-17.3 CONSTRUCTION REQUIREMENTS

7-17.3(1) PIPE BEDDING

Install bedding of the class or classes shown on the Drawings, including all Materials and work within the limits of the bedding zones, as shown on Standard Plan 285.

Unless otherwise specified in the Contract, bedding for ductile iron pipe must be Class D and bedding for all other rigid and flexible pipe must be Class B.

All classes of bedding must provide uniform support along the entire pipe barrel, without load concentration at joint collars or bells. Do not use blocking of any kind to adjust the pipe to grade except when used with embedment concrete. Excavate bell holes as required to ensure uniform support along the pipe barrel. Bedding disturbed by pipe movement, removal of shoring, or movement of a trench shield or box must be reconsolidated before backfill. Provide adequate bedding support at wye or tee connections and adjacent to maintenance holes or other Structures to avoid bending or shearing stresses at these critical points.

7-17.3(1)A BEDDING FOR CONCRETE PIPE

Bedding must be Class B or Class C. The requirements and limits for the various classes of bedding are as shown on Standard Plan 285 and are described as:

- Class B bedding: Class B bedding of Type 9 Mineral Aggregate must be placed in at least 3 lifts. Place the first lift before the pipe is installed at a minimum of 4 to 6 inches in thickness, shown as dimension A on Standard Plan 285. Spread the Material smoothly so the pipe is uniformly supported along the barrel with bell holes provided at each joint. Subsequent lifts of not more than 6 inches must be brought up to a point 6 inches above the top of the pipe. Bring each lift up on both sides of the pipe equally and carefully work under the pipe haunches by slicing with a

1 shovel, vibration, or other approved procedures. Compact bedding to 90 percent maximum dry density as determined
2 by methods specified in Section 2-11.

3 2. Class C bedding: Class C bedding must be the same as for Class B except that the Type 9 Mineral Aggregate
4 extends only to the springline of the pipe. From the springline, place selected native Material in 6-inch lifts to 6 inches
5 above the pipe, using the same methods as those required for Class B bedding. Compact Mineral Aggregate Type 9
6 to 90 percent maximum dry density as determined by methods specified in Section 2-11. Compact native Material as
7 specified in Section 2-11.

8 Where unauthorized excavation has been made below the established grade, the Contractor must provide, place, and
9 compact suitable bedding Material to the proper grade and elevation at no cost to the Owner. If the Engineer substitutes
10 imported Mineral Aggregate Type 9, instead of the selected native Material shown for Class C bedding on Standard Plan 285,
11 the bedding will be measured and paid for as "Bedding, Class B, (Size) Pipe."

12 **7-17.3(1)B BEDDING FOR FLEXIBLE PIPE**

13 Bedding for flexible pipe is specified in Section 7-17.3(1)A except:

14 1. Bedding Material must be Mineral Aggregate Type 22.

15 **7-17.3(1)C BEDDING FOR VITRIFIED CLAY PIPE**

16 Bedding for vitrified clay pipe is specified in Section 7-17.3(1)A except:

17 1. Bedding Material must be Mineral Aggregate Type 22.

18 2. Class B bedding must have a load factor of 2.2.

19 3. Class C bedding must have a load factor of 1.9.

20 **7-17.3(1)D BEDDING FOR DUCTILE IRON PIPE**

21 Bedding for ductile iron pipe is specified in Section 7-17.3(1)A except:

22 1. Class D Bedding: Class D bedding must be attained by carefully excavating the trench to proper grade, over-
23 excavating at the bell sections, and placing and compacting selected native Material around the pipe. Class D
24 bedding, backfill, and compaction must be as specified in Section 2-10 and Section 2-11.

25 If the Engineer substitutes imported Mineral Aggregate instead of the selected native Material shown for Class C and for
26 Class D bedding on Standard Plan 285, the bedding will be measured and paid for as "Bedding, Class B, (Size) Pipe."

27 **7-17.3(2) INSTALLING SEWER PIPE**

28 **7-17.3(2)A SURVEY LINE AND GRADE**

29 Install pipe to the true line and grade specified in the Contract at the invert of the pipe. The variance at the invert must not
30 exceed ± 0.03 feet from true line and grade when backfilling, and must not result in reverse flow or a sag. Checking of the
31 invert elevation of the pipe may be made by calculations from measurements on the top of the pipe.

32 The Contractor may use any method, such as "laser beam," which would allow accurate transfer of the control points
33 provided by the Engineer to installing the pipe to the designated alignment and grade.

34 When using a laser beam to set pipe alignment and grade, constantly check position of the laser beam from surface hubs
35 provided by the Contractor to verify laser beam alignment and grade. In the event the laser beam is found out of position, stop
36 work and make necessary corrections to the laser beam equipment and to pipe installed.

37 **7-17.3(2)B PIPE INSTALLATION AND JOINTING**

38 **7-17.3(2)B1 PIPE INSTALLATION**

39 After an accurate grade line has been established, install the pipe in the properly dewatered trench. Keep mud, silt,
40 gravel, and other foreign Material out of the pipe. Keep pipe joints clean and protected at all times, and lubricated as
41 recommended by the pipe manufacturer before joining.

42 Keep all pipe installed in the trench in longitudinal compression until the bedding has been placed and compacted around
43 and over the pipe.

44 Exercise care in matching pipe joints for concentricity and compatibility. Do not join 2 pipes together with ends
45 exceeding the maximum manufacturer's tolerance.

46 Install the pipe in the up-grade direction from the point of connection from either the existing pipe or the designated
47 Structure as the starting point. Install the pipe with the bell end forward or upgrade.

48 When pipe installation is not in progress, any open end of the pipe must be sealed with an approved temporary water
49 tight plug.

50 **7-17.3(2)B2 JOINTS ON CURVES**

51 Where pipelines will be installed on specified curves of sufficiently short radius to deflect the pipe joints in an amount
52 greater than recommended by the pipe manufacturer, the curves must be achieved with a series of tangents and shop

1 fabricated bends complying with the pipe manufacturer's recommendations as approved by the Engineer. Submit the pipe
2 manufacturer's recommendations at least 5 Working Days in advance.

3 Hand mortared pipe joints are not allowed. All joints must be water tight and comply with the applicable test requirements
4 specified in Section 7-17.3(3).

5 See Section 7-17.3(2)D for gasketed and compression sealed jointing.

6 **7-17.3(2)C PLUGS AND CONNECTIONS**

7 **7-17.3(2)C1 GENERAL**

8 Make connections to new and existing pipe with a tee, unless indicated otherwise in the Contract. Except for concrete
9 pipe, all tees on new pipe less than 24-inch inside diameter must be prefabricated.

10 Connections to existing pipe must comply with SPU Core Tap Procedures for Storm and Sewer Mains, whether SPU or
11 the Contractor is coring and installing a new tee. SPU will core and install tees on existing pipe when shown on the Drawings
12 and the Contractor must schedule the work and provide all materials and support functions.

13 Fittings must be sized to maintain smooth transitions and inside diameter of the mainline pipe. If reducers are shown on
14 the Drawings, coupling must maintain a smooth and continuous pipe invert.

15 All fittings must be capped or plugged with a plug of an approved Material gasketed with the same gasket Material as the
16 pipe unit, or have an integrally cast knockout plug. If the Contractor wishes to substitute a mechanical stopper, the
17 manufacturer's catalog cuts and installation recommendations must be submitted to the Engineer at least 5 Working Days in
18 advance. The plug must be able to withstand all test pressures without leaking, and when later removed, must allow
19 continuation of piping with jointing similar to joints in the installed line.

20 **7-17.3(2)C2 TEE FITTINGS**

21 Unless otherwise specified in the Contract, provide tee fittings in the Sewer and Storm Drains for side Sewers, catch
22 basin connections and service drains. Tees must be 8 inches inside diameter, except tees for side Sewers must be 6 inches
23 inside diameter unless indicated otherwise in the Contract. All fittings must be of sufficient strength to withstand all handling
24 and load stresses normally encountered. All fittings must be of the same Materials as the pipe, except when core drilling to
25 insert a tee, which must be as specified in Section 7-17.3(2)C3. Material joining the fittings to the pipe must be free from
26 cracks and adhere tightly to each joining surface. Fittings must make for a water tight connection meeting the requirements
27 specified in Section 7-17.3(3).

28 Install the tee at locations and alignments shown on the Drawings. When tee alignment is not shown on the Drawings,
29 position the tee no higher than a 45 degree angle above springline and no lower than a 30 degree angle above springline.

30 **7-17.3(2)C3 CUT IN TEE ON EXISTING OR NEW PIPE**

31 For information on SPU Core Tap Procedures for Storm and Sewer Mains, go to:

32 http://www.seattle.gov/util/cs/groups/public/@spu/@esb/documents/webcontent/spu01_002534.pdf

33 Unless the Contract indicates otherwise, locate and cut a hole in the existing or new pipe centered at a 30 to 45 degree
34 angle above the springline and sized for proper fit of the lateral tee material. Springline is defined as the widest cross-section
35 of the host pipe measured horizontally. The cored out piece or other materials must not drop into the pipe. Notify the Engineer
36 at least 2 Working Days in advance of cut in tee operation. For manufactured tee products, installation must be per the
37 manufacturer's recommendations for the specific host pipe material and size for the specific lateral pipe material and size. For
38 pipe connection types not specified in the Drawings, in this Section, or the SPU Core Tap Procedures for Storm and Sewer
39 Mains, submit a proposed method of connection to the Engineer for review.

40 Cut-in tees must be installed per the following:

- 41 1. Concrete pipe tee to concrete pipe: A concrete tee may be installed on an existing concrete pipe 18 inches in
42 diameter or larger by placing a short length of concrete pipe into the core drilled hole with its bell end against the
43 outside face of the pipe and the barrel end inserted just to the inside face of the pipe. Thoroughly clean the bonding
44 areas between the tee and the pipe so that the surfaces are free of dirt, dust, grease, oil or other contaminants that
45 may reduce the bond between the grout and the pipe surfaces. First coat both surfaces with a concrete bonding
46 agent submitted for review and accepted by the Engineer. Then tightly pack the annular space between the tee and
47 the core drilled surfaces with non-shrink cement sand grout meeting the requirements of Section 9-04.3(2). The
48 connection must be neatly finished inside and outside the existing concrete pipe.
- 49 2. Ductile iron tee to existing concrete pipe: Core drill the existing concrete pipe with a hole large enough to
50 accommodate the barrel of the specified size of ductile iron pipe and provide a 1-inch space between ductile iron pipe
51 and the existing concrete pipe for application of grout. Cut a length of ductile iron pipe so that it can be placed in the
52 core drilled hole with its bell end against the outside face of the existing pipe without the barrel protruding beyond the
53 inside face of the existing pipe. Clean the outside of the ductile iron pipe, removing loose particles, dust, dirt, oil, or
54 film of any sort that may reduce the bond between the grout and the pipe. After core drilling, the exposed surface of
55 the existing concrete pipe must be rough and clean. Coat both surfaces with a bonding agent submitted for review
56 and approved by the Engineer. Tightly pack the annular space between the pipe and core drilled surfaces with non-
57 shrink cement sand grout meeting the requirements of Section 9-04.3(2). The connection must be neatly finished
58 inside and outside the existing concrete pipe.

- 1 3. Corrugated metal tee to corrugated metal pipe: In corrugated steel and aluminum pipes, sawcut a hole to match a
2 shop fabricated tee as shown on Standard Plan 279.

3 The flange plate of the fabricated tee must be corrugated to match corrugation of the pipe to which it is attached.
4 Insert a neoprene gasket or approved equal between the outside face of the existing pipe and the flange plate of the
5 tee and connect by bolting. Provide corrosion protection if the pipe section of the tee is non-corrugated aluminum
6 pipe.

7 Connect the incoming pipe and the tee using a flexible gasketed coupling with stainless steel shielding as specified in
8 Section 9-05.18. If the pipe section of the tee is aluminum, provide corrosion protection by isolating the aluminum
9 from the steel by extending the gasket 1 inch beyond the edge of the stainless steel coupling.

- 10 4. Compression seal inserted tee to clay, or concrete pipe: The Contractor must submit the method and type of tee
11 recommended by the tee manufacturer to the Engineer for approval at least 5 Working Days in advance. Core drill a
12 full size hole in 1 operation to accommodate an Engineer approved PVC tee insert with a coupling fitting.

13 All existing pipe, 24-inch and smaller diameter, must be fully exposed for inspection and securing the coring machine to
14 the pipe.

15 Restore the bedding as specified in Section **Error! Reference source not found.**. Notify the Engineer at least 2 Working
16 Days before starting cut-in operations. The Engineer will inspect existing pipe for defects before the drilling or cutting operation
17 starts, again during drilling or cutting operations, and after installation of the tee is completed to make certain that no defective
18 parts or work remain undetected and uncorrected. If the exposed pipe is found cracked or deformed, the Engineer will arrange
19 for either roll in of a new pipe, or repair of the damage at no cost to the Contractor, provided the damage was not caused by
20 the Contractor's operations. If the Engineer rolls in a new pipe with a tee already on it, no fitting will be required.

21 **7-17.3(2)D GASKETED AND COMPRESSION SEALED JOINTS**

22 Pipe handling after the gasket has been affixed must be carefully controlled to avoid disturbing the gasket and knocking it
23 out of position, or contaminating it with dirt or other foreign Material. Any gaskets so disturbed must be removed, cleaned,
24 replaced, and relubricated before joining the sections.

25 Pipe with bonded compression seals must be handled so that no damage occurs to the seal or its bond with the pipe.
26 Store pipe such that the pipe does not rest on the compression seal. Pipe with bonded compression seals determined by the
27 Engineer to be damaged in any way will be rejected and not incorporated in the Work.

28 Properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe must be
29 partially supported by hand, sling, or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity
30 until the gasket is properly positioned. Since most joints tend to creep apart when the end pipe is deflected and straightened,
31 such movement must be held to a minimum once the joint is home.

32 Apply sufficient pressure in making the joint to ensure that it is home, as described in the standard installation
33 instructions provided by the pipe manufacturer. Apply sufficient restraint to the line to ensure that joints, once home, are held
34 so until fill Material under and alongside the pipe has been sufficiently compacted. At the end of the Working Day, block the
35 last pipe in an effective way to prevent creep.

36 Where pipe must be deflected to accommodate required horizontal or vertical curvature, it must first be joined in straight
37 alignment and then deflected as required. See Section 7-17.3(2)B2 for hand mortar joints and joints on curved pipe.

38 **7-17.3(2)E JOINTING – BREAK-OUT AND RECONNECT AND MISMATCHED WALL THICKNESS**

39 Where it is necessary to break out or connect to an existing pipe, use new pipe of the same inside diameter to reconnect
40 the pipeline. Inverts, grade, and alignments must match.

41 Where joints must be made between pipes with a mismatched wall thickness, the Contractor must measure the outside
42 diameter of both pipes to the hundredth of an inch, and install a coupling manufactured to the actual dimensions for each pipe
43 to be connected. A record of the measurement of the pipes and the coupling Manufacturer's model number installed must be
44 submitted to the Engineer as specified in Section 1-05.3.

45 Couplings must be flexible gasketed couplings with stainless steel shielding, adapters, or coupling-adapters, as specified
46 in Section 9-05.18, to make a watertight joint that maintains the internal pipe alignment.

47 **7-17.3(2)F STORM DRAIN AND SEWER CONNECTIONS**

48 Catch basin installation must be as specified in Section 7-08. Service drain and side Sewer connections must be as
49 specified in Section 7-18.

50 Catch basin, service drain, or side Sewer connections to Sewer and Storm Drain trunks, mains, or laterals, must be left
51 uncovered until after the Engineer has inspected and approved the Work. Complete the bedding and trench backfill Work after
52 approval of the connection.

53 **7-17.3(2)G PROTECTION OF EXISTING SEWER FACILITIES**

54 Keep all existing live Sewers including septic tanks and drain fields in service at all times. Provide for disposal of sewage
55 flow if any existing Sewer is damaged.

56 Water accumulating during construction must be removed from the new pipeline but is not permitted to enter the existing
57 system. The Contractor is responsible for flushing out and cleaning any existing pipeline into which gravel, rocks, or other

1 debris has entered as a result of his/her operations, and must repair lift stations or other facilities damaged by his/her
2 operations.

3 Do not make the physical connection to an existing maintenance hole or pipeline until authorized by the Engineer. Such
4 authorization will not be given until all upstream lines have been completely cleaned, all debris removed and, where
5 applicable, a pipe has been temporarily placed in the existing channel and sealed.

6 **7-17.3(2)H TRENCHLESS CONSTRUCTION AND CASING PIPE**

7 **7-17.3(2)H1 GENERAL**

8 Directional drilling must be as specified in Section 2-16. Trenchless construction except directional drilling, qualifications
9 of the trenchless construction Contractor, casing pipe, and carrier pipe, spacers, and end seals must be as specified in the
10 Contract.

11 **7-17.3(2)H2 CASING PIPE, SPACERS AND END SEALING**

12 When casing pipe is required, and the size and gauge of pipe has not been specified in the Contract, select the gauge
13 and size of the casing pipe compatible with the construction operation and surrounding loading conditions. Prevent caving
14 ahead or around the casing, which would create voids outside the casing pipe.

15 When the Contract does not specify spacers and end seal, the carrier pipe must be carefully skidded through the casing
16 pipe and adjusted to the line and grade shown on the Drawing. The annular space between the casing and carrier pipes must
17 be filled with Material specified in the Contract.

18 When the Contract specifies using spacers and end seals, submit the spacer type and layout and method of adjustment
19 to maintain the line and grade shown on the Drawing. Submit spacer and end seal manufacturer's catalog cuts and installation
20 instructions to the Engineer at least 5 Working Days in advance of this work.

21 **7-17.3(2)H3 TRENCHLESS CONSTRUCTION**

22 Where indicated on the Drawings, install pipe by trenchless construction methods including jacking, auguring, tunneling,
23 microtunneling, pipe bursting, or any other trenchless technology method or use of rapid excavation machine except
24 directional drilling, including installing the pipe in a casing pipe, or by any combination of these methods.

25 Ground support in portal areas, shafts, and pits, whether launch, intermediate, or receiving, must be designed to support
26 adjacent structures, support the sides of excavation, and withstand all forces from jacking and other operations.

27 Safety rules and standards must comply with Section 1-07.1(2). At least 1 assigned person must be on duty above
28 ground whenever any employee is working underground. The Contractor must have in place communications, hoisting
29 equipment, emergency provisions, air quality monitoring, and ventilation equipment as necessary.

30 Excluding directional drilling as specified in Section 2-16, at least 20 Working Days in advance of underground
31 construction activities, submit 8 sets of a single Shop Drawing and all necessary calculations describing these activities:

- 32 1. Dimensions of shaft, pit, or portal.
- 33 2. Method of shaft excavation, shoring installation, maintenance and removal, and all supporting equipment.
- 34 3. Method of trenchless construction and all supporting equipment.
- 35 4. Control and monitoring equipment, including provisions to maintain line and grade, minimize over excavation and
36 control the face of the excavation.
- 37 5. Staging and surface support, including waste disposal, including slurry handling and disposal, when applicable, as
38 specified in Section 1-05.3.
- 39 6. Qualifications of trenchless construction Contractor. The submittal must include the name of the assigned person.

40 The material, procedure, and equipment used by the Contractor does not relieve the Contractor of responsibilities nor
41 waive or change any provisions of the Contract.

42 **7-17.3(2)I TEMPORARY SEWER BYPASS**

43 Install a temporary bypass to maintain uninterrupted Sewer service on projects calling for reconstruction of existing
44 Sewer mains or on projects where construction Work will interfere with sewage flow in the existing Sewer. The bypass must be
45 made by diverting the effluent flow at an upstream access maintenance hole and pumping it through a separate conduit to a
46 downstream reentry point or to an adjacent Sewer system. The pump and bypass conduit must be of adequate size and
47 capacity to handle the flow. Do not allow the effluent level in the bypass pumping maintenance hole to rise more than 1 foot
48 above the crown of the incoming Sewer pipe. Conduct work in such a manner as to comply with the requirements of Section 1-
49 07.

50 Submit a written proposal for bypassing the remaining portion of the Sewer system and the list of all equipment to be
51 used for the Work , allowing at least 10 Working Days for review and return of comments. The Engineer's review does not
52 relieve the Contractor of its responsibilities or of any public liability for sewage spills under this Contract.

1 7-17.3(3) CLEANING AND TESTING**2 7-17.3(3)A GENERAL**

3 After backfilling, pipelines and appurtenances must be cleaned, television inspected, and tested using the low pressure
4 air method. Infiltration testing is additionally required when the ground water elevation is in, or fluctuates through the pipe
5 zone. Substitute exfiltration testing for the low pressure air method when the pipe or detention system is in or near, as
6 specified in the Contract, Environmentally Critical Areas designated as geologically hazardous areas.

7 All required work involving cleaning and testing pipelines between maintenance holes or rodding inlets must be
8 completed within 15 Working Days after backfilling of pipelines and Structures. Any delay must be submitted to the Engineer
9 well in advance and requires the written consent of the Engineer. The Contractor must furnish all labor, Materials, tools, and
10 equipment necessary to perform the test, clean the lines, and perform all related Work. The Contractor must perform the tests
11 in the presence of the Engineer. All testing must be accepted by the Engineer, before final pavement restorations. Prevent
12 joints from drawing apart during tests. The Contractor must repair any damage resulting from these tests. The manner and
13 time of testing are subject to approval by the Engineer.

14 Plug all wyes, tees, and stubs using test tees, or acceptable alternate, securely fastened to withstand the internal test
15 pressure. Such test tees must be readily removable, and their removal must provide a socket suitable for making a flexible
16 jointed lateral connection or extension.

17 Flexible pipe must comply with the deflection testing requirements of Section 7-17.3(3)F.

18 Testing of side Sewers including runoff and downspout connections must comply with the requirements of Section 7-
19 18.3(6).

20 Television inspection is specified in Section 7-17.3(3)G.

21 7-17.3(3)A1 PIPE NOT PASSING TESTING

22 If any pipeline installation fails to comply with the requirements of the test method used, or is indicated as defective by
23 television inspection, determine the source or sources of leakage and replace all defective pipe. A new test method cannot be
24 substituted to demonstrate passing, except with the written consent of the Engineer.

25 Should the Contractor believe the pipe which is damaged, or which failed the test, can be repaired by methods other than
26 remove and replace, the Contractor must submit a repair method for approval by the Engineer at least 5 Working Days in
27 advance. Do not replace or repair defective pipe until the method is approved. The replaced or repaired pipe must be
28 reinspected and retested at no additional cost to the Owner.

29 All lateral or side Sewer branches included in the test section must be taken into account in computing allowable
30 leakage.

31 Upon final acceptance of the Work, all Sewers, side Sewers and fittings must be open, clean, and free draining.

32 7-17.3(3)B EXFILTRATION TEST

33 Before making exfiltration leakage tests, the Contractor may fill the pipe with clear water to allow normal absorption into
34 the pipe walls, provided that after filling the pipe the leakage test is completed within 24 hours. When under test, the allowable
35 leakage is limited according to the provisions that follow. Specified allowances assume pre-wetted pipe.

36 Leakage must be less than 0.28 gph per inch inside diameter per 100 linear feet of pipe, with a hydrostatic head of 6 feet
37 above the crown at the upper end of the test section, or above the natural groundwater table during test, whichever is higher.
38 The length of pipe tested must be limited so the pressure at the lower end of the section tested does not exceed 16 feet of
39 head above the invert, and in no case can the length be greater than 700 linear feet or the distance between maintenance
40 holes when greater than 700 linear feet.

41 Where the test head is not 6 feet, the measured leakage must not exceed 0.28 gph per inch inside diameter per 100
42 linear feet times the ratio of the square root of the test head to the square root of 6.

$$43 \text{ Leakage maximum} = 0.28 \times \sqrt{H} / \sqrt{6} = 0.114 \times \sqrt{H}$$

44 Where:

45 Leakage is in gph/inch inside diameter/100 linear feet.

46
47
48 When the test is made 1 joint at a time, the leakage per joint must not exceed the computed allowable leakage per length
49 of pipe.

50 An allowance of 0.2 gallons per hour per foot of head above invert must be made for each maintenance hole included in
51 a test section.

52 7-17.3(3)C INFILTRATION TEST

53 Acceptance may be based on no visible leakage when the Engineer observes the pipe directly or through CCTV after
54 groundwater pumping has been discontinued for a minimum of 24 hours and the Engineer determines the ground water
55 elevation is at a suitable head above the crown of the pipe to represent the expected operational conditions.

1 When leakage is observed, the Contractor may select to measure the infiltration rate. Testing must be from
 2 maintenance hole to maintenance hole. For vitrified clay pipe, infiltration testing and acceptance must be per ASTM C1091.
 3 For concrete pipe, infiltration testing and acceptance must be per ASTM C969.

4 **7-17.3(3)D AIR PRESSURE TEST**

5 Conduct air pressure testing after the pipe has been backfilled and before paving.

6 Pipe with inside diameter of 42 inches and less may be tested from maintenance hole to maintenance hole or on shorter
 7 lengths at the Contractor's option. Pipe greater than 42 inches in diameter must be tested at all joints individually and in
 8 consecutive order along the entire line.

9 The Contractor must furnish the test equipment to be used, which must be inspected and approved by the Engineer
 10 before use. The Engineer may at any time require a calibration test of gauges, other instrumentation, and equipment used for
 11 this test.

12 Safety Provisions: Plugs used to close the Sewer pipe for the air test must be securely braced to prevent the
 13 unintentional release or loosening of a plug. Gauges, air piping manifolds, and valves must be at the ground surface. No
 14 person is permitted to enter a maintenance hole where a plugged pipe is pressurized. Four pounds per square inch gauge
 15 (psig) air pressure develops a force against the plug in a 12-inch diameter pipe of approximately 450 pounds, and over 5,000
 16 pounds in a 42-inch diameter pipe. Plug failure may result in injury or death. Air testing apparatus must be equipped with a
 17 pressure release device designed to relieve pressure in the pipe at a pressure recommended by the pipe manufacturer.
 18 Submit the pipe manufacturer's recommendations to the Engineer including the safety precautions for pipe testing.

19 **7-17.3(3)D1 TEST TIME**

20 The table below shows the required test time, T, in minutes/100 feet of pipe for each nominal pipe size. Test times are for
 21 a 1.0-psi pressure drop from 3.5 to 2.5 psi. If a 1 psi drop does not occur within the test time, the line has passed. If the
 22 pressure drop is more than 1 psi during the test time, the line has failed the test.

23 **Minimum Test Time for Pipe Sizes 4" to 42"**

24

| Nominal Pipe Size, in | T (time) min/100 ft. |
|-----------------------|----------------------|
| 4 | 0.3 |
| 6 | 0.7 |
| 8 | 1.2 |
| 10 | 1.5 |
| 12 | 1.8 |
| 15 | 2.1 |
| 18 | 2.4 |
| 21 | 3.0 |
| 24 | 3.6 |
| 27 | 4.2 |
| 30 | 4.8 |
| 33 | 5.4 |
| 36 | 6.0 |
| 39 | 6.6 |
| 42 | 7.3 |

25
 26 To calculate test times or allowable air loss for nominal pipe sizes not in the minimum test time table, the Contractor has
 27 the option to calculate test times and allowable air loss, or to use the time associated with the next higher pipe size in the
 28 table.

29 Calculate the required test time at a given allowable air loss as follows:

$$T = K \times (D^2L / Q)$$

31 Calculate air loss with a timed pressure drop as follows:

$$Q = K \times (D^2L / T)$$

33 Where:

34 D = nominal size, inches

35 K = 0.371 x 10⁻³ for inch-pound units

36 L = length of line of 1 pipe size, ft

37 Q = air loss, ft³/min

1 T = time for pressure to drop 1.0 psi, min

2 **7-17.3(3)D2 GENERAL PROCEDURE FOR CONDUCTING ACCEPTANCE TEST BY PRESSURE DROP METHOD**

3 1. Plug all pipe outlets with suitable test plugs. Brace each plug securely.

4 2. All gauge pressures in the test must be increased by the amount of groundwater pressure at the center of the pipe.

5 3. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.

6 4. After an internal pressure of 4.0 psig is obtained allow at least 2 minutes for air temperature to stabilize, adding only
7 the amount of air required to maintain pressure.

8 5. After the 2 minute period, disconnect air supply.

9 6. When pressure has decreased to 3.5 psig, start stop watch. Determine the time in seconds that is required for the
10 internal air pressure to reach 2.5 psig. This time interval must then be compared with the time specified in Section 7-
11 17.3(3)D1.

12 7. If the pressure has not dropped to 2.5 psig in the time specified in Section 7-17.3(3)D1, then the test may be
13 terminated and the test section has passed the low pressure air test.

14 **7-17.3(3)E HYDROSTATIC TEST FOR SEWER FORCE MAINS**

15 **7-17.3(3)E1 GENERAL**

16 All force mains and appurtenances must be subjected to hydrostatic pressure testing as soon as possible after they are
17 installed and backfilled.

18 **7-17.3(3)E2 EQUIPMENT**

19 The Contractor must furnish the following equipment for the hydrostatic tests:

| Amount | Description |
|--------|---|
| 2 | Approved graduated containers |
| 2 | Pressure gauges |
| 1 | Hydraulic force pump approved by the Engineer |
| | Suitable hose and suction pipe as required |

21
22 Pressure gauges must be calibrated within 6 months of hydrostatic testing. At least 2 Working Days before using the
23 pressure gauge, provide a manufacturer's certificate of compliance stating the date of calibration.

24 **7-17.3(3)E3 PROCEDURE**

25 Use clean water or approved reclaimed water as the hydrostatic test fluid. All parts of the piping system must be
26 subjected to a minimum test pressure of 50 psi plus pressure head required to overcome pumping height.

27 Where any section of pipe is provided with concrete thrust blocking, do not make the pressure test until at least 5 Days
28 have elapsed after the thrust blocking is installed. If high early cement is used for thrust blocking, the time may be reduced to
29 no less than 2 days.

30 The Contractor must provide all temporary plugs, caps, and thrust blocking and all closure sections and couplings
31 required to test the pipeline in sections at the specified test pressure.

32 **7-17.3(3)E4 DURATION**

33 The duration of each pressure test must be a minimum of 1 hour. A leakage test of at least 2 hours duration must
34 immediately follow the pressure test.

35 **7-17.3(3)E5 EXPELLING AIR AND FILLING PIPE**

36 Before applying the specified test pressure, expel all air from the pipe by slowly filling the pipe with water and allow to
37 stand for 48 hours before testing.

38 **7-17.3(3)E6 PRESSURE TEST**

39 Test pressures must be applied by a pump connected to the pipe. Apply the test pressure and operate the pump as
40 necessary to maintain the test pressure at its full value for the entire duration of the pressure test.

41 **7-17.3(3)E7 LEAKAGE TEST**

42 For the leakage test, the pump suction must be in a barrel or similar device or metered so the quantity of water put into
43 the pipeline can be accurately measured. Apply the test pressure and operate the pump as necessary to maintain the pressure
44 in the pipeline at a minimum of 90 percent of the test pressure for the entire duration of the leakage test. At the end of the test
45 period operate the pump until the test pressure is again attained. Leakage is defined as the quantity of makeup water required

1 to maintain the pipeline pressure during the test and to restore the test pressure at the end of the test period. No pipe
 2 installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following
 3 formula:

$$L = N \times D \times (P)^{1/2} / 1850$$

6 Where:

7 L = Allowable leakage, in gallons per hour

8 N =Number of joints in the length of pipe tested.

9 D =Nominal diameter of pipe, in inches.

10 P =Average test pressure during the leakage test, in pounds per square inch gauge.

11 **7-17.3(3)E8 CORRECTION OF EXCESSIVE LEAKAGE**

12 Should any test of pipe indicate leakage greater than that allowed, locate and repair the defective joints or pipe until the
 13 leakage from subsequent testing is within the specified allowance. Submit the method of repair to the Engineer for approval at
 14 least 3 Working Days in advance.

15 **7-17.3(3)F DEFLECTION TEST FOR FLEXIBLE PIPE**

16 All Sewer and Storm Drain constructed of flexible pipe must be tested for vertical deflection no less than 30 Days after
 17 trench backfill and compaction have been completed, and before pavement restoration. Diameter of the installed pipe must not
 18 exceed a tolerance of more than 5 percent for 12-inch and smaller nominal diameter pipe, and no more than 3 percent for all
 19 larger than 12-inch nominal diameter pipe and less than or equal to 30-inch nominal diameter pipe.

20 For pipes less than or equal to 30 inches nominal diameter, pull a mandrel through the pipe by hand to ensure the
 21 maximum allowable deflection has not been exceeded. Before use, the mandrel must be measured, inspected for roundness,
 22 and certified as being sound and accurate. A manufacturer’s certificate of compliance stating the mandrel to be used meets
 23 these Specifications must be submitted to the Engineer at least 1 Working Day before the test. The use of an uncertified
 24 mandrel or a mandrel changed or modified after certification will invalidate the test, requiring a 2 Working Day advance
 25 notification to the Engineer of a retest with a certified mandrel. If the mandrel fails to pass through the pipe, the pipe will be
 26 deemed overdeflected and unacceptable.

27 Pipe large enough for a person to work inside it may be accepted on the basis of direct measurements rather than using
 28 a mandrel. Submit a method for making deflection measurements including the measurement device, how the measurement
 29 device is verified as providing reasonably repeatable results, how mark points will be placed on the pipe for the deflection
 30 measurements, and how the measurement data at each test location is presented to demonstrate that any indicated deflection
 31 is within the tolerances allowed. The Engineer may determine the number of measurements and the orientations of each
 32 measurement at each test location. The minimum number of orientations per test location must be 3 in equal angle
 33 projections, at 0 degrees, 60 degrees, and 120 degrees. The Engineer also may determine the number of test locations. The
 34 minimum number of test locations on any single section of pipe is 2, and at least 3 pipe sections will be tested, and at least 3
 35 pipe sections tested per any 100-foot length of pipeline.

36 Testing must be conducted on a maintenance hole to maintenance hole basis after the line has been thoroughly flushed
 37 with water. If testing reveals an overdeflected pipe, it will be uncovered and, if not damaged from overdeflection or from
 38 excavation activities, the pipe may be corrected and reinstalled. If the pipe requires repair, submit the proposed repair to the
 39 Engineer for approval at least 3 Working Days before making the repair. Before performing the repair, provide a
 40 manufacturer’s certificate of compliance stating that the overdeflected pipe as repaired will acceptably perform as required by
 41 the Specifications. If no repair is recommended, the Contractor must submit a written statement that includes the reason why
 42 the pipe requires no repair, and provide a manufacturer’s certificate of compliance stating that the pipe, without repair, will
 43 acceptably perform as specified. Any pipe damaged beyond reasonable repair, due to overdeflection or from any other cause,
 44 must be uncovered and removed from the Project Site and replaced with a new pipe at no cost to the Owner.

45 The mandrel must :

- 46 1. Be a rigid, nonadjustable, odd numbering leg (9 legs minimum) mandrel having an effective length not less than its
 47 nominal diameter.
- 48 2. Have a minimum diameter at any point along the full length as follows:

| Minimum Mandrel Diameter (inches) | Pipe Material | Nominal Size (Inches) |
|-----------------------------------|-----------------------------|-----------------------|
| 5.619 | PVC ASTM D 3034 (SDR 35) | 6 |
| 7.524 | | 8 |
| 9.40 | | 10 |
| 11.91 | | 12 |
| 13.849 | | 15 |

| Minimum Mandrel Diameter (inches) | Pipe Material | Nominal Size (Inches) |
|-----------------------------------|------------------------------|-----------------------|
| 16.924 | PVC ASTM F 679 (T 1 Wall) | 18 |
| 19.952 | | 21 |
| 22.246 | | 24 |
| 25.29 | | 26 |
| 28.502 | | 30 |

- 1
2 3. Be fabricated of steel, be fitted with pulling rings at each end, be stamped or engraved on some segment except a
3 runner indicating the pipe material, material specification, nominal pipe size, and mandrel outside diameter, e.g. PVC,
4 ASTM D 3034, 8 inch, 7.524 inch; and be furnished in a suitable carrying case labeled with the same data as
5 stamped or engraved on the mandrel.

6 **7-17.3(3)G TELEVISION INSPECTION WITH AUDIO ASSESSMENT**

7 After all maintenance holes have been rechanneled and excavations backfilled with all Mineral Aggregates, and before
8 pavement installation, the Contractor, in the presence of the Engineer, must perform television inspection of the interior of all
9 mainline Sewer and Storm Drain pipe larger than 6 inches in diameter and all catch basin connection pipe. SPU will review the
10 television inspection to determine acceptance of this portion of the Work. Pipe larger than 48 inches may also be inspected
11 visually by SPU, after cleaning and successful testing by the Contractor. Side Sewer and inlet connection pipe will not require
12 television inspection.

13 Upon written notice by the Engineer, promptly conduct a second television inspection meeting specified requirements,
14 and submit a second recording at no additional or separate cost to the Owner.

15 Personnel qualifications: Personnel performing television inspection must have completed the Pipeline Assessment and
16 Certification Program (PACP). Submit said certification to the Engineer at least 3 Working Days in advance of the first
17 television inspection.

18 Camera equipment: The camera must be a 360 degree radial view color television camera (also known as pan and tilt)
19 with a mechanical footage counter calibrated to indicate video footage consistent with distance traveled in the pipe. Footage
20 must be zeroed at centerline structure (such as maintenance hole or vault) where the video starts and footage increases as it
21 travels forward, and decreases when backward camera movement is required. Display footage must be shown on the video
22 recording and be mentioned on the audio portion (see audio commentary on recording). Demonstrate correct adjustment of
23 the recording apparatus and monitor by use of the test video or other device approved by the Engineer. Demonstrate
24 satisfactory performance of the camera by the recording of the appropriate test device at the commencement of each day for a
25 minimum period of 30 seconds (over a minimum of fifteen feet).

26 Light Source: The camera must have a light source providing adequate illumination to clearly identify pipe invert, crown,
27 joints, sides, connections, and infiltration/exfiltration. Provide adequate illumination to record images at least 15 feet in front of
28 the camera.

29 Camera travel in the pipe: All mainline inspections must be from the downstream maintenance hole to the upstream
30 maintenance hole. Position the camera to reduce the risk of picture distortion. In circular pipes, position the camera lens head
31 centrally within the pipe. The camera must travel along pipe invert to provide the best view of the crown, invert, connections
32 and sides of the pipe, traveling no faster than 25 feet per minute.

33 Audio commentary on recording: Commentary must be objective and based on PACP defined assessment conditions.
34 Audio must be intelligible and as free from interference and background noise as can reasonably be done. Do not use
35 subjective comments such as: the fault of, caused by, and opinion. Comments must include the footage counter reading, each
36 connection, the starting and ending structure, indicated flaws, areas of infiltration/exfiltration, open joints, outfall, and other
37 features as may be necessary.

38 Required labeling on recording and in audio commentary: Each recording must have audio accompaniment and address
39 a single run of pipe between 2 structures (e.g. maintenance holes, vaults, catch basin, tee, or ending in an outfall) on a single
40 DVD-R disc. Include the following information on a legible label on the recording, as well as at the start of the audio
41 commentary:

- 42 1. Date and time of day television inspection performed.
43 2. Names of television inspection crew members.
44 3. Project name, vault plan number listed on Drawings, and Drawing sheet number.
45 4. Location with structure labels (for example: maintenance hole 25, vault 2, outfall), camera travel direction, size of
46 pipe, pipe material (such as Broad Street, Fifth Ave west to midblock, maintenance holes 24 to 25, going upstream,
47 24-inch reinforced concrete pipe).
48 5. A unique identification number, with these numbers being in consecutive sequence on all DVD-R discs of project
49 pipe.

1 Recording quality and characteristics: Submit television inspections on DVD-R discs. All inspections must be in a PACP
2 format, with uploadable capability to the SPU Granite database. Contact SPU for specific database requirements.

3 At the start of each inspection or survey, record and report the length of the pipe from 0 footage to the cable calibration
4 point to obtain a full record of the pipe length. Describe only 1 survey in the final report. Record all reverse set-ups, blind
5 maintenances, and buried maintenance holes on a separate log.

6 The footage reading entered on to the data display at the cable calibration point must allow for the distance from the start
7 of the survey/inspection to the cable calibration point so that the footage at the start of the survey is 0.

8 At the start of each pipe, a data generator must electronically generate and clearly display, on the viewing monitor and
9 the DVD-R recording, a record of data in alphanumeric form containing all fields required by the PACP information standard
10 including maintenance hole depths.

11 The size and position of the data display must not interfere with the main subject of the picture and must be centered on
12 the viewing screen with white lettering against a black background.

13 Once the survey of the pipe is under way, continually display the following minimum information:

- 14 a. Automatic update of the camera's footage position in the pipe line from adjusted 0
- 15 b. Pipe dimensions in inches
- 16 c. Maintenance hole to maintenance hole reference numbers
- 17 d. Direction of survey, i.e. downstream (D) or upstream (U)
- 18 e. Date

19 Footage and corresponding time elapsed video read out must be provided throughout survey/inspection for all relevant
20 defects and construction features encountered unless otherwise agreed. All continuous defects must incorporate a start and
21 finish footage reading in the log report.

22 Recording of a single segment of pipe must not extend over more than 1 DVD-R disc. A completed inspection must be
23 continuous between maintenance holes. An inspection from different directions and overlapping is not acceptable.

24 Required prenotification: Notify the Engineer at least 3 Working Days in advance of the first television inspection.

25 Pretelevision inspection preparation: Perform television inspection before allowing mainline flow into the pipe from
26 upstream sources. Upstream bypass, when used, must accommodate television inspection to afford full visibility of pipe
27 inverts, as specified in Section 7-17.3(2)l. See Section 7-17.3(3) for pressure testing requirements.

28 Required extra inspection: At all lateral connections, areas of indicated infiltration/exfiltration, open joints, indicated pipe
29 deflection, defects of any kind, and as the Engineer may request, slow down the camera and fully focus on such areas
30 including having the camera slowly travel backward and forward for multi-directional views. Said areas require focused video
31 inspection of not less than 5 seconds. Cameras with telescoping ability must view the area by telescoping in and out as
32 appropriate for the Engineer to evaluate the condition with certainty.

33 Reinspection: Should television inspection reveal defective work, the Contractor must correct said defects upon written
34 notice from the Engineer. An additional television inspection (reinspection) will be taken of the corrected pipe run to verify the
35 corrected pipe meets Specifications. The audio portion on this recording must indicate the same information as specified in
36 Required Labeling on recording and in audio commentary also stating: "this is an additional television inspection to verify
37 corrections at ___ footage location." Such reinspection is specified in Section 1-05.7.

38 Temporary breakdowns: Should an occurrence such as camera breakdown or inability to perform as specified, or other
39 condition arise where no camera or television or audio progress can be made, after the initial 30 seconds of such condition,
40 the operator must make comment on the audio of such condition and the footage location, then shut down the camera and the
41 audio. Upon fixing such a condition, restart the video and audio and include in the audio a comment to the effect " _____
42 condition fixed and video and audio restarting at _____ footage location".

43 Submittal: Provide the Engineer with DVD-R discs of specific pipe lengths within 5 Working Days of each television
44 inspection for acceptance. All DVD-R discs become the property of the Owner. Do not provide more than 6 DVD-R discs to the
45 Engineer per day.

46 **7-17.4 MEASUREMENT**

47 Measurement for "Bedding, (Class), (Size) Pipe" and for Sewer, Culvert, and Storm Drain as shown on Standard Plan
48 285, and for Water Main as shown on Standard Plan 350, will be by the linear foot of pipe actually installed. For Sewer and
49 Storm Drain, measurement will be from center to center of standard maintenance holes or to the inside face of other
50 Structures. For Water Main, measurement will be to inside face of Structure, to end of pipe, or to centerline of connecting tee.
51 Class D bedding will not be measured. Bedding beyond neat lines shown on the Standard Plans will not be measured.

52 Measurements for "Pipe, (Use), (Material), (Class), (Size)", and for "Pipe, (Use), (Material), (Class), (Size), (Trenchless
53 Construction Method)" except directional drilling will be by the linear foot of pipe actually installed and tested, and must be
54 along the centerline of the pipe through the tees or wyes with the exception of pipe ending at a tee or wye. Measurements will
55 be to the center of new maintenance hole or rechanneled existing maintenance hole; or to the inside face of Structure or
56 existing maintenance hole not rechanneled; or to the end of pipe where it meets a maintenance hole stub; or to a wye; or to a
57 tee whether with stub or cut-in. Measurement will be to the nearest 0.1 foot. See Standard Plan 010.

58 Measurement for "Casing Pipe, (Class), (Size), (Construction Method)" will be by the linear foot of pipe actually installed.

1 Measurement for "Tee, (Material), (Size)" and for "Tee, (Size), Cut In Existing (Material) Pipe", will be per each where
 2 "size" applies to the size of the pipe fitting into the tee branching off the mainline pipe as shown on Standard Plan 010, and
 3 "Material" is the Material of the mainline pipe with the branching tee.

4 Measurement for "Temporary Sewer Bypass" will be by lump sum.

5 Measurement for "Television Inspection" will be for the linear feet of installed mainline Sewer and Storm Drain pipe larger
 6 than 6 inches in diameter and all catch basin connection pipe videotaped once during final inspection. Measurement will be
 7 made along the pipe centerline, through tees, starting and ending:

- 8 1. From center to center of new or rechanneled maintenance holes;
- 9 2. At the inside face of Structures or maintenance holes not channeled;
- 10 3. At the end of pipe where it dead ends beyond maintenance holes;
- 11 4. From the catch basin to the mainline pipe; or
- 12 5. From the flow control structure to the mainline pipe.

13 Measurement for "Extra Excavation" is specified in Section 2-04.

14 Measurement for foundation Material will be by the cubic yard of Mineral Aggregate required to fill the void made by extra
 15 excavation and will be based on neat line width of trench and depth and length as computed by the Engineer.

16 Measurement for protective system will be as specified in Section 2-07.4.

17 Measurement for "Mineral Aggregate, (Type)" will be by the cubic yard based on the neat line trench pay width as
 18 specified in Section **Error! Reference source not found.** and the Standard Plans, or other neat line dimensions when
 19 designated by the Engineer. Imported Mineral Aggregate used beyond these neat line limits will be at the Contractor's sole
 20 expense.

21 **7-17.5 PAYMENT**

- 22 1. **"Bedding, (Class), (Size) Pipe"**, per linear foot

23 The Bid Item price for "Bedding, (Class), (Size) Pipe" includes all costs for the work required to furnish and install
 24 bedding. Cost of Class D bedding is included in the Bid Item for the pipe Bid Item and no separate or additional payment will
 25 be made.

- 26 2. **"Pipe, (Use), (Material), (Class), (Size)"**, per linear foot

27 The Bid Item price for "Pipe, (Use), (Material), (Class), (Size)" includes all costs for the work required to furnish and
 28 install the pipe of the type and size specified, and the following:

- 29 a. Trench excavation, haul, stockpile and or disposal of soil, backfill, and compact suitable native Material backfill;
- 30 b. Handling, hauling, storage, removal; and off-site disposal of excess suitable and unsuitable excavated native
 31 material; or hauling, storage, and placement of suitable excess excavated native material elsewhere on the
 32 Project Site except where designated for embankment construction;
- 33 c. Dewatering of the trench;
- 34 d. Required trench excavation, backfill, and compaction;
- 35 e. Cleaning and testing per Section 7-17.3(3), except separate payment will be made for Television Inspection per
 36 Section 7-17.3(3)G;
- 37 f. Class D bedding;
- 38 g. Pipe coupling, measuring outside diameters of pipes to be connected; and
- 39 h. Removal and disposal of existing pipe within trench neat line limits when pipe replacement is called for in the
 40 Contract.

41 All costs in connection with excavating test pits and for standby time during field density tests for compaction is
 42 considered as included in the Bid Item prices for the applicable pipe Bid Items.

43 The Contractor is solely responsible for all costs of correcting any unauthorized excavation below the established trench
 44 grade by providing, placing and compacting suitable Material to the proper grade elevation as specified in Section 2-09.3(1).

45 Cost for the work of cleaning, testing, and furnishing and installing caps and plugs for the tests is included in the Bid Item
 46 prices of the pipe Bid Items.

47 Costs for the work required in proof testing the pipe are considered included in the Bid Item prices for the appropriate
 48 pipe Bid Items.

49 The Contractor is solely responsible for all costs of correcting any damage resulting from testing of the Sewers and
 50 appurtenances specified in Section 7-17.3(3)A.

51 All costs of determining the source or sources of leakage and the cost to repair or replace the Sewer found defective as
 52 specified in Section 7-17.3(3), will be borne by the Contractor as specified in Section 1-05.7

53 If the pipe fails the deflection test as specified in Section 7-17.3(3)F, all costs to locate and repair the failed sections and
 54 retest the pipe will be borne by the Contractor as specified in Section 1-05.7.

1 All costs for the work required to furnish and install joint coupling devices as specified in Section 7-17.3(2)E are
2 considered as included in the Bid Item prices for the pipe Bid Items.

3 3. **“Casing Pipe, (Material), (Class), (Size), (Construction Method)”**, per linear foot

4 The Bid Item price for “Casing Pipe, (Material), (Class), (Size), (Construction Method)” except directional drilling includes
5 all costs for the work required to furnish and install casing pipe as specified in Section 7-17.3(2)H, including installation and
6 removal of shoring of any access pit.

7 Payment for directional drilling installation will be as specified in Section 2-16.5.

8 4. **“Pipe, (Use), (Material), (Class), (Size), (Trenchless Construction Method)”**, per linear foot

9 The Bid Item price for “Pipe, (Material), (Class), (Size), (Trenchless Construction Method)” except directional drilling
10 includes all costs for the work required to furnish and install the pipe as specified in Section 7-17.3(2)H. Bid Item price also
11 includes the cost for furnishing and installing pipe skids, casing spacers, and pipe end seals. All cost for filling the annular
12 space, when required in the Contract, is incidental to this Bid Item and no separate or additional payment will be made.

13 Payment for directional drilling installation will be as specified in Section 2-16.5.

14 5. **“Tee, (Material), (Size)”**, each

15 The Bid Item price for “Tee, (Material), (Size)” includes all costs for the work required to furnish and install the tee
16 including plug when required.

17 6. **“Tee, (Size), Cut In Existing (Material) Pipe”**, each

18 The Bid Item price for “Tee, (Size), Cut In Existing (Material) Pipe” includes all costs for the work required to furnish and
19 install the tee as specified in Section 7-17.3(2)C3. If SPU installs a tee, no payment will be made.

20 7. **“Temporary Sewer Bypass”**, per lump sum

21 The Bid Item price for “Temporary Sewer Bypass” includes all work required to bypass Sewer flow around the
22 construction work.

23 8. **“Television Inspection”**, per linear foot

24 The Bid Item price for “Television Inspection” includes all costs for the work required for television inspection of mainline
25 Sewer and Storm Drain pipe larger than 6 inches in diameter, and all catch basin connection pipe. Costs also include
26 furnishing an acceptable DVD-R disc to the Engineer for each segment of pipe. Costs for additional television inspections
27 necessary to verify corrections or replacement of pipe or done solely for the Contractor’s convenience will be borne by the
28 Contractor.

29 The cost for the Owner’s labor and equipment for the videotaping during the final acceptance process and the
30 videotaping 6 to 11 months later to recheck the pipe condition will be borne by the Owner unless additional videotape
31 inspection is necessary to verify corrections or replacement of deficient pipe. The cost of additional television inspections and
32 cleaning in preparation for television inspection necessary to verify repairs or replaced pipe will be borne by the Contractor.
33 The Contractor is also responsible for all costs incurred in any television inspection performed solely for the benefit of the
34 Contractor.

35 9. **Other payment information**

36 See Section 2-07 for payment information on protective systems.

37 Where unauthorized excavation has been made which increases the established trench depth beyond 4 feet, the
38 Contractor must comply with the requirements specified for Protective Systems in Section 2-07 at no additional cost to the
39 Owner.

40 Payment for imported Material when ordered instead of native backfill Material by the Engineer will be paid as “Mineral
41 Aggregate, (Type)”, or other imported Material acceptable to the Engineer.

42 Foundation Material when required will be paid as “Mineral Aggregate, (Type)” per cubic yard, as specified in Section 4-
43 01.5.

44 Where the Engineer determines that the existing foundation is unsuitable, and foundation Material specified by the
45 Engineer is not in the Contract and no Bid Item for “Mineral Aggregate, (Type)” is included in the Bid Form, payment will be
46 made as specified in Section 1-04.1(2).

47 The Contractor must provide all necessary water for construction and testing purposes, as specified in Section 2-12.

48 No separate or additional payment will be made for submittals, or for Material used in the jacking operations or for the
49 cost of the backfilling operations, including compaction.

50 Payment for plugging pipes will be as specified in Section 2-02.5.

51 Payment for “Selected Material” will be as specified in Section 2-10.5.

52 The Contractor is solely responsible for all costs of providing pipe of increased strength classification or placing a class of
53 bedding of higher load bearing capacity, as required by the Engineer, when the maximum trench width specified in Section 2-
54 04 is exceeded without prior written approval of the Engineer. The Contractor must furnish and install any approved imported
55 backfill Material required outside the trench neat line limits at no additional cost to the Owner.

1 SECTION 7-18 SIDE SEWERS**2 7-18.1 DESCRIPTION**

3 Section 7-18 describes Work consisting of locating and placing a side Sewer, locating tees, and testing of side Sewers.
4 This Section also accommodates private construction in the Right of Way under permit by SDCI and SDOT Street Use.

5 A side Sewer is considered as pipe labeled as side Sewer, or combined side Sewer or service drain as addressed in Title
6 21 of the SMC and applicable Director's Rules. All privately owned and operated drainage control facilities or service drain
7 facility, whether or not they discharge to a public facility are considered a side Sewer. A side Sewer does not include internal
8 building piping or connecting appurtenances.

9 7-18.2 MATERIALS

10 Materials for a side Sewer must comply with the requirements of the following Sections:
11

| Material | Section |
|--------------------------------|--------------|
| Pipe | Section 9-05 |
| Pipe Bedding & Trench Backfill | Section 2-10 |

12 A side Sewer in Right Of Way must be at least 6 inches inside diameter unless otherwise specified in the Contract.

13 Clearly mark all pipe with type, class, date of manufacture, location of manufacturing facility, and/or thickness, as
14 applicable. Marking must be legible and permanent on the outside surface of the pipe, and be able to withstand normal wear
15 due to handling and storage.
16

17 Jointing must be flexible gasketing. Flexible gasketing includes rubber, synthetic rubberlike and plastic Materials specially
18 manufactured for the joint, pipe size, and use intended and must be furnished by the manufacturer of the pipe to be used.

19 Mortared joints are not allowed.

20 Tees, wyes, couplers, and adapters must conform to the requirements of this Section.

21 Bends and transition sections are specified in the Contract.

22 Couplings to existing pipe and between dissimilar pipe must have stainless steel shielding to provide shear control.

23 Side Sewer that may be exposed to hot sewage, steam, or other extreme exposure must be of a Material and with joints
24 as specified in the Contract, and comply with the clearance requirements specified in Section 1-07.17(2).

25 7-18.3 CONSTRUCTION REQUIREMENTS**26 7-18.3(1) SIDE SEWER CONSTRUCTION****27 7-18.3(1)A GENERAL**

28 This Work also includes excavation, backfilling and compaction as specified in Section 2-04, Section 2-10, and Section 2-
29 11.

30 Work in excavations over 4 feet deep must comply with Section 2-07.

31 Unless noted otherwise in the Contract, Side Sewer work within the Right of Way must be performed by a registered side
32 Sewer contractor.

33 Side Sewer installation must be as shown on Standard Plan 283.

34 Where Section 7-18 does not address specific construction requirements, the construction requirements for Sewer in
35 Section 7-17 of these Specifications apply.

36 Side Sewer locations shown on the Drawings are subject to relocation in the field after construction starts to
37 accommodate Job Site specific conditions. Regardless of the Drawing location, place the tee or wye branch in the main Sewer
38 or Storm Drain at the location designated by the Engineer.

39 When the Work requires, the Engineer will establish the depth for the invert elevation of side Sewer at the Right of Way
40 margin.

41 Install side Sewer per the clearance requirements specified in Section 1-07.17(2) and other code, law, and regulation.

42 Where it is necessary to break out an existing side Sewer during construction due to grade conflict with a newly
43 constructed pipeline, use only new pipe in reconnecting the side Sewer. Lay new pipe so as to minimize bends and as
44 approved by the Engineer.

45 Separate side Sewer documentation of all new, re-laid, replaced, or repaired pipe and fittings must be per SMC 21 and
46 applicable Director's Rules.

47 7-18.3(1)B SIDE SEWERS SHOWN ON THE DRAWINGS**48 7-18.3(1)B1 PROTECTION OF EXISTING SIDE SEWER**

49 See Section 1-07.16.

1 7-18.3(1)B2 REMOVE AND REPLACE EXISTING SIDE SEWER

2 When the Drawings call for removal and replacement of existing side Sewer, use only new pipe to replace the removed
3 pipe.

4 7-18.3(2) EXCAVATION, FOUNDATION PREPARATION, BEDDING, AND BACKFILL

5 Excavation, foundation preparation, bedding and backfill for side Sewer must conform to the requirements of Division 2,
6 except that bedding must be limited to that required to hold the pipe in true alignment and to grade before backfill. Provide the
7 Engineer at least 2 Working Days advance notice for inspection and testing per Section 7-18.3(6) before covering the side
8 Sewer.

9 7-18.3(3) PIPE INSTALLATION AND JOINTING**10 7-18.3(3)A GENERAL**

11 Pipe installation and jointing, except as specified in this Section, must conform to the requirements of Section 7-17 and
12 Chapter 21.16 of the SMC.

13 7-18.3(3)B LINE AND GRADE

14 Install side Sewer to a line and grade between the main Sewer or Storm Drain tee branch or wye branch and the Right of
15 Way margin, so as to best serve the property relative to these conditions:

- 16 1. Where a vacant property is level with or lower than the street grade, the invert elevation of the proposed side Sewer
17 at the Right of Way margin must be 1 foot higher than the elevation of the crown of the main Sewer or Storm Drain at
18 the location of its tee or wye branch connection. See Standard Plan 283 for additional requirements.
- 19 2. Where an occupied property is situated at higher elevation than the street grade and where the slope of the proposed
20 side Sewer is steeper than 50 percent, the maximum elevation of the side Sewer at the Right of Way margin will be
21 established by the Engineer with due consideration for placing the side Sewer below the invert of any proposed
22 Storm Drain pipe, unless conditions require otherwise. The clearance between the invert of an existing Storm Drain or
23 Sewer and the crown of a side Sewer below it must be at least 6 inches. In either of these conditions, place the end
24 of the side Sewer at the Right of Way margin deep enough to accommodate at least 2-1/2 vertical feet of compacted
25 backfill between the crown of the pipe and finished grade at that point.
- 26 3. Side Sewer Pipe must be installed on a grade of at least 2 percent.

27 7-18.3(3)C PIPE INSTALLATION

28 Install bell and spigot pipe with the bell end facing up grade. All pipe installation must start and proceed up grade from
29 the point of connection at the Sewer or Storm Drain or other starting point.

30 Between fittings, install pipe in a straight line at a uniform grade.

31 7-18.3(3)D JOINTING – NEW PIPE TO EXISTING PIPE

32 Where joints cannot be made due to dissimilar pipe Material or mismatched wall thickness, use a coupling as specified in
33 Section 9-05.18 to make a water tight joint.

34 7-18.3(4) FITTINGS

35 All fittings must be factory produced and be designed for installation on the pipe to be used.

36 The maximum deflection permissible at any 1 fitting or joint must not exceed the pipe manufacturer's recommendation,
37 and must never exceed 2 inches per foot at any joint or fitting. The maximum deflection of any combination of 2 adjacent
38 fittings or joints must not exceed 45 degrees (1/8 bend). Should greater than 45 degree deflection be needed between
39 adjacent joints or fittings, install a straight pipe of not less than 2-1/2 feet in length between such adjacent fittings or joints,
40 unless either one of such fittings is a wye branch with a cleanout provided on the straight leg or such a wye branch fitting is
41 substituted for a joint.

42 Connect side Sewer to the tee or wye provided at the main Sewer or Storm Drain where such is available, using
43 approved fittings or couplings. Where no tee or wye is provided or available, connect by core drilling and installing a
44 connection as specified in Section 7-17.3(2)C3.

45 When the side Sewer Material is ductile iron pipe and is connecting to a mainline by core drilling and an inserted tee,
46 connection includes a 1 foot long plain end by plain end section of ductile iron pipe inserted into the bell end of the tee
47 manufactured to accept ductile iron pipe. Connect the 1 foot section to the upstream pipe using a flexible gasketed coupling
48 with stainless steel shielding as specified in Section 9-05.18.

49 The installation of side Sewer to a vertical connection at the main Sewer or Storm Drain is shown on Standard Plan 234.

50 7-18.3(5) CLEANOUTS

51 Refer to Section 7-19.

1 7-18.3(6) INSPECTION AND TESTING**2 7-18.3(6)A INSPECTION**

3 As specified in Section 7-18.3(2), side Sewer covered without Engineer inspection must be uncovered for inspection.

4 7-18.3(6)B TESTING

5 All newly installed side Sewer must be tested after backfill. Side Sewer that is reconstructed or repaired to a length of 10
6 feet or more must be tested for water tightness as specified in Section 7-17.3(3)B. No testing is required if:

- 7 1. A new reconstruction of side Sewer consisting of a single length of pipe.
- 8 2. An existing side Sewer reconnected to the Sewer or Storm Drain.

9 Testing must be performed in the presence of the Engineer as specified in Section 7-17.3(3).

10 All side Sewer constructed in conjunction with main Sewer or Storm Drain construction, for purposes of testing as
11 specified in Section 7-17.3(3), must have a 6-inch tee fitting placed at the point where the side Sewer crosses the Right of
12 Way margin as shown on Standard Plan 283. Position the tee opening perpendicular to the side Sewer slope.

13 When the new side Sewer is connected to a new main Sewer or Storm Drain installed under the same Contract, and the
14 side Sewer is not tested simultaneously with the test of the main Sewer or Storm Drain, furnish and place an additional 6-inch
15 tee in the first length of pipe out of the tee on the main Sewer or Storm Drain so that an inflatable rubber ball can be inserted
16 for sealing off the side Sewer and thus allow separate side Sewer and mainline tests.

17 When the new side Sewer is connected to an existing main Sewer or Storm Drain, furnish and place 2 test tees as shown
18 on Standard Plan 283 and as follows:

- 19 a. One immediately adjacent to the main Sewer or Storm Drain.
- 20 b. A second at the Right of Way margin.

21 The ends of side Sewer and test tee openings must be plugged water tight with Materials and by method acceptable to
22 the Engineer.

23 Side Sewer installed with pipe extending beyond the Right of Way margin that includes other connection, such as runoff
24 or downspout, and is associated with private construction under the inspection of SDCI, is not part of the Contract, and may
25 require testing of the entire side Sewer system including pipe in the Right of Way.

26 7-18.3(7) MISCELLANEOUS REQUIREMENTS**27 7-18.3(7)A PIPE AND CONNECTIONS – PRIVATE PROPERTY**

28 Side Sewer in utility easement must be at least 6 inches inside diameter. Side Sewer and/or service drain on private
29 property must be at least 4 inches inside diameter. Do not connect any roof drain, area drain, or subsurface drain to a side
30 Sewer that is connected to a separate main line sanitary only Sewer.

31 Private property roof drains or service drains in areas of mainline combined Sewer must be run in a separate pipe, not
32 combined with sewage, to the property line before connecting into the side Sewer.

33 7-18.3(7)B PROXIMITY TO OTHER UNDERGROUND FACILITIES

34 In private property, clearance between side Sewer and/or service drain and water supply lines must comply with
35 Washington State Department of Health requirements and other applicable code and regulation.

36 In the Right of Way, side Sewer clearances are specified in Section 1-07.17(2).

37 7-18.3(7)C PLUGS

38 In the Right of Way, securely seal unused side Sewer openings with a water tight plug fastened in place.

39 The only exception is private construction under permit from SDCI and SDOT Street Use where unused side Sewer
40 openings in private property and side Sewer openings in the Right of Way, must be closed with a water tight plug fastened in
41 place as approved by SDCI.

42 7-18.3(7)D SEPTIC TANKS AND CESSPOOLS – PRIVATE PROPERTY

43 Do not construct side Sewer through or adjacent to an existing cesspool or septic tank. If Job Site conditions prohibit any
44 other location, abate the cesspool or septic tank by such means as the SDCI inspector may direct.

45 7-18.3(8) RESTORATION, FINISHING, AND CLEANUP – PRIVATE CONSTRUCTION

46 Restoration, finishing, and cleanup due to private construction in Seattle's street Right of Way under Street Use permit
47 and SDCI permit, must comply with the Street and Sidewalk Pavement Opening and Restoration Rules.

48 7-18.3(9) EXTENDING SIDE SEWER INTO PRIVATE PROPERTY

49 Extending side Sewer into private property is not part of the Contract and will not be allowed.

50 Unless authorized by Title 21 of the SMC, private property owners who wish to extend side Sewer into the Right of Way
51 or connect with Sewer or Storm Drain, must do so under permit with SDCI and SDOT Street Use.

1 **7-18.3(10) END PIPE MARKER**

2 At the Right of Way margin, bury a 4-foot long, 2" x 4 "stake to a 3-foot depth directly over the side Sewer. Paint the
3 exposed 1 foot of stake traffic white, and paint the depth to the invert of the side Sewer from finish grade legibly and with black
4 permanent ink (or other durable marking agent) on the exposed white portion of stake. Securely nail a 2" x 4 "cleat to the
5 bottom of the stake to prevent withdrawal of the buried stake. In addition, attach a 12-gauge galvanized wire to the tee on the
6 side Sewer, or to the plugged end of the side Sewer if no tee, and extending to 6 inches above finished grade at the stake. Do
7 not attached the wire to the stake.

8 **7-18.4 MEASUREMENT**

9 Measurement for "Pipe, (Use), (Material), (Class), (Size)" will be to the nearest 0.10 feet along the pipe from the tee or
10 wye of the main Sewer or Storm Drain through tees, wyes and other fittings to the Right of Way margin as shown on Standard
11 Plan 010, or to the end of pipe when the Contract or Engineer requires.

12 Measurement for "Tee, Test, (Material), (Size)" will be per each.

13 Measurement for protective systems will be as specified in Section 2-07.4.

14 **7-18.5 PAYMENT**

15 1. "Pipe, (Use), (Material), (Class), (Size)", per linear foot

16 The Bid Item price for "Pipe, (Use), (Material), (Class), (Size)", includes all costs for the Work required to furnish all
17 Material and Supplies necessary to install the side Sewer pipe of the type specified, including, but not limited to, the following:

- 18 a. Trench excavation, haul, stockpiling, backfill, and compaction of suitable native Material
- 19 b. Removal and disposal of excess and/or unsuitable excavated native Material
- 20 c. Dewatering of the trench
- 21 d. Removal and disposal of existing side Sewer pipe encountered in required trench excavation and backfill
- 22 e. Temporary bypass of sewage, including pumping
- 23 f. Cleaning and testing
- 24 g. End pipe marker, plug, and balloon
- 25 h. Class D Bedding
- 26 i. Separate documentation per SMC 21 and applicable Director's Rules.

27 2. "Tee, Test, (Material), (Size)", per each

28 The Bid Item price for "Tee, Test, (Material), (Size)" includes all costs for the work required to furnish, install, and remove
29 as necessary the test tee.

30 3. **Other payment information**

31 Payment for protective systems will be as specified in Section 2-07.5.

32 Payment for "Tee, (Material), (Size)", for "Bedding, CDF, (Size) Pipe", and for "Bedding, (Class), (Size) Pipe" will be as
33 specified in Section 7-17.5.

34 All cost associated with uncovering a side Sewer without Engineer inspection and all cost associated with re-
35 constructing any portion of completed Work associated with the uncovering will be at the Contractor's sole expense and no
36 separate or additional payment will be made.

37 Remove and reinstall side Sewer will be paid as "Pipe, (Use), (Material), (Class), (Size)".

38 No payment will be made for any expense associated with the Contractor installing an additional tee on the side Sewer
39 and requiring separate tests for purposes of testing as specified in Section 7-18.3(6)B.

40 All costs relating to construction in private property, and to private construction in Seattle's Right of Way under the
41 jurisdiction of SDCI and SDOT Street Use, is not part of the Contract and no separate or additional payment will be made.

42 **SECTION 7-19 SEWER CLEANOUT**

43 **7-19.1 DESCRIPTION**

44 Section 7-19 describes Work consisting of the construction of sanitary Sewer cleanouts per Standard Plan 280 and as
45 specified in the Contract.

46 **7-19.2 MATERIALS**

47 All Materials incorporated into the total cleanout structure must comply with the requirements of the various applicable
48 Sections of these Standard Specifications.

49 **7-19.3 CONSTRUCTION REQUIREMENTS**

50 Provide a clean out at locations shown on the Drawings. All cleanouts located in the Right Of Way must be locking and
51 must extend to finish grade.

1 Provide a cleanout on side Sewers for each total change of 90 degrees in grade or alignment. The spacing of cleanouts
2 must not exceed 100 feet. No cleanout is required at the connection of the side Sewer to a riser on the public Sewer. A
3 suitably located cleanout in the house piping or plumbing may be considered as a cleanout for the side Sewer. Cleanouts
4 consist of a wye branch in the side Sewer.

5 **7-19.4 MEASUREMENT**

6 Measurement for "Sewer Cleanout, (Size)" will start at the wye branch and extend through the casting, as shown on
7 Standard Plan 280.

8 **7-19.5 PAYMENT**

- 9 1. "Sewer Cleanout, (Size)", per each

10 The Bid Item price per each for "Sewer Cleanout, (Size)" includes all costs for the work required for furnishing and
11 installing the wye, Sewer pipe, pipe bands, pipe plug, casting, and concrete collar.

12 **SECTION 7-20 ADJUSTMENT OF NEW AND EXISTING UTILITY STRUCTURES TO FINISH GRADE**

13 **7-20.1 DESCRIPTION**

14 Section 7-20 describes Work consisting of adjusting new and existing maintenance holes, catch basins, inlets, valve
15 chambers, water meter boxes, handholes, and similar utility Structures encountered during the Work to a new grade elevation.
16 The Work includes adjustment by removing and installing adjustment brick, by removing or adding a vertical riser section to
17 the utility Structure, by removing and rebuilding a portion of the existing Structure, or by any combination of the preceding
18 methods.

19 The Contractor must adjust publicly owned utility Structures to finished grade. Privately owned utility agencies are
20 responsible for all adjustments and relocations of their own facilities. Schedule the Work so utility adjustments by others can
21 be accomplished without undue delay.

22 The requirements of Section 7-20 apply to utility Structures constructed from precast concrete sections, masonry brick or
23 blocks, and cast in place concrete.

24 Reinforce concrete pavement around castings per Standard Plan 406 and Section 5-05.3(9).

25 **7-20.2 MATERIALS**

26 Material used in the adjustment of existing utility Structures must comply with the requirements for new construction
27 specified in the Specification Section applicable to the item being adjusted.

28 **7-20.3 CONSTRUCTION REQUIREMENTS**

29 **7-20.3(1) ADJUSTMENT OF MAINTENANCE HOLES, CATCH BASINS, AND SIMILAR STRUCTURES**

30 **7-20.3(1)A GENERAL**

31 The Contractor must establish approximate grade elevation for the tops of existing utility Structures requiring adjustment
32 as specified in Sections 1-05.4 and 1-05.5. Establish the final alignment and grade elevation from adjacent roadway surfaces,
33 forms, or such offset hubs as may be provided by the Contractor as specified in Sections 1-05.4 and 1-05.5.

34 To meet the new grade elevation, remove the pavement around the casting; remove the casting and install or remove
35 leveling or adjustment brick or block; or excavate around the utility Structure, remove a portion of it as necessary and rebuild
36 the Structure. Minimize pavement removal to the amount required to facilitate the adjustment. Adjustment of drainage
37 Structure to finished grade elevation, by whatever method, must result in a finished Structure meeting the requirements for
38 new construction as specified in Sections 7-05.3(1)L, 7-05.3(2)C, or 7-05.3(2)D corresponding to Structure type. The overall
39 distance between the top of the casting to the bottom of the adjustment brick must not exceed 26 inches.

40 Where a publicly owned casting adjustment is required and a new casting is shown on the Drawings, the Contractor must
41 furnish and install a new casting. When a new publicly-owned casting is not shown on the Drawings, the utility must have the
42 opportunity to furnish a new casting for Contractor installation. The Contractor must schedule the Work so the public utility has
43 a minimum 2 Days notice to provide castings. Fit the new casting to the existing frame and ground to rest evenly and without
44 rocking. When adjustment is made by adding or removing leveling bricks, fill all joints in the bricks with mortar and seat the
45 casting in mortar on the top brick course. When bricks are added, installation must be as shown on Standard Plan 220,
46 running bond pattern.

47 After the utility Structure has been adjusted to grade, and the Structure made water tight by plastering with mortar
48 cement, backfill and compact all voids around the Structure with imported Mineral Aggregate Type 17. Secure the casting in
49 place with a tapered layer of concrete or asphalt, as applicable.

50 Adjust water meter boxes encountered in the planting strip and sidewalk area to finish grade.

51 Should adjustment to a water meter box require adjustment or relocation of the water meter, notify the Engineer at least 5
52 Working Days in advance and the water meter will be adjusted or relocated by SPU Water Operations. Then make final
53 adjustment of the meter box.

1 Maintenance holes, catch basins, and similar Structures must be raised or lowered to match the finished roadway grade.
2 Structures flush with to no more than 3/8 inch below the finished roadway grade will be accepted by the Engineer. All
3 Structures in sidewalks, walkways and trails must be flush. Utility adjustments not within these tolerances as determined by
4 the Engineer will be considered defective work as specified in Section 1-05.7.

5 **7-20.3(1)B CEMENT CONCRETE PAVING PROJECTS**

6 Maintenance holes, catch basins and similar Structures must be constructed or adjusted as specified in Section 7-
7 20.3(1)A except that the final adjustment must be made and the cast iron frame set after the forms have been placed and
8 checked. In placing the concrete pavement, do not change the position of the casting in any way.

9 All Standard Plan 230 and 361 castings for maintenance holes and valve chambers installed in and requiring new
10 concrete pavement or rigid concrete base pavement must comply with the reinforcing requirements of Standard Plan 406 and
11 Section 5-05.3(9).

12 See Section 7-20.3(1)C for temporary transition tapers around exposed castings.

13 **7-20.3(1)C ASPHALT CONCRETE PAVING PROJECTS**

14 Utility Structures requiring adjustment of frames to match finish grade must be adjusted before the start of the final
15 paving operation.

16 The tops of existing utility Structure frames must be raised or lowered to match the finish grade. Immediately after
17 adjustment of the frame to finish grade in lanes that are to remain open to traffic, install temporary asphalt or temporary
18 pavement patch transition tapers around the Structure frame to prevent a nuisance to traffic. Maintain the asphalt tapers and
19 furnish, install, and maintain warning signs and barricades as specified in Section 1-07.23 and Section 1-10. Remove the
20 asphalt tapers immediately before the start of paving operations.

21 Inside surfaces of adjusted Structure frame and bricks or rings which are disturbed or damaged by the adjustment, as
22 well as the new adjustment area, must be mortared to provide a smooth, water tight surface.

23 **7-20.3(1)D ASPHALT RESURFACING PROJECTS**

24 Adjustment of maintenance holes, catch basins, and similar Structures on asphalt resurfacing projects must comply with
25 the requirements of Section 7-20.3(1)C.

26 **7-20.3(2) ADJUSTMENT OF INLETS**

27 Establish the final alignment and grade of frames for new and old inlets to be adjusted to grade from the forms or from
28 adjacent pavement surfaces. Perform the final adjustment of the inlet frame as specified in Section 7-20.3(1)A and the
29 adjacent roadway surface must have the Drainage Transition Zone per Standard Plan 260a.

30 On asphalt concrete paving projects using curbs and gutters, that portion of the frame not embedded in the gutter section
31 must be solidly embedded in concrete. Extend the concrete a minimum of 6 inches beyond the edge of the frame and leave 1-
32 1/2 inches below the top of the frame so the wearing course of asphalt concrete pavement butts against the frame. Paint the
33 existing concrete pavement and edge of the casting with hot asphalt cement.

34 Make adjustments in the inlet structure frame and frame extension in the same manner and of the same Material as that
35 required for new inlets. The inside of the inlet frame and frame extension must be plastered smooth.

36 **7-20.3(3) ADJUSTMENT OF MONUMENTS, AND FRAME AND COVER**

37 Adjust monuments and monument castings to grade as specified in Section 7-20.3(1)A.

38 **7-20.3(4) ADJUSTMENT OF VALVE BOX CASTINGS**

39 Adjustment of valve box castings and Water Main castings is specified in Sections 7-20.3(1)A and 7-20.3(5).

40 **7-20.3(5) FURNISHING CASTINGS**

41 Where adjustment of existing utility Structures is required and the Drawings indicate that the existing castings be
42 replaced, furnish new castings of the type specified on the Drawings. Casting includes frame and grate, or ring and cover
43 unless the Contract specifies otherwise. Clean and deliver salvaged castings as specified in Section 2-02.3(7).

44 **7-20.3(6) REPLACEMENT OF INLET GRATE**

45 Furnish and install new grates where the Drawings show existing inlet grate replacement. Do not replace the inlet frame.

46 **7-20.4 MEASUREMENT**

47 Bid Items of Work completed under the Contract will be measured as specified in Section 1-09.1, unless otherwise
48 provided for in this Section.

49 **7-20.5 PAYMENT**

- 50 1. "Adjust Existing Maintenance Hole, Catch Basin or Valve Chamber", per each
- 51 2. "Adjust Existing Inlet", per each

3. **“Adjust Existing Monument Frame and Cover”**, per each

4. **“Adjust Existing Valve Box”**, per each

5. **“Adjust Existing Handhole”**, per each

The Bid Item price for “Adjust Existing (Item)” includes all costs for the work required to adjust the existing utility casting from original grade elevation to finished grade elevation with or without removing or adding adjustment bricks.

6. **“Utility Casting, (Type)”**, per each

The Bid Item price for “Utility Casting, (Type)” includes the costs for all work required to furnish and install new castings of the type specified in the Contract when existing castings are to be replaced.

When a maintenance hole is required to be rebuilt to accommodate a new casting, the cost of the utility casting will be included in the price Bid for the Bid Item “Rebuild (Item)” per Section 7-05.5 where “item” is “maintenance hole”.

7. **“Install Casting, Utility Furnished”**, per each

The Bid Item price for “Install Casting, Utility Furnished,” includes all costs for the Work required to install and adjust to finished grade a casting provided by the utility owner.

8. **“Utility Casting, (Type), Grate”**, per each

The Bid Item price for “Utility Casting, (Type), Grate” includes all costs for the Work required to replace the inlet grate with specified grate. Costs do not include replacing the frame. If the Engineer determines that the existing frame must be replaced, the cost to replace the frame and grate will be paid as “Utility Casting, (Type)”.

9. **“Utility Casting, (Type), Cover”**, per each

The Bid Item price for “Utility Casting, (Type), Cover” includes all costs for the Work required to replace the utility cover with specified cover. Costs do not include replacing the frame. If the Engineer determines that the existing frame must be replaced, the cost to replace the frame and cover will be paid as “Utility Casting, (Type)”.

10. **“Install Grate/Cover, Utility Furnished”**, per each

The Bid Item price for “Grate/Cover, Utility Furnished,” includes all costs for the Work required to replace the utility grate or cover provided by the utility owner.

11. Other Payment Information

Costs for adjustment to finish grade of water meter boxes except adjustment of the water meter itself; small castings except inlet, catch basin, maintenance hole, valve chamber, handhole, monument, and water valve box; hydrant valve castings; and private and other public utility castings requiring coordination with the private or public casting owner, will be included in the Bid Item prices for the applicable Bid Items and no separate payment will be made.

Mineral Aggregate ordered as backfill instead of native Material will be paid as “Mineral Aggregate, (Type)”.

Restoration of the roadway surface is per the applicable Section covering the Work involved.

The costs for asphalt or cement concrete used to obtain castings before paving are considered incidental to the Work and no separate payment will be made.

All Work required to adjust castings of all newly installed or rebuilt utility Structures to finished street grade is considered included in the Bid Item prices of the Bid Items for the appropriate type of utility Structure.

In asphalt resurfacing projects, as specified in Section 7-20.3(1)D, all costs to remove the asphalt concrete and/or concrete base will be considered included in the Bid Item price of the Bid Items of work for adjusting the specified Structures.

SECTION 7-21 BIORETENTION

7-21.1 DESCRIPTION

Section 7-21 describes Work consisting of the installation of bioretention soil in bioretention cells intended to receive surface water runoff for infiltration.

7-21.2 MATERIALS

Materials must comply with the requirements of the following Sections:

| Material | Section |
|--------------------------|-------------------|
| Bioretention Soil | Section 9-14.1(4) |
| Mineral Aggregate | Section 9-03 |
| Geotextile | Section 9-37 |
| Arborist Wood Chip Mulch | Section 9-14.4(4) |
| Compost | Section 9-14.4(8) |

Unless otherwise specified, geotextile must be nonwoven construction geotextile for separation.

1 Unless otherwise specified or shown on the Drawings, aggregates for the discharge subbase gravel must comply with
2 the requirements of Mineral Aggregate Type 26.

3 **7-21.3 CONSTRUCTION REQUIREMENTS**

4 **7-21.3(1) GENERAL**

5 Runoff is not allowed to enter the bioretention cell as specified in Sections 1-07.15 and Section 8-01, until authorized by
6 the Engineer.

7 Bioretention soil must be protected from rainfall, surface runoff and other sources of added moisture at the Supplier's
8 site, in covered conveyance, and at the Project Site until incorporated into the Work.

9 Do not operate heavy equipment within the cell or earth berm perimeter once bioretention cell excavation has begun,
10 including during excavation, backfilling, tree pit preparation, mulching, or planting.

11 Do not mix or dump Materials or substances except the bioretention soil within the cell or earth berm area that may be
12 harmful to plant growth, or prove a hindrance to the planting or maintenance operations.

13 Relocation and/or adjustments of water meters is specified in Section 7-15 Water Service Connection Transfers.

14 When the Contract specifies testing by a Contractor provided testing laboratory, the laboratory must be a STA, AASHTO,
15 ASTM or other standards organization, as designated in the Contract, accredited laboratory with current and maintained
16 certification. The testing laboratory must be Capable of performing all tests to the standards specified, and must provide test
17 results with an accompanying manufacturer's certificate of compliance.

18 **7-21.3(1)A SUBMITTALS FOR BIORETENTION SOIL MIX DESIGN**

19 At least 10 Working Days before placement of bioretention soil, submit to the Engineer, as specified in Section 1-05.3,
20 the following:

- 21 1. Aggregate Analysis: Grain size analysis results of the Mineral Aggregate for bioretention soil specified in Section 9-
22 03.2(2), performed by an independent laboratory per ASTM D 422, Standard Test Method for Particle Size Analysis
23 of Soils.
- 24 2. Compost Analysis: Quality analysis results for the compost for bioretention soil performed per STA standards, as
25 specified in Section 9-14.4(8).
- 26 3. Mix Analysis: Organic content test results of the bioretention soil mix. Perform organic content test per Testing
27 Methods for the Examination of Compost and Composting 05.07A, Loss-On-Ignition Organic Matter Method.
- 28 4. Mix Samples: Two 5 gallon samples of the bioretention soil mix, along with the following information:
29 a. The manufacturer's certificate of compliance, as specified in Section 1-06.3, from the Supplier of the bioretention
30 soil mix, and the Suppliers of the Mineral Aggregate and compost components, including their name and address.
31 b. A description of the equipment and methods to mix the Mineral Aggregate and compost to produce bioretention
32 soil.
- 33 5. Laboratory Information:
34 a. Name of laboratory including contact person
35 b. Address
36 c. Phone contact
37 d. E-mail address
38 e. Qualifications of laboratory and personnel including date of current certification by STA, ASTM, AASHTO, or
39 approved equal.

40 **7-21.3(2) BIORETENTION CELLS AND EARTH BERMS CONSTRUCTION**

41 Construct bioretention cells and earth berms as shown on the Drawings.

42 **7-21.3(2)A GRADING AND PLACEMENT FOR BIORETENTION CELLS**

43 **7-21.3(2)A1 GENERAL**

44 Do not start bioretention cell grading or placement until all areas of the Project Site draining to the bioretention area have
45 been stabilized and authorization is provided by Engineer.

46 Grading within Zone B of trees to be kept is per the TVSP specified in Sections 1-07.16(2) and Section 8-01. Notify the
47 Engineer of conflicts with tree protection standards and/or other Job Site conditions before proceeding with the Work.

48 Locations and grading requirements to support new trees as a component of the bioretention system must be field
49 marked by the Engineer when identified as field locate by the Engineer on the Drawings. A minimum advance notice is
50 required for the Engineer to locate plantings as specified in Section 8-02.3(5).

1 7-21.3(2)A2 EXCAVATION

2 At the locations shown on the Drawings, excavate bioretention cells to the depth necessary to accommodate the
3 placement of bioretention soil and, if applicable, Mineral Aggregate Type 26 for discharge subbase gravel as shown on the
4 Drawings.

5 Excavation within 6 inches of final native soil grade is not permitted if the Project Site soil is frozen, has standing water,
6 or has been subjected to more than 1/2 inch of precipitation within 48 hours.

7 Where shown on the Drawings, place construction geotextile for separation as specified in Section 2-15.

8 Provide the Engineer the opportunity to inspect the excavation at least 1 Working day before placement of any Materials
9 or subgrade soil scarification.

10 After excavation to subgrade, if any sediment laden runoff has entered the cell before placement of bioretention soil,
11 remove the sediment deposition by over-excavating the cell by a 3-inch minimum and place an additional 3 inches of
12 bioretention soil, at no expense to the Owner.

13 7-21.3(2)A3 SUBGRADE

14 Scarify the surface of the subgrade to a minimum depth of 4 inches before placement of bioretention soil or Mineral
15 Aggregate for discharge subbase gravel, if applicable.

16 Where shown on the Drawings, place Mineral Aggregate for discharge subbase gravel in loose lifts and hand rake
17 Mineral Aggregate to final grade.

18 If applicable, after placement of Mineral Aggregate for discharge subbase gravel, if any sediment laden runoff has
19 entered the cell before placement of bioretention soil, remove the sediment deposition by excavating Mineral Aggregate in the
20 cell by a 3-inch minimum and replace it with clean Mineral Aggregate at no expense to the Owner.

21 7-21.3(2)A4 PLACEMENT OF BIORETENTION SOIL

22 Do not place bioretention soil until the Engineer has reviewed and confirmed the following:

- 23 1. Soil mix delivery tickets: Delivery tickets must show that the full delivered amount of bioretention soil matches the
24 product type, volume and manufacturer named in the submittals.
- 25 2. Visual match with submitted samples: Delivered product will be compared to the submitted 5-gallon sample, to verify
26 that it matches the submitted sample. The Engineer may inspect any loads of bioretention soil on delivery and stop
27 placement if the soil does not appear to match the submittals and require sampling and testing of the delivered soil to
28 determine that organic matter content is within the 4 to 8 percent target, and approximately equal to that of the
29 approved submittal, before authorizing soil placement. The Contractor is responsible for all testing costs.

30 Do not place and consolidate bioretention soil when it is excessively wet, as determined by the Engineer. There must be
31 no visible free water in the material.

32 Placing bioretention soil is not allowed if the area receiving bioretention soil is frozen, excessively wet or saturated, or
33 has been subjected to more than 1/2 inch of precipitation within 48 hours before placement. The Engineer will have final
34 authority to determine if wet or saturated conditions exist.

35 Place bioretention soil loosely with a conveyor belt, unless otherwise approved by the Engineer, on a prepared subgrade
36 per these Specifications and in conformity with the lines, grades, depth, and typical cross-section shown on the Drawings or as
37 established by the Engineer.

38 Rake soil to final grade.

39 Final soil depth will be measured and verified only after the soil has been water consolidated, which requires filling the
40 cell with water in a controlled manner, without creating any scour or erosion, to at least 1 inch of ponding. Allowing
41 uncontrolled runoff from adjacent impervious areas to enter cell is not an acceptable method for consolidation. Repeat until
42 final depth is achieved.

43 Place bioretention soil specified for grass areas in loose lifts. Compact bioretention soil to a relative compaction of 85 to
44 90 percent of modified maximum dry density, per ASTM D 1557, where slopes allow, as determined by the Engineer. Where
45 bioretention soil is placed in the 2-foot road shoulder, compact to a minimum relative compaction of 90 percent of modified
46 maximum dry density, per ASTM D 1557. Final soil depth will be measured and verified only after the soil has been
47 compacted.

48 After placement of bioretention soil, notify the Engineer at least 1 Working day in advance of planned planting or
49 mulching. The Engineer will perform compaction testing.

50
51

Compaction Requirements

| Bioretention Area | Relative Compaction |
|--------------------------------|---|
| Bottom and side slopes planted | Water consolidation |
| Bottom and side slopes grassed | 85-90 percent of modified dry density (ASTM D 1557), using roller or sprinkler. |

| Bioretention Area | Relative Compaction |
|--|--|
| 2-foot road shoulder | 90 percent of modified dry density (ASTM D 1557), using roller or late compaction. |
| 7-foot radius around power poles | No requirement, existing soil untouched |
| Around water meters and over other utilities | Same as listed for areas above |

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7-21.3(2)A5 FINAL MULCHING AND PLANTING

The cell must be planted and mulched as shown on the Drawings.

At least 1 Working Day before placement of compost or arborist wood chip mulch in each cell, as specified in the Drawing, notify the Engineer to inspect the bioretention cell. If any sediment laden runoff has entered the cell, remove the top 3 inches of bioretention soil and replace with bioretention soil per design, at no expense to the Owner.

The finished elevation must be 1 inch below walks, curbs, pavements and driveways, unless adjacent to a bermed area. Upon completion of finish grading Work, remove all excess Material from the Project Site and dispose of it accordingly.

7-21.3(2)B GRADING FOR EARTH BERM

At the locations shown on the Drawings, construct earth berms per these Specifications and in conformity with the lines, grades, depth, and typical cross-section shown on the Drawings or as established by the Engineer.

Place bioretention soil specified for berm areas in loose lifts.

Compact bioretention soil to a maximum relative compaction of 85 percent of modified maximum dry density, per ASTM D 1557.

Before the placement of arborist wood chip mulch, notify the Engineer at least 1 Working Day in advance for approval of finished grading.

7-21.4 MEASUREMENT

Measurement for "Bioretention Soil" will be by the ton or cubic yard

Measurement for "Mineral Aggregate (type)" for discharge subbase gravel will be by the ton or cubic yard.

Measurement for grading will not be made.

7-21.5 PAYMENT

1. "Bioretention Soil ", per ton or cubic yard

The Bid Item price for "Bioretention Soil" includes all costs for the work necessary to furnish, place, compact, grade, shape, and mix bioretention soil.

2. "Common Excavation", per ton or cubic yard as specified in Section 2-04

3. "Mineral Aggregate (type)", per ton or cubic yard as specified in Section 4-01

4. "Construction Geotextile for Separation", per square yard as specified in Section 2-15

No separate payment will be made for finish grading work required to hand grade bioretention cells and earth berms to final shape as specified.

END OF DIVISION

1 **DIVISION 8 MISCELLANEOUS CONSTRUCTION**2 **SECTION 8-01 CONSTRUCTION STORMWATER POLLUTION PREVENTION**3 **8-01.1 DESCRIPTION**

4 Section 8-01 describes furnishing, installing, maintaining, removing, and disposing of construction stormwater and
 5 erosion controls, tree, vegetation and soil protection, and pollutant prevention and countermeasures. These controls must
 6 prevent erosion and scour, treat sediment laden water for acceptable discharge, and prevent conveyance of pollutants and
 7 sediment into surface waters, drainage systems, and environmentally critical areas.

8 The CSECP, the TVSPP, the SP and the TDP described in this Section must apply BMPs that contain elements to
 9 protect water quality and downstream resources.

10 **8-01.2 MATERIALS**

11 Materials must comply with the following Sections:
 12

| Material | Section |
|---------------------------|--------------|
| Riprap and Quarry Spall | Section 9-13 |
| Erosion Control Materials | Section 9-14 |
| Geotextile | Section 9-37 |

13
 14 Unless the Contract specifies otherwise, erosion control geotextile must be permanent erosion control, high survivability.

15 **8-01.3 CONSTRUCTION REQUIREMENTS**16 **8-01.3(1) GENERAL**

17 Work involving construction stormwater pollution prevention within The City of Seattle limits must comply with this
 18 Section and Sections 1-05.13(3), 1-07.15 and 1-07.5. Work involving erosion and sedimentation control not within the City of
 19 Seattle limits must also comply with the provisions of the local jurisdiction.

20 If applicable, SWPPP provisions of a National Pollutant Discharge Elimination System (NPDES) construction permit,
 21 local jurisdiction, or both, must be addressed in the CSECP and the TDP.

22 The Contractor's Work and Project Site conditions must ensure elements are in place to protect water quality and to
 23 protect downstream resources. These elements must cover aspects of general water quality protection strategies consisting
 24 of: limiting Project Site impacts, protecting the public drainage system and water bodies, preventing erosion and
 25 sedimentation, protecting the infiltration rate of soils, and managing activities and potential pollutant sources.

26 The elements of water quality and downstream resource protection are:

- 27 1. Define and field identify clearing limits and environmentally critical areas (CSECP & TVSPP).
- 28 2. Keep top layer of soil (TVSPP).
- 29 3. Establish construction access (CSECP).
- 30 4. Protect downstream properties and receiving waters (CSECP & TDP).
- 31 5. Prevent erosion and sediment transport from the Job Site (CSECP).
- 32 6. Prevent erosion and sediment transport from the Job Site by vehicles. (CSECP).
- 33 7. Stabilize soils (CSECP).
- 34 8. Protect slopes (CSECP).
- 35 9. Protect Storm Drains and ditches (CSECP).
- 36 10. Stabilize channels and outlets (CSECP).
- 37 11. Control pollutants (CSECP, TDP, SP & others as applicable).
- 38 12. Control dewatering (CSECP & TDP).
- 39 13. Maintain BMPs (ALL).
- 40 14. Inspect BMPs (ALL).
- 41 15. Execute Construction Stormwater Control Plan (ALL).
- 42 16. Minimize open trenches (CSECP).
- 43 17. Phase the project (ALL; must also be shown on CPM Schedule, see Section 1-08.3).
- 44 18. Install permanent flow control and water quality facilities.
- 45 19. Protect infiltrative stormwater BMPs (CSECP & TVSPP).

46 To the degree possible, the Contractor must coordinate this temporary work with permanent drainage and erosion control
 47 work the Contract requires. The Engineer may require additional temporary control measures if it appears pollution or erosion

1 may result from weather, the nature of the Materials, or progress on the Work. The Engineer may also require erosion control
 2 work to be done with or immediately after grading. Sediment control devices and BMPs must be installed before any ground
 3 disturbing activity.

4 **8-01.3(2) CONSTRUCTION STORMWATER POLLUTION PREVENTION SUBMITTALS**

5 Required submittals for Construction Stormwater Pollution Prevention are:

- 6 1. CSECP
- 7 2. TVSPP
- 8 3. SP
- 9 4. TDP

10 The submittals described in this Section must be submitted as individual plans for review by the Engineer. Updates,
 11 phasing and locations must be coordinated between all plans. Allow 10 Working Days for review of the CSECP, the TVSPP,
 12 the SP, and the TDP as specified in Section 1-05.3.

13 **8-01.3(2)A CONSTRUCTION STORMWATER AND EROSION CONTROL PLAN (CSECP)**

14 The Construction Stormwater and Pollution Prevention submittals must include a CSECP. When a conceptual CSECP
 15 has been developed by the Engineer and included in the Contract, the Contractor must consider these Drawings for
 16 information only unless details or Drawing contain elements noted as "required." The Contractor may propose alternative,
 17 change, or adopt the Engineer's conceptual CSECP elements to reflect the Contractor's means and methods. The
 18 Contractor's means and methods must comply with any required elements in the Engineer's CSECP.

19 If a conceptual CSECP does not exist in the Contract, the Contractor must develop all elements of the CSECP.

20 Refer to SPU Director's Rule DWW-200, Volume 2, Construction Stormwater Control of the Stormwater Manual for
 21 guidance on the CSECP. Checklists for Selecting Construction BMPs are included in this manual. The Contractor must
 22 provide a schedule for CSECP implementation, including installation, maintenance, phasing and removal of each control and
 23 incorporate it into the Contractor's CPM Schedule, see Section 1-08.3.

24 The CSECP must cover all areas of the Contractor's Work and may affect areas outside of the Project Site limits,
 25 including disposal sites, haul roads, all nearby property, streams, and other bodies of water).

26 The CSECP submittal must:

- 27 1. Describe with Shop Drawings of sufficient scale and detail and showing the Project Site, the locations and types of
 28 temporary erosion and sediment controls.
- 29 2. As necessary, show by a series of time sequence Shop Drawings, how construction stormwater and erosion control
 30 BMPs are to be installed, maintained, removed and coordinated with the Work and the CPM Schedule. Describe how
 31 non-work areas will be identified and protected.
- 32 3. Describe how stormwater from non-work areas will be kept separate from stormwater in the work area.
- 33 4. Describe the details and continuing maintenance of entrance and exit equipment wash areas.
- 34 5. Show locations of existing inlets and catch basins within 500 feet downslope of the Work, and describe how they will
 35 be protected.
- 36 6. When stormwater is to be concentrated and collected, show locations with cross-sections as applicable and describe
 37 control details of proposed ditch, berm, culvert, pipe, sediment basin, basin outfall, scour control, inlet, catch basin,
 38 drain, bypass, subsurface drain and related features and coordinate with the TDP.
- 39 7. When detention of collected stormwater is proposed in any location designated for vegetation or pervious cement
 40 concrete sidewalk on the Drawings, describe the proposed restoration of the underlying soils.
- 41 8. Describe locations, protections, and covering practices for stockpile, muck, and related deposits.
- 42 9. Describe the controls to prevent sediment, debris, and other pollutants from entering surface waters and drainage
 43 features.
- 44 10. Provide manufacturer's certificate of compliance, certified laboratory test reports, catalog cuts, samples, and other
 45 information providing adequate description of Supplies and Material proposed for Construction Stormwater and
 46 Erosion Control applications.
- 47 11. Provide the name of the Certified Erosion and Sediment Control Lead (CESCL), or Certified Professional in Erosion
 48 and Sediment Control (CPESC), including contact information. If the work is of such a magnitude that it requires
 49 additional help, describe the qualifications of additional help, any on-site training that may be necessary, and
 50 frequency and type of reporting to the CESCL.
- 51 12. Include a schedule of typical inspections ensuring timely maintenance and repair of erosion control BMPs; minimum
 52 once per week and within 24 hours of a significant precipitation event.
- 53 13. Identify and provide timelines for submitting permit required or related documentation; may reference submittal
 54 control document, see Section 1-05.3.
- 55 14. Provide details of seed mix, amendment, mulch, and protections for placing and establishing temporary seeded
 56 erosion control areas.

- 1 15. In areas where exposed erodible soil exceeds 4000 square feet or may be unprotected for more than 2 Calendar
2 Days, describe the controls and the proposed monitoring to ensure runoff from the Job Site remains compliant.
- 3 16. Identify the method for collecting, containing, removing, and properly disposing washout of concrete trucks and
4 concrete handling equipment. Concrete washout is not permitted onto the ground unless approved by the Engineer.
- 5 17. Provide details of other construction stormwater and erosion control measures that may be used in the Work.
6 The Contractor must provide at a designated location at the Project Site the current (or copies of the current) CSECP.

7 **8-01.3(2)B TREE, VEGETATION AND SOIL PROTECTION PLAN (TVSPP)**

8 The Contractor must develop, implement, maintain and regularly update a Project Site specific TVSPP including all
9 materials, equipment, and labor to be used, for the duration of the Contract. The TVSPP must show the location of BMPs
10 related to the protection of existing (not designated for removal) and new trees (including roots), vegetation, and soil.

11 The Contractor's schedule for installation of protective measures must be shown in the Contractor Critical Path Schedule
12 and applicable weekly look-ahead schedules. The Engineer's review of the TVSPP must involve a joint field review with the
13 Contractor. Conflicts between protection measures and Work required under the Contract must be brought to the attention of
14 the Engineer during the joint field review of the TVSPP. The TVSPP must be accepted before any mobilization. The TVSPP
15 may be submitted by phases when specified or approved by the Engineer.

16 Locations, extent, and type of "specific protective measures" must be approved by the Engineer during the TVSPP joint
17 field review. The Contractor must amend the TVSPP submittal as necessary to document site conditions and show required
18 protections measures, which may include:

- 19 1. Protection of trees identified by the note "Protect Trees" on the Drawings or trees not identified for removal where
20 Zone B (see Standard Plan 133) is within the construction limits.
- 21 2. Protection of vegetation identified by the note "Protect Landscaping" on the Drawings or vegetation identified for
22 protection during the TVSPP joint field review.
- 23 3. Protection of soil conditions and existing tree and vegetation roots in areas identified by the note "Do Not Disturb" on
24 the Drawings.
- 25 4. Roots within zone B of a tree encountered during excavation, except when the roots are less than 2 inches in
26 diameter and are within roadway surfacing section, driveway surfacing section, sidewalk surfacing section, utility
27 prisms, and within 1-foot of improvement structures geometrics (such as retaining walls, bridge abutments, and pole
28 foundations.) A utility prism is the volume centered about the utility equal to the trench width in both vertical and
29 horizontal dimensions. Utility prisms are not defined for conduit.
- 30 5. All areas marked as "Pervious Concrete Sidewalk" on the Drawings.
- 31 6. All areas marked as "Rain Garden" or "Bioretention" on the Drawings.
- 32 7. Other areas to be protected as directed by the Engineer during the joint field review and as documented in the
33 Contractor's proposed TVSPP.

34 Storage of equipment or materials is not allowed within the areas marked on the Drawings as "Do Not Disturb" or within
35 the Zone B of a tree unless "specific protective measures" per the Engineer approved TVSPP are in place. "Specific protective
36 measures" for approved storage within areas marked as "Do Not Disturb" must be at a minimum 1-inch steel plate or 4-inch
37 thick timber planking over 2 to 3 inches of AWCM, or a minimum 3/4-inch plywood over 6 to 8 inches of AWCM.

38 For protection of trees, as specified in item 1. above, the TVSPP must address the following "specific protective
39 measures" unless otherwise approved by the Engineer in writing:

- 40 a. Where construction operations are within the limits of Zone B for a duration more than 30 Calendar Days, protect
41 trees in unpaved planting strips or in tree pits per Standard Plan 132a.
- 42 b. Where construction operations are within the limits of Zone B for a duration of 30 Calendar Days or less, a Standard
43 Plan 132b enclosure must surround the entire unpaved tree pit area and be anchored and maintained in a stable
44 upright condition.
- 45 c. Show the limits of each required exploratory excavation location to minimize tree root damage, as directed by the
46 Engineer during the joint field review, and address the method to be used to expose the roots in each location, such
47 as air spade or hand digging. The method must allow for all roots 2 inches and larger in diameter to be protected.
48 Where roots 2 inches in diameter and larger are discovered, the Contractor must promptly notify the Engineer. If
49 allowed, root pruning must be as specified in Section 8-02.3(7)A.

50 For protection of vegetation, as specified in item 2. above, the TVSPP must include chain link fencing for protection of
51 vegetated areas per Standard Plan 132a, Option 2. Where construction operations are within the limits of Zone B for a
52 duration of less than or equal to 30 Calendar Days, vegetation protection using temporary construction fencing supported by
53 tee stakes may be approved by the Engineer at the request of the Contractor.

54 For protection of soil conditions and existing roots, as specified in item 3. above, the TVSPP must include the following
55 specific protective measures to prevent damage to existing soils or roots during construction within Zone B:

- 56 1) Double-layered burlap cover for all newly exposed soil and/or roots and daily watering for exposure of 5 Working
57 Days or less.

- 1 2) 6 inches of AWCM cover for all newly exposed soil and/or roots and twice weekly watering to protect soil from
2 compaction, retain soil moisture, and control erosion.
- 3 3) Temporary or chain link construction fencing enclosing all newly exposed soil and/or roots associated with trees and
4 other vegetation beyond the construction limits.

5 For protection of pervious concrete sidewalk, as specified in item 5. above, following the removal of any existing
6 pavement, a Standard Plan 132b enclosure must surround the entire area where pavement was removed and be anchored
7 and maintained in a stable upright condition.

8 For protection of rain gardens or bioretention areas, as specified in item 6. above, and where construction operations are
9 within the limits rain gardens or bioretention areas for a duration of more than 30 Calendar Days, protection per Standard Plan
10 132a surrounding the entire area as shown on the Drawings is required. Where construction operations are within the limits
11 shown on the Drawings for a duration of 30 Calendar Days or less, a Standard Plan 132b enclosure must surround the entire
12 area and be anchored and maintained in a stable upright condition.

13 The TVSPP must also address the following general protective measures unless otherwise approved by the Engineer in
14 writing:

- 15 a) If canopy/clearance pruning is required to perform the Work within standard vertical clearances, the Contractor must
16 notify the Engineer at the TVSPP joint field review, or at least 15 Working Days in advance to allow pruning by the
17 Owner or private property owner. The Engineer may require that this canopy/clearance pruning be performed by the
18 Contractor as specified in Section 1-04.3. Standard vertical clearances is considered 14 feet for roadway, 10 feet for
19 bicycle paths, 8 feet for sidewalks, and as specified in the Contract.
- 20 b) Pruning of canopy for construction clearance above standard vertical clearances is not allowed unless no alternative
21 option, such as temporary tie-up of low limbs or alternative construction methods, is feasible as determined by the
22 Engineer.
- 23 c) Where canopy/clearance pruning above standard vertical clearances is approved by the Engineer, the Contractor is
24 responsible for this pruning and all associated costs.
- 25 d) If the Contractor performs canopy/clearance pruning, The Contractor must be a registered Tree Service Provider with
26 the current registration on file with SDOT Urban Forestry, and must identify technicians with current ISA certification
27 that will perform the work. See Section 8-02.3(7)A for pruning specifications. When pruning necessary to perform the
28 work is not identified and brought to the attention of the Engineer during the TVSPP joint field review, the Contractor
29 must submit a canopy/clearance plan, including current registration and ISA certification, as an addendum to the
30 TVSPP. A separate TVSPP-canopy/clearance pruning submittal must be submitted at least 5 Working Days in
31 advance as specified in Section 1-05.3. If pruning is performed at both the Owner's and Contractor's cost as
32 described here within, the cost will be prorated.
- 33 e) Where construction activity involves the operation of equipment or redirection of traffic from established travel lanes
34 within the dripline (Zone B) of trees within the ROW and/or the dripline of trees overhanging the ROW, the Contractor
35 must depict these conditions on the TVSPP.
- 36 f) Protective measures installed over grass or groundcover and underlying soil proposed to be kept in an undisturbed
37 condition in unpaved planting strips or open areas must be installed and removed in a timely manner to minimize
38 impact to understory vegetation.
- 39 g) Soil management/protective measures must include eradication of ivy and other invasive weed species detrimental to
40 the preservation of trees before placement of AWCM in all areas to be protected from disturbance.
- 41 h) Excavation or tunneling of any kind within the Critical Root Zone (Zone A) of a tree requires approval by the Engineer.
42 The Contractor must provide at least 2 Working Days advance written notice for review and must not proceed without
43 approval.
- 44 i) Excavation or portions thereof excluded from specific protective measures but within Zone B of a tree must be
45 performed with care to minimize damage to roots. In all excavations, if roots 2 inches and larger are encounter, the
46 excavation at the root location must stop and the Contractor must promptly notify the Engineer. If root pruning is
47 required, see Section 8-02.3(7)A for pruning cuts and methods.
- 48 j) Protect trees from exhaust heat. Exhaust deflection panels may be required on some equipment to prevent burning of
49 foliage and branches of trees to be kept.

50 See Standard Plans 132a and 132b for additional tree protection guidance. See Standard Plan 133 for tree/root Zones A,
51 B, and C.

52 Alteration of the TVSPP and protection measures is allowed only as deemed necessary by the Engineer. In order to
53 accommodate actual construction details and to coordinate with Standard Plans 132a and 132b, the fence at the dripline
54 required on Standard Plan 133 may be moved to a location closer to the tree, if approved by the Engineer.

55 **8-01.3(2)C SPILL PLAN**

56 The Construction Stormwater and Pollution Prevention submittals must include a SP.

57 As specified in Section 1-07.15(1) and applicable laws, the Contractor must prepare a project specific construction
58 prevention, control and countermeasures SP to be used for the duration of the project. The Contractor must develop,

1 implement, maintain and regularly update a Project Site specific SP, including all materials, equipment, and labor to be used
2 for the duration of the project.

3 The SP must be approved by the Engineer before the commencement of any Project Site construction activities. The
4 Contractor must maintain a copy of the SP at the Project Site, including any necessary updates as the Work progresses.

5 The Contractor must update the SP throughout project construction so that the written plan reflects actual Job Site
6 conditions and practices. The Contractor must update the SP at least annually and maintain a copy of the updated SP on the
7 Project Site. All project employees must be trained in spill prevention and containment, and must know where the SP and spill
8 response kits are located and have immediate access to them.

9 If hazardous materials are encountered or spilled during construction, the Contractor must do everything possible to
10 control and contain the material until appropriate measures can be taken. The Contractor must supply and maintain spill
11 response kits of appropriate size within close proximity to hazardous materials and equipment.

12 The Contractor must implement the spill prevention measures identified in the SP before performing any of the following:
13 placing materials or equipment in staging or storage areas; refueling, washing, or maintaining equipment; or stockpiling.

14 The SP must set forth the following information in the following order:

- 15 1. Responsible Personnel: Identify the name, title, and contact information for the personnel responsible for
16 implementing and updating the plan, including the Spill Prevention and Response lead (per 1-05.13(3)C) and all spill
17 responders.
- 18 2. Spill Reporting: List the names and telephone numbers of the federal, state, and local agencies the Contractor must
19 notify in the event of a spill. The Contractor must also notify the Engineer.
- 20 3. Project Site Information: Describe the following items:
 - 21 a. The project scope of work;
 - 22 b. The Project Site location and boundaries;
 - 23 c. The drainage pathways from the Project Site; and
 - 24 d. Nearby waterways and sensitive areas and their distances from the Project Site.
- 25 4. Potential Spill Sources: Describe each of the following for all potentially hazardous materials brought or generated
26 on-site, including materials used for equipment operation, refueling, maintenance, or cleaning:
 - 27 a. Name of material and its intended use;
 - 28 b. Estimated maximum quantity on-site at any one time;
 - 29 c. Locations (including any equipment used below the ordinary high water line) where the material will be staged,
30 used, and stored and the distance from nearby waterways and sensitive areas;
 - 31 d. Decontamination location and procedure for equipment that comes into contact with the material; and
 - 32 e. Disposal procedures.
- 33 5. Pre-Existing Contamination: Describe any pre-existing contamination and contaminant sources (such as buried pipes
34 or tanks) in the project area that are described in the Contract documents. Identify equipment and work practices that
35 will be used to prevent the release of contamination.
- 36 6. Spill Prevention and Response Training: Describe how and when all personnel (including refueling contractors and
37 Subcontractors) will be trained in spill prevention, containment and response per the Spill Plan. Describe how and
38 when all spill responders will be trained per WAC 296-824.
- 39 7. Spill Prevention: Describe the following items:
 - 40 a. Spill response kit contents and location;
 - 41 b. Security measures for potential spill sources;
 - 42 c. Secondary containment practices and structures for hazardous materials;
 - 43 d. Methods used to prevent stormwater from contacting hazardous materials;
 - 44 e. Site inspection procedures and frequency;
 - 45 f. Equipment and structure maintenance practices;
 - 46 g. Daily inspection and cleanup procedures that ensure all equipment used below the ordinary high water line is free
47 of all external petroleum based products; and
 - 48 h. Refueling procedures for equipment that cannot be moved from below the ordinary high water line.
- 49 8. Spill Response: Outline the response procedures the Contractor will follow for each scenario listed below. Include a
50 description of the actions the Contractor will take and the specific, on-site, spill response equipment that will be used
51 to assess the spill, secure the area, contain and eliminate the spill source, and clean up and dispose of spilled and
52 Contaminated Material.
 - 53 a. A spill of each type of hazardous material at each location identified in 4, above.
 - 54 b. Stormwater that has come into contact with hazardous materials.
 - 55 c. A release or spill of any pre-existing contamination and contaminant source described in 5, above.

- 1 d. A release or spill of any unknown pre-existing contamination and contaminant sources (such as buried pipes or
- 2 tanks) encountered during project work.
- 3 e. A spill occurring during work with equipment used below the ordinary high water line (if applicable).
- 4 9. Project Site Map: Provide a map showing the following items:
- 5 a. Site location and boundaries;
- 6 b. Site access roads;
- 7 c. Drainage pathways from the site;
- 8 d. Nearby waterways and sensitive areas;
- 9 e. Hazardous materials, equipment, and decontamination areas identified in 4, above;
- 10 f. Pre-existing contamination or contaminant sources described in 5, above; and
- 11 g. Spill prevention and response equipment described in 7 and 8, above.
- 12 10. Spill Report Forms: Provide a copy of the spill report forms that the Contractor will use to record the release and
- 13 cleanup.

14 If the Contractor will use a Subcontractor for spill response, provide contact information for the Subcontractor under item
 15 1. (above), identify when the Subcontractor will be used, and describe actions the Contractor must take while waiting for the
 16 Subcontractor to respond.

17 An environmental spill is considered a release of contaminant or any material that may be hazardous, or dangerous, or
 18 harmful to the environment. In addition to the specifications in Section 1-07.5(2), the Contractor must take precautions to
 19 assure that contaminants are under control and prevented from release. Contaminants anticipated for use in performing the
 20 Work (such as fuel, hydraulic oil, asphalt sealer, pesticide, lubricant, and paint) must be stored, handled, transported, used,
 21 and disposed of per each product’s Material Safety Data Sheet (MSDS), manufacturer’s recommendations, and applicable
 22 law, code, and regulation. Equipment (such as valves, pumps, and switches) and Supplies (such as hose, containers, and
 23 connections) must be maintained at all times in good operating condition, leak proof, and must be routinely inspected for leaks
 24 and releases, and immediately repaired or replaced when needed. MSDS information for each potential contaminant at the
 25 Project Site must be maintained on the Project Site in a location that is readily accessible.

26 Should an environmental spill occur, the Contractor must immediately contain the spill and must make the notifications
 27 specified in Section 1-07.28, and as described in the Contractor’s approved SP. This Contract information must be posted
 28 using the Emergency Response for the SP form. The form must be provided on request.

29 In addition to immediate verbal notification, the Contractor must submit written documentation (spill report) for all
 30 releases of hazardous material to the Engineer within 24 hours of initial discovery of the release. The Contractor must submit a
 31 written update of the spill report, including documentation of the response and cleanup of the release, to the Engineer within 5
 32 Business Days of completion of the cleanup.

33 In addition, the Contractor must comply with any instruction provided by the Engineer or any agency having the authority
 34 to direct cleanup activities at the Project Site.

35 **8-01.3(2)D TEMPORARY DISCHARGE PLAN**

36 The Construction Stormwater and Pollution Prevention submittals must include a TDP.

37 The Contractor must develop, implement, maintain and regularly update a Project Site specific TDP. The TDP must
 38 include all materials, equipment, and labor to be used, for the duration of the project for water management per all Owner
 39 provided and Contractor obtained permits that identify flow rates, quantity and quality controls of concentrated and collected
 40 temporary discharges of groundwater, and process water and stormwater to the drainage and Sewer system (or land, if
 41 applicable). See related Sections 1-05.13(3), 1-07.6, and dewatering Specifications.

42 The TDP must incorporate requirements limiting flow rate, quantity and quality of the proposed discharge, record keeping
 43 and reporting to comply with the most restrictive of the following (if applicable):

- 44 1. A National Pollutant Discharge Elimination System (NPDES) construction permit;
- 45 2. A King County Industrial Discharge permit;
- 46 3. Side Sewer permit for Temporary Discharge; and
- 47 4. Other applicable permits.

48 The TDP must include:

- 49 a. A schematic flow diagram from collection or generation of water to an approved point of discharge at the drainage
 50 and Sewer system that includes any detention, settling, or treatment, flow restrictions, measurement equipment and
 51 location, quality sampling equipment and location.
- 52 b. Site layout drawing showing the above, which may be incorporated into the CSECP described in 8-01.3(2)A.
- 53 c. Description of any weather related permit restrictions and the Contractor’s planned response.
- 54 d. Description of all flow measuring equipment and any manufacturer recommended calibration and maintenance (if
 55 applicable).
- 56 e. Sample measurement report and a schedule for recording and reporting all flow measurements (if applicable).

- 1 f. Description of all sampling and measuring equipment for turbidity, total settleable solids, chlorine and pH and
2 manufacturer recommended calibration and maintenance.
- 3 g. Description of sampling equipment and procedures for all other pollutants that will be sent to an approved Laboratory
4 (if applicable).
- 5 h. Sample discharge quality report and a schedule for recording and reporting all quality measurements (if applicable).

6 **8-01.3(2)E DEWATERING PLAN**

7 The Construction Stormwater Pollution Prevention Submittals may include a Dewatering Plan per Section 2-08.3.

8 **8-01.3(3) MAINTAINING CSECP AND TVSPP CURRENT**

9 During the course of the Work, the Engineer may require the Contractor and Construction Stormwater Pollution
10 Prevention Coordinator and the Tree, Vegetation and Soil Protection lead, see Section 1-05.13(3), to discuss with the
11 Engineer the status of the CSECP and the TVSPP controls in-progress and future controls as they relate to the Work, to the
12 progress schedule, to permits, to Change Orders, and as may be required in the Contract.

13 Significant addition of work, the encountering of unexpected ground water, the occurrence of a slide, or changes in the
14 Contractor's method of operation may require significant modifications to the CSECP or TVSPP. When revisions to the current
15 CSECP or TVSPP are required, the Contractor and applicable leads must update the CSECP, TVSPP, or both and must
16 submit the updated plans to the Engineer within 5 Working Days unless the Engineer agrees to other arrangements.

17 The Contractor's CESCL and TVSPP lead must verify all BMPs are being followed at least once every calendar week
18 and within 24-hours of runoff events in which stormwater discharges from the site. Inspections of temporarily stabilized,
19 inactive sites may be reduced to once every calendar month. The Construction Stormwater Pollution Prevention Inspection
20 Form must be completed for each inspection and a copy must be submitted to the Engineer before the end of the next
21 Working Day following the inspection. Separate inspection may be performed and submitted for the CSECP and the TVSPP.

22 **8-01.3(4) AUTHORITY OF CONSTRUCTION STORMWATER POLLUTION PREVENTION COORDINATOR**

23 See Section 1-05.13(3).

24 **8-01.3(5) EROSION CONTROL SEEDING**

25 **8-01.3(5)A GENERAL**

26 The application of seed, fertilizer, lime, mulch, tackifier, and other amendments must be as specified in Section 8-02, as
27 may be required in the Contract, and as described in the construction stormwater pollution prevention submittals.

28 Where the application of erosion control seeding is within, near, or may contribute to runoff entering into streams, surface
29 waters, and environmental critical areas, all fertilizers must be a slow release formulation.

30 **8-01.3(5)B CULTIVATION**

31 Soil surfaces disturbed, compacted or exposed to erosion must be prepared before seeding by cultivation to incorporate
32 amendments to produce an 8-inch minimum depth of homogeneous mixture containing 5 percent organic matter suitable for
33 seeding, see Section 8-02.

34 Clearing, grubbing, grading, removal of debris and delineation of areas to be excluded from cultivation must be
35 completed by the Contractor and inspected by the Engineer before cultivation. Exposed soil surfaces within areas excluded
36 from cultivation must be topdressed with 1 inch of amended soil for seeding or mulched as directed by the Engineer.

37 Cultivating may be by rototiller, farm disc, harrow, or other equipment approved by the Engineer.

38 On slopes or grades, cultivating must follow the contours or be done at right angles to the natural flow of water. Where
39 the slope grade is relatively steep, including but not limited to areas identified as Environmentally Critical Areas, the Contractor
40 must submit a cultivating plan to the Engineer for review at least 2 Working Days in advance. When near streams and other
41 bodies of water, including but not limited to Environmentally Critical Areas, designated Wetlands, Wildlife Corridors, and Fish
42 and Wildlife Habitat Conservation Areas cultivating must be done reasonably parallel to the water bodies' boundaries and must
43 gradually transition with distance from the water to slope or grade cultivating.

44 Cultivation within the drip line of existing trees, shown as "Zone B" on Standard Plan 133, is excluded from areas unless
45 otherwise directed by the Engineer.

46 **8-01.3(5)C COMPACTION**

47 After cultivation and before seeding, cultivated areas must be compacted for a depth of 4 inches to not less than 80
48 percent and not more than 85 percent as maximum dry density, as determined by the method specified in Section 2-11.

49 On slopes, and as the grade may permit, equipment must make a series of passes that compact parallel strips following
50 the contour. Where parallel to the contour sequencing of compaction cannot be accomplished, the Contractor must follow the
51 contour to the maximum extent feasible.

52 Soil to be seeded that is adjacent to curb, sidewalk, driveway, walking path, pavement, and other improved surface for
53 pedestrian or vehicular traffic, must be at least 1 inch below the finished grade of the improved surface.

1 8-01.3(5)D SEEDING

2 Unless the Contract specifies otherwise, areas must be seeded immediately following cultivation and compaction.

3 Seeding, fertilizing, and mulching must be performed at times when environmental conditions are conducive to
4 satisfactory growth. Do not seed during windy weather that would interfere with uniform distribution of seed or mulch, when the
5 ground is frozen, or when the ground is excessively wet or dry as determined by the Engineer. If environmental conditions are
6 not conducive to satisfactory growth, the Contractor must install an alternative cover method until environmental conditions
7 improve.

8 Seed of the mix type specified must be placed at the rate of application for the seed mix as specified in Section 9-14.2,
9 unless otherwise specified.

10 The application of seed, fertilizer, mulch, and other identified amendment in the construction stormwater pollution
11 prevention submittals must be a single operation for all seed applications. Seeding must be applied by the following methods,
12 as applicable:

- 13 1. Hydroseeding: A hydroseeder may be used that uses water as the carrying agent, and can acceptably handle
14 fertilizer, mulch, and other amendment as identified. The hydro-seeder must have an operating and feed capacity
15 sufficient to agitate, keep in suspension, and mix the required mixture of seed, water, and amendment into a
16 homogeneous slurry. Distribution and discharge lines must be sized to prevent blockage and binding, and must allow
17 for uniformity in required application rates. Spray nozzles must be designed to provide a uniform and consistent slurry
18 application.
- 19 2. Seeding With Blower-Applied Compost: A pneumatic blower device equipped with a computer-calibrated seed
20 injection system may be used to apply a mixture of seed, compost, and other amendment as needed. The blower
21 device must have an operating and feed capacity sufficient to uniformly mix and apply the specified growing medium
22 and seed.
- 23 3. Small area applications: Areas of a size not economical for hydroseeding methods must be seeded by hand or by
24 small-scale equipment or both. The Contractor must provide the proposed method for applying seed or seed mixture
25 to the Engineer at least 2 Working Days in advance.

26 8-01.3(5)E HYDROSEEDING

27 For hydroseeding applications, seed, fertilizer, mulch, and other identified amendment must be applied in 1 application,
28 provided that:

- 29 1. The quantity of fertilizer added to the seed mixture must produce the specified rates in Section 9-14.3(1) for all
30 ingredients. Place fertilizer in the hydro-seeder tank no more than 30 minutes before application.
- 31 2. Unless the CSECP indicates otherwise, wood cellulose fiber mulch is added to the seed mixture to act as a buffer.
32 The mulch can substitute as a tracer; however, the rate of mulch application must not exceed 250 pounds per acre.
- 33 3. The seed mixture must have a tracer added to aid in uniform application by visual means. If a tracer other than wood
34 cellulose fiber mulch is used, it must not be harmful to the environment.

35 8-01.3(5)F SEEDING WITH BLOWER-APPLIED COMPOST

36 For blower applications, seed, fertilizer, mulch, and other identified amendment must be applied in 1 application, provided
37 that:

- 38 1. Compost must comply with specifications in Section 9-14.4(8).
- 39 2. The quantity of fertilizer added must be adjusted allowing for the nutrients provided in compost.
- 40 3. Before application of the growing medium and seed, the Contractor must ensure that the pneumatic blower has been
41 properly calibrated to apply the specified quantity of seed.
- 42 4. Seeding is not done when winds interfere with uniform application.

43 8-01.3(5)G ESTABLISHMENT PERIOD AND MAINTENANCE

44 The seeding establishment period for temporary erosion control seeding must start on the Day the seed is applied and
45 must continue for the greater of 90 Days or as identified in the Construction Stormwater Pollution Prevention submittals. The
46 Contractor must perform the following maintenance during this establishment period:

- 47 1. Protect seeded areas from vehicle and pedestrian traffic.
- 48 2. Employ erosion and sediment control measures to protect seeded areas.
- 49 3. 60 Days after seeding, seeded areas exhibiting no germination or germination insufficient to provide 90 percent
50 coverage, damaged by traffic, covered by sediment or eroded must be repaired as needed. Repair may include all of
51 the following required to remediate: removal of sediment, regrading, reseeding, refertilizing, and remulching.
- 52 4. Repaired areas must be re-inspected 30 Days after repair is completed to ensure establishment with a minimum of
53 90 percent coverage.

54 Seeding applications that do not comply with establishment and coverage requirements after 90 days are subject to a
55 supplementary establishment period of 30 Days until requirements are met.

1 **8-01.3(6) EROSION CONTROL MULCHING**

2 **8-01.3(6)A GENERAL**

3 When the CSECP indicates a separate mulch application for an area in addition to seeding, Mulch Material must be
4 coarse compost applied as specified in Section 8-01.3(6)F, unless otherwise specified in the Contract.

5 If Compost mulch cannot be applied along with seed using blower equipment as specified in 8-01.3(5)F, then mulching
6 must immediately follow the seeding, unless otherwise specified by the Engineer.

7 Areas not accessible by mulching equipment must be mulched by approved hand methods.

8 **8-01.3(6)B STRAW MULCH**

9 Straw mulch erosion control application must use a forced air mulch spreader. In spreading straw mulch, the spreader
10 must not cut or break the straw stalks into lengths less than 2 inches. Where a forced air equipment mulch application is
11 providing unacceptable results, the Contractor must use other application methods such as hand spreading and raking.

12 Straw mulch coverage must have a minimum thickness of 2 inches.

13 If straw mulch coverage at any time exposes bare ground of more than 50 percent in any 100 square foot area, then the
14 Contractor must promptly remulch the exposed area to full coverage of the thickness required.

15 **8-01.3(6)C ARBORIST WOOD CHIP MULCH**

16 Arborist Wood Chip Mulch or approved equal as specified in Section 9-14.4(4) must be the Material used to comply with
17 erosion control and tree/vegetation protection requirements unless otherwise specified in the Contract.

18 Wood chip mulch erosion control application must use a forced air mulch spreader, or by a delivery method that does not
19 disturb the surface to be protected, followed by hand-raking to obtain uniform coverage and clearance around tree trunks.
20 Where a forced air equipment mulch application is indicated as providing unacceptable results, the Contractor must use
21 manual or other application methods such as hand spreading and raking.

22 AWCM must be applied to provide a 2-inch minimum thickness coverage.

23 Mulch must be raked or manually cleared 6 to 8 inches from the trunk of each tree, to prevent damage from rot or
24 rodents.

25 Should the wood chip mulch coverage expose at any time bare ground of more than 50 percent in any 100 square foot
26 area, the Contractor must promptly remulch the exposed area to full coverage of the thickness required.

27 **8-01.3(6)D BARK MULCH**

28 Bark mulch as specified in Section 9-14.4(3) must be the Material used to comply with erosion control and
29 tree/vegetation protection requirements. Application must be with a pneumatic blower device, or by a delivery method that
30 does not disturb the surface to be protected, followed by hand raking to obtain uniform coverage and clearance around tree
31 trunks. Where a bark mulch spreader application is providing unacceptable results, the Contractor must use other application
32 methods such as hand spreading and raking.

33 Bark mulch must be applied to provide a 2-inch minimum thickness coverage.

34 Mulch must be raked or manually cleared 6 to 8 inches from the trunk of each tree, to prevent damage from rot or
35 rodents.

36 Should the bark mulch coverage expose at any time bare ground of more than 50 percent in any 100 square foot area,
37 then the Contractor must promptly remulch the exposed area to full coverage of the thickness required.

38 **8-01.3(6)E WOOD CELLULOSE FIBER MULCH**

39 Wood fiber mulch as specified in Section 9-14.4(2) must be applied using a hydroseeder. Where a hydroseeder
40 application is providing unacceptable results, the Contractor must use other methods such as hand spreading and raking.

41 When used without seeding for the sole purpose of erosion control, the rates of application specified in Section 9-14.4(2)
42 are amended as follows:

- 43 1. 70 pounds per 1000 square feet, or 3000 pounds per acre, for areas ranging from level to having a slope of 4
44 horizontal to 1 vertical.
- 45 2. 100 pounds per 1000 square feet, or 4000 pounds per acre, for areas having a slope ranging from greater than 4
46 horizontal to 1 vertical to as much as 4 horizontal to 1 vertical.
- 47 3. 120 pounds per 1000 square feet, or 5000 pounds per acre, for areas having a slope greater than 2 horizontal to 1
48 vertical.

49 Should the wood cellulose fiber mulch coverage expose at any time bare ground of more than 50 percent in any 100
50 square foot area, the Contractor must promptly remulch the exposed area to full coverage of the thickness required.

1 **8-01.3(6)F COMPOST BLANKET (COMPOST MULCH)**

2 Compost mulch for erosion control (i.e. compost blanket) must consist of coarse compost meeting the specifications in
3 Section 9-14.4(8). Where the compost will later be incorporated into the soil as an amendment for turf areas, the Engineer may
4 specify the use of fine compost instead of coarse compost.

5 Compost blanket erosion control application must use a blower as specified in Section 8-01.3(5)E. Where a forced air
6 mulch spreader application is indicated as providing unacceptable results, the Contractor must use manual or other methods
7 such as hand spreading and raking, or other mechanical methods if approved by the Engineer.

8 Coverage applications must have a minimum thickness of 2 inches, and a maximum thickness of 4 inches.

9 Should the compost blanket mulch coverage at any time expose bare ground of more than 25 percent in any 100 square
10 foot area, the Contractor must promptly re-mulch the exposed area to full coverage of thickness required.

11 **8-01.3(7) EROSION CONTROL MATTING**

12 **8-01.3(7)A GENERAL**

13 Erosion control matting may consist of one or more applications of coir, jute, or excelsior matting; per Section 9-14.4.

14 Erosion control matting must be installed and secured per the manufacturer's recommendations.

15 Unless the matting manufacturer recommends otherwise, seeding, with or without amendment or mulch, must be applied
16 before the placement of matting.

17 Staking must be driven flush with grade and must penetrate the earth by a minimum of 12 inches.

18 The Contractor must maintain the integrity of the matting by promptly repairing or replacing as necessary all improperly
19 anchored, torn, uplifted, and missing matting. Torn or missing matting must be covered with additional matting overlapping the
20 tear or the exposed area with a minimum 24-inch overlap of all surrounding matting. This patch must be staked at each corner
21 3 inches from the edge of patch and along all edges with a spacing not exceeding 12 inches. Uplifted and improperly anchored
22 matting must be repaired by replacing failed anchors, or by increasing the density of anchors as applicable.

23 **8-01.3(7)B NON-DITCH AND NON-CHANNEL MATTING INSTALLATION**

24 Matting must be placed flush with the soil surface with the first matting installed at the lowest elevation. Additional upper
25 elevation matting must be installed over lower elevation matting with a minimum 6-inch overlap. Matting must be installed with
26 the long axis of matting parallel to the contour.

27 Unless the matting manufacturer recommends otherwise, the higher elevation edge of matting must be buried in an
28 anchor trench 6 inches deep by 12 inches wide with soil firmly tamped against the matting. Upper elevation matting must be
29 installed over lower elevation matting with an overlap the full width of anchor trench. Before backfilling the anchor trench,
30 staking must penetrate the matting in the center of the anchor trench. Spacing of staking within the trench must not exceed 3
31 feet. A stake must be placed through the mat fabric 6 inches from edges at the corner including if overlapped by another mat.
32 Backfill in the trench must be tamped firm.

33 Trenching to anchor matting is not allowed within the dripline area of trees, Staking to anchor the upslope edge of
34 matting must be installed approximately 3 inches from the edge. Spacing of the stakes must not exceed 3 feet, except at ends
35 where the stake must be installed through the mat fabric 6 inches from all edges including when overlapped. Upper elevation
36 fabric installed over lower elevation fabric must have a minimum 12-inch overlap with staking placed in the overlapping area 3
37 inches from the upper edge of fabric.

38 For all width matting fabrics, spacing of stakes within a row must be 3 feet or less and spacing between rows of stakes
39 must be 3 feet or less. Each long edge of matting fabric, whether overlapped or not, must be staked 3 inches from the long
40 edge with stake spacing not exceeding 3 feet. The fabric ends, the short edge, must be staked 3 inches from the end whether
41 overlapped or not, with a minimum 3 stakes along the short edge.

42 **8-01.3(7)C DITCH AND CHANNEL MATTING INSTALLATION**

43 Matting installed in ditches and channels must have the long axis of the matting parallel to the direction of water flow. The
44 first matting installation must be at the invert of the ditch or channel. Additional matting installation must be installed
45 overlapping the upper edge of previously placed fabric by at least 12 inches. In the direction of flow, upstream matting must
46 overlap downstream matting by 12 inches. Matting must be held in place with ballast by other means capable of withstanding
47 peak flows.

48 **8-01.3(8) PLASTIC COVERING**

49 Stockpiles, areas with no vegetative growth, areas where vegetative growth is to be inhibited, and areas with disturbed
50 soil may be covered with permeable or impermeable black plastic covering. Sandbag or similar ballast must be placed on the
51 cover in a grid with no less than 5 feet spacing in 2 right angle directions. At all ends without overlap, ballast must be placed
52 within 12 inches of the edge and spaced no more than 5 feet along the perimeter.

53 Clear plastic covering must cover areas where the growth of vegetation is not to be inhibited.

54 With the exception of stockpiles, plastic covering sheets must be installed with the long axis parallel with slope contours.

1 The upper edge of the fabric must be placed into a 12-inch wide by 6-inch deep anchor trench and backfilled with native
2 soils tamped into place. Upper slope fabric must overlap downslope fabric in the anchor trench a minimum of 12 inches. Along
3 the same contour, the ends of new fabric must overlap in-place fabric a minimum of 24 inches. Within the dripline of trees,
4 excavation of anchor trenches will not be allowed. Rather, ballast must be placed on the fabric and the overlaps secured by
5 rope tied to anchor stakes upslope of the dripline area.

6 In general, ballast must be placed on the cover using sandbags or similar ballast distributed over the cover as to prevent
7 uplift, slippage, and any other movement of the cover. Spacing of ballast must be not more than a 10-foot grid in line with and
8 against the long axis of the sheet. All overlaps, edges, and corners must be ballasted. Uplifted areas must receive additional
9 ballast resulting in reduced ballast spacing. On steep slopes and where slippage of ballast or ballasted fabric is indicated, the
10 ballast must be secured in-place by rope tied to upslope anchors firmly set in the earth.

11 Rips and tears must be repaired by placing additional covering over the defect with a minimum 24-inch overlap in all
12 directions from the defect. The repair must be ballasted with spacing in any direction of no more than 5 feet and along all
13 edges and at all corners. Ballast must be anchored to upslope stakes. Areas where covering has slipped and the underlying
14 surface becomes exposed must be promptly repaired in the same manner as rips and tears.

15 Clear plastic covering intended to cover a vegetated surface without long term inhibiting effects requires frequent
16 monitoring ensuring permanent damage is not occurring. Should vegetative degradation be indicated, the Contractor must
17 amend the cover practice to a condition not detrimental to the vegetation.

18 **8-01.3(9) STRUCTURAL AND BIOMECHANICAL EROSION CONTROLS**

19 **8-01.3(9)A EQUIPMENT WASH AREA**

20 Where equipment and vehicular traffic may contribute to the transport of sediment and other debris beyond or within a
21 Project Site, the Contractor must have in place a stabilized construction wash area to remove sediment, mud, and other debris
22 from tires, equipment and vehicles.

23 Stabilized construction wash areas must be in place and ready for operation before the potential for transporting such
24 material occurs.

25 The wash area must consist of one or more of the following as the Work requires and as the Contract may require:

- 26 1. Graded entrance and exit wash area for all equipment and vehicles.
- 27 2. A water trough for each direction. The depth of water in the trough must be maintained at a level adequate for the
28 size of equipment and vehicle expected. The length and width of the trough must be sized to ensure all equipment
29 and vehicles can be acceptably cleaned.
- 30 3. Hose, hose brush, long handled brush, and similar Supplies, and adequate labor to acceptably handle the size and
31 volume of traffic.
- 32 4. Adequate source of water and means to contain the water within the designated wash area.
- 33 5. Regular removal and disposal of sediment and debris.
- 34 6. Removal and disposal of non-debris and non-sediment pollutants and contaminants.
- 35 7. As may be necessary, an area before and after the wash area of sufficient size with quarry spall or other coarse
36 aggregate to allow for after-wash drip collection.

37 **8-01.3(9)B ROAD STABILIZATION AND STABILIZED CONSTRUCTION ENTRANCE**

38 Stabilized construction entrances are required in locations where traffic leaves the construction site, and moves onto a
39 public road or other paved area, or as shown on the CSEC Plan as specified in Section 8-01.3(2). The stabilization required
40 must be adequate for the equipment and vehicular traffic and for the Project Site local condition, local climate, and weather
41 typical for the Contract Time.

42 Temporary road stabilization measures may be required in areas within and beyond the Project Site, such as access
43 roads, haul roads, subdivision roads, parking areas, staging areas, and other vehicular and equipment traffic routes.

44 Stabilized construction entrances consist of a 12-inch (minimum) thick rock pad of quarry spalls placed over geotextile
45 across the full width of vehicle ingress and egress area. The minimum length of stabilized construction entrances is 100 feet,
46 unless otherwise approved by the Engineer.

47 Temporary road stabilization measures may consist of placing and compacting a thickness of quarry spall, a thickness of
48 Mineral Aggregate Type 2 or Type 13, other aggregate, or a combination of these and other Material.

49 Where stabilized construction entrances or temporary road construction cannot be aligned to avoid areas within the
50 dripline of trees not identified for removal, the Contractor must comply with Section 1-07.16(2).

51 Stabilized construction entrances must be maintained in a condition that will prevent tracking or flow of mud onto public
52 Rights-of-Way. Maintenance must include repairing ruts, tracks, settling, and other failing areas. Such repairs may include
53 placing and compacting additional aggregate. Any quarry spalls loosened from a stabilized construction entrance pad that
54 enter the roadway must be removed immediately. Settled, broken, rutted and otherwise damaged timber, mulch, and other
55 material within the driplines of trees must be repaired by increasing the thickness of the material.

1 Upon completion of the Work, or as may be required to accommodate the Work, stabilized construction entrances and
2 temporary road stabilization measures must be removed and disposed. Within the dripline of tree, the removal must be
3 conducted to prevent damage to feeder and surface roots and minimize compaction soils.

4 **8-01.3(10) TEMPORARY SEDIMENT CONTROLS**

5 **8-01.3(10)A SILT FENCE (SEDIMENT FENCE OR FILTER FENCE)**

6 Silt fences must act as a filter to both allow the passage of water through the fence and also to prevent the passage of
7 sediment through, under, or over the fence. Silt fences must be either in-place before the area is disturbed, or must be
8 coordinated with beginning soil disturbance activity.

9 Silt fences must be constructed at locations downstream or downslope of surface runoff areas, and upstream or upslope
10 of surface bodies of waters. Silt fences must be spaced to account for grade of slope, runoff flow rate and velocity, sheeting
11 and rilling, type and relative density of soils, rate of sediment loading, expected maintenance type and frequency, and other
12 factors as the Project Site and Work require. Do not place silt fences across or in streams, channels and ditches.

13 Silt fences must be located along contours with the ends turned uphill to capture runoff and prevent flow around the end
14 of the fence. Where the installation requires crossing of contours in areas except at the ends, gravel check dams must be
15 placed perpendicular to the uphill face of the fence to minimize concentrated flow and erosion along the fence. The gravel
16 check dams must be approximately 1 foot deep at the fence and must continue perpendicular to the fence at the same
17 elevation until the top of the check dam intercepts the ground surface. The gravel check dams must consist of crushed
18 surfacing base course gravel backfill for walls, or shoulder ballast. The gravel check dams must be spaced at intervals not
19 exceeding 10 feet along the fence where the fence crosses contours. The slope of the fence line where contours are crossed
20 must not be steeper than 3 horizontal to 1 vertical.

21 The height of the fence fabric, the geotextile, above ground surface must be 30 inches minimum and 36 inches
22 maximum.

23 Posts must be either wood or steel. Wood posts must have minimum dimensions of 1-1/4" x 1-1/4" and must be white
24 oak or other hardwood resistant to rot, and with no defects. Steel posts must consist of U, T, L, or C shape posts with a
25 minimum weight of 1.33 pounds per foot, or other steel posts having equivalent or greater strength and bending resistance
26 than those listed in this paragraph. Posts must be of a length to be installed to a depth and with a spacing to withstand
27 maximum loading for the durations estimated between sediment removals. Unless the Contractor can justify otherwise to the
28 Engineer, posts must be installed to a minimum 30-inch depth, except as specified below within the dripline of trees, and must
29 be spaced within a fence line of not greater than 6 feet. Where required post depth penetration cannot be obtained, the posts
30 must be secured on the upslope side by bracing or guying to an anchor to prevent overturning.

31 The fence fabric and support backing systems must be attached on the up-slope side of the posts with staples, wire, hog
32 rings, or other connection device as recommended by the manufacturer, in a manner that does not tear or damage the fabric.

33 At the bottom of the fence, the fabric and support backing system must be buried at least 6 inches below the ground
34 surface, and then backfilled with native soils compacted by tamping or other appropriate compaction methods.

35 Excavation for installation of silt fence within the dripline of trees, and around other vegetation to be kept, is not allowed.
36 Alternative methods necessary to comply with functional requirements to keep sediment without excavation within the dripline
37 must be submitted for approval by the Engineer. Trenchless silt fence installation must be designed and installed to ensure
38 consistent ground contact and stability.

39 Fence support backing system, in the form of wire or plastic mesh with maximum mesh spacing of 2 inches by 4 inches
40 and of adequate strength to withstand maximum loading, must be attached to posts and fabric as recommended by the
41 Supplier. Plastic mesh must have the same or greater ultraviolet (UV) resistance as the geotextile fabric. All geotextile fabric
42 must have backing whether exposed or buried.

43 Fence fabric must be continuous along any single length of filter fence. Continuous fence is defined as follows:

- 44 1. The geotextile fabric may be sewn together at the point of manufacture or by the Supplier to form a single length of
45 geotextile for a continuous fence application. All sewn seams must be at a support post.
- 46 2. Separate geotextile fabric may be installed across posts with a minimum 10-foot overlap where the overlap is
47 supported by no less than 3 posts with spacing between any posts not greater than 4 feet. Overlapped fabric must
48 always be secured to support backing.
- 49 3. The Contractor may place 2 posts, one on each side of the overlapped fabric and backing, and twist the overlapped
50 fabric at least 2 complete revolutions before driving the posts into the earth. The overlaps must extend a minimum 1
51 foot beyond the 2 posts before twisting.
- 52 4. Lapped or twisted fabric and backing that slip is considered defective and must be replaced with sewn geotextile. For
53 pre-staked silt fence, laps may be performed per the manufacturer's written recommendations.

54 **8-01.3(10)B SEDIMENT REMOVAL**

55 Sediment must be removed and disposed of when the sediment build-up reaches a height of 6 inches.

56 **8-01.3(10)C DAMAGED FENCE REPAIR**

57 Damaged or improperly functioning silt fence must be promptly repaired or replaced.

1 Rips, tears, holes, and other defects in the geotextile fabric or the backing or both must be promptly repaired by placing
2 new materials over the damaged materials the full width and height of fence including buried or covered fabric and backing,
3 and must overlap existing fence materials a minimum 5 feet each side of the defect. The repaired fence must be supported by
4 and securely tied to 5 evenly spaced posts.

5 Broken posts must be replaced with 2 posts spaced 1 foot on each side of the broken post driven 30 inches into the soil,
6 or braced to upslope anchors. The fabric and backing must be securely tied to each new post.

7 Posts that lean greater than 1 horizontal to 4 vertical must be replumbed and must be supported at the top with bracing
8 or guying to an installed upslope anchor.

9 Water or sediment escaping beneath the silt fence must be repaired by installing new fabric and backing over the existing
10 material extending 3 feet upslope with a minimum 3-foot overlap on both sides. Ballast must be placed over the surface repair
11 with a minimum 6-inch depth aggregate ballast. New post or posts must be installed along the leak with spacing not exceeding
12 2 feet.

13 Any other conditions that reduce the effectiveness of the silt fence must require immediate repair and/or replacement.

14 **8-01.3(11) SHEAR BOARDS**

15 Shear boards must be spaced horizontally to allow not greater than a 6-foot vertical change of grade between boards.
16 Shear board must be securely nailed to four 2" x 4 "stakes – one stake at each end and the remaining stakes spaced evenly
17 between. Stakes must be driven a minimum 24 inches into the earth and must extend to the full height of shear board.

18 The Contractor must promptly repair or replace shear boards and stakes exhibiting decay, structural failure, or leaning
19 more than 1 horizontal to 4 vertical. Frequency of removal of sediment build-up against the board must be such that build-up
20 does not exceed 1/3 the height of the shear board.

21 **8-01.3(12) PROTECTION OF THE DRAINAGE AND SEWER SYSTEM**

22 The Contractor must take measures to prevent blockage of the surface flow path and drainage Structures; to prevent the
23 introduction of pollutants, contaminants, sediment, and other material into drainage Structures; to promptly clean out material
24 that has entered drainage Structures; and to dispose of groundwater, process water and stormwater per all permits and the
25 Temporary Discharge Plan. See Section 1-07.6 and permit restrictions on discharge quality, quantity and flow rates to maintain
26 the function of the drainage and Sewer system. Gutters and drainage Structures are to remain functional except when
27 designated for removal on the Drawings, or as approved by the Engineer.

28 **8-01.3(12)A PREVENT BLOCKAGE OF SURFACE FLOW PATH**

29 The Contractor must submit a CSECP as specified in Section 8-01.3(2) that identifies the surface flow path and all
30 drainage Structures within 500 feet downslope of the Work. Staging, storage, and stockpiles must be identified on the plan,
31 must be contained and must not be placed in the gutter, and must not block any existing drainage Structure. Sweep or vacuum
32 daily to remove any debris and material that enters the gutter.

33 **8-01.3(12)B INLET AND CATCH BASIN PROTECTION**

34 The Contractor must submit a CSECP as specified in Section 8-01 that identifies drainage inlets and catch basins within
35 the work zone and within 500 feet downslope of the Work. Existing Structures with sufficient depth (minimum 12 inches) to
36 allow insertion of a manufactured filter sock must be identified in the CSECP as "Protect Inlet". New inlets, catch basins and
37 pipelines must be protected from sediment and sediment-laden water until Job Site stabilization.

38 Manufactured filter socks must have a high flow bypass opening oriented towards the pipe outlet of the Structure. Excess
39 material that extends beyond the grate must be trimmed to allow normal flow into the Structure. After placement of a filter sock
40 under an inlet or catch basin grate, curb inlet openings may be plugged as approved by the Engineer.

41 Filter socks must be cleaned or removed and replaced when sediment has filled 1/3 of the available storage, or the fill
42 limits recommended by the manufacturer. Filter socks must be removed within 5 Business Days after final Job Site
43 stabilization.

44 **8-01.3(12)C CLEANING INLETS AND CATCH BASINS**

45 The Contractor must submit a CSECP as specified in Section 8-01.3(2) that identifies drainage inlets and catch basins
46 within the work zone and within 500 feet downslope of the Work. Structures with insufficient depth to comply with Section 8-
47 01.3(12)B, must be identified in the CSECP as "Clean Inlet".

48 Existing inlets and catch basins must be cleaned when protection is not possible and when protection measures have
49 failed. Inlets must be cleaned whenever debris or sediment is visible within the Structure. Catch basins must be cleaned when
50 debris or sediment have filled more than one-half the volume of the Structure below the outlet pipe, or is within 18 inches of
51 the outlet pipe invert. Inlets and catch basins may be cleaned by vacuum truck or shovels. Jetting material downstream is not
52 allowed.

53 **8-01.3(12)D TEMPORARY DISCHARGE OF GROUNDWATER, PROCESS WATER AND STORMWATER**

54 The Contractor must submit reports on flow rate, quantity and quality controls for groundwater, process water and
55 concentrated and collected stormwater as detailed in the Temporary Discharge Plan. During the Work, the Contractor and

1 temporary discharge lead must be prepared to discuss with the Engineer the status of temporary discharge controls in-
2 progress and to come as they relate to the Work, to the progress schedule, to permits, and as may be required in the Contract.

3 **8-01.3(13) COMPOST SOCKS, COMPOST BERMS, AND STRAW WATTLES**

4 Use compost socks or compost berms instead of straw wattles unless otherwise specified.

5 **8-01.3(13)A COMPOST SOCKS**

6 Compost socks may be used as shown in the CSECP or as directed by the Engineer in these applications:

- 7 1. As an alternative to silt fence, or in addition to silt fence, to filter out sediment, protect project perimeters, or channel
8 runoff to treatment;
- 9 2. As an alternative to earthen dikes at the top or bottom of a slope, to intercept drainage from areas above and direct it
10 to a stabilized outlet or treatment;
- 11 3. Around drain inlets as a temporary protection from sediment-laden water;
- 12 4. As temporary check dams in swales or ditches, or when seeded as permanent check dams where specified;
- 13 5. To contain small temporary pools for pumping, or for settling sediment; and
- 14 6. To filter and neutralize pH of runoff from new cement concrete installations, or to filter water contaminated by oil or
15 grease.

16 Compost socks must consist of mesh fabric tube with a minimum strand thickness of 5 mils, and must be warranted by
17 the manufacturer as appropriate for use in compost socks. It must be clean, evenly woven, and free from cuts, tears, and
18 broken or missing yarns. The fabric must be of a biodegradable type for applications where the sock will be filled planted or
19 seeded to be left on-site. Compost socks must be at least 8 inches in diameter; larger diameter socks may be required where
20 ponding behind the sock is anticipated or observed.

21 Socks must be filled with coarse compost as specified in Section 9-14.4(8).

22 The socks must be filled on-site by forced-air mulch spreader equipment, and must be firmly packed yet flexible. Sections
23 less than 15 feet long may be filled off-site. The sock must be blown full continuously, if a break is necessary the socks must
24 be overlapped 5 feet at their ends and staked in place.

25 Soil surfaces must be graded smooth, and the compost filled sock must be placed directly onto the soil surface. The sock
26 must then be walked to press it firmly to the surface. 2" x 2" stakes must be driven through the sock into the soil at intervals of
27 10 feet, unless otherwise shown in the CSECP or as specified by the Engineer.

28 On slopes, compost socks must be placed parallel with the contour and perpendicular to runoff or other flow. Ends of
29 socks must be placed angling upslope to prevent water flowing around. Socks must be placed at the top of the slope, and at
30 intervals across the slope to allow not greater than a 6-foot vertical elevation change between sock rows, or as shown in the
31 CSECP or specified by the Engineer, to prevent concentrated water flows from running down the slope.

32 Compost socks must be maintained in contact with the soil, and must be inspected immediately after a runoff producing
33 rainfall to verify soil contact.

34 Where compost socks are not intended to be left in place to support permanent plantings (e.g. planted with live stakes for
35 slope stabilization efforts), compost socks must be slit and removed from Project Site, and compost spread for incorporation
36 into the soil.

37 **8-01.3(13)B COMPOST BERMS**

38 Compost berms are triangular cross-section rows of compost that can serve the same functions as compost socks or
39 straw wattles on a temporary basis. The Engineer may specify and approve the temporary use of compost berms for any of
40 the applications specified in Section 8-01.3(13)A Compost Socks.

41 Compost berms must be applied using a pneumatic blower device or equivalent, to create a uniform cross-section and
42 berm density.

43 Compost berms must have a 2:1 base to height ratio, with a minimum size of 2 feet wide at base by 1 foot high in cross-
44 section. Larger sizes may be specified by Engineer.

45 The compost used must be coarse compost as described in Section 9-14.4(8).

46 Compost berms may be used for up to 2 weeks. Berms may be used longer if seeded and vegetated, or if backed up by
47 silt fence as shown in the CSECP or specified by the Engineer.

48 On slopes, compost berms must be placed parallel with the contour and perpendicular to runoff or other flow. Ends of
49 berms must be constructed angling upslope to prevent water flowing around. Berms must be placed at the top of the slope,
50 and at intervals across the slope to allow not greater than a 6-foot vertical elevation change between berms, or as shown in
51 the CSECP or specified by the Engineer, to prevent concentrated water flows from running down the slope.

52 The compost berm must be maintained at the specified height, and any breaches or depressions must be immediately
53 repaired to restore that height.

54 After use, the compost may be spread and reused as a compost blanket or for soil amendment.

8-01.3(13)C STRAW WATTLES

Wattles must be installed within shallow trenches parallel with the contour and perpendicular to runoff or other flow. A sequence of wattles must start at the base of the slope and proceed uphill. Excavated material must be spread evenly along the upslope side and must be compacted using hand tamping or similar method. On gradually sloped or on clay and plastic silt type soils, trenches must be 2 to 3 inches deep. On loose granular soils, in high rainfall areas, or on steep slopes, trenches must be 3 to 5 inches deep or half the thickness of the wattle, whichever is greater.

Wattles must be spaced horizontally to allow not greater than a 6-foot vertical change of elevation between wattle rows.

The wattle must be installed snugly into the trench, abutting adjacent wattles tightly end to end with minimal overlapping of ends. Wattles must be staked at each end, and in between at 4-foot maximum centers. Where trench conditions require, pilot holes for the stakes must be driven through the wattle and into the soil using a straight bar. Stakes must be driven through the center of the wattle at least 6 inches into the earth leaving 2 to 3 inches of the stake protruding above the wattle.

Wattles must be maintained in contact with the soil in the trench, and must be inspected immediately after a runoff producing rainfall verifying soil contact.

8-01.3(14) EROSION AND SEDIMENT CONTROL MAINTENANCE

Construction stormwater and erosion control measures must be inspected at regular intervals (at least once every calendar week), and within 24 hours following significant runoff producing rainfall events. The various devices must be inspected for damage, bypass, undercutting, and nonperformance, and must be promptly repaired.

The individual functions and the whole must be verified performing acceptably and must be maintained until the Job Site is stabilized, or until they are to be converted as part of a permanent erosion and sediment control when specified in the Contract.

Sediment buildup must be removed as specified or more frequent intervals when performance becomes questionable. Debris and contaminated sediment must be properly disposed.

8-01.3(15) REMOVAL AND REUSE OF TEMPORARY EROSION AND SEDIMENT CONTROLS

When a temporary erosion or sediment control feature is no longer required, the Contractor must remove the feature. The Contractor must remove all temporary erosion or sediment control features within 5 Business Days of Job Site stabilization.

Reuse of a control measure may be acceptable if:

1. The measure or device has been thoroughly cleaned of all debris;
2. The measure or device is free of tears, holes, or other damage; and
3. The measure is verified it can perform as intended.

8-01.3(16) SWEEPING AND WASHING

In addition to the complying with Section 1-04.10, the Contractor must ensure that soil, debris, or other material tracked and deposited are removed by sweeping or by washing and properly disposed. In particular, when wet weather is forecast, the On-Site Erosion Control lead must verify that all measures are in-place and are functioning effectively and acceptably.

8-01.4 MEASUREMENT

Construction Stormwater Pollution Prevention plans specified in Section 8-01.5 and in the Bid Form will be measured by lump sum.

8-01.5 PAYMENT

1. "Construction Stormwater and Erosion Control Plan (CSECP)", per lump sum
2. "Tree, Vegetation and Soil Protection Plan (TVSPP)", per lump sum
3. "Spill Plan (SP)", per lump sum
4. "Temporary Discharge Plan (TDP)", per lump sum

The Bid Item price for each Construction Stormwater Pollution Prevention Plan indicated above and included in the Bid form must include all costs for the work required to prepare, submit and update as necessary all Plans described in this Section and to furnish, install, maintain, remove, relocate, restore and dispose of, construction stormwater pollution prevention measures including documentation, inspection, testing, provisions of permits, and, Specifications of Sections 1-07.15, 1-07.16(2), Section 8-01, and other Contract provisions.

The Bid Item price must also include all costs for the work required by the: Construction Stormwater and Pollution Prevention Coordinator (CSPPC); Certified Erosion and Sediment Control lead (CESCL); Tree, Vegetation and Soil Protection lead (if applicable); Spill Prevention and Response lead; Temporary Discharge lead (if applicable) and any other supporting staff as may be necessary. See Section 1-05.13 for descriptions.

Payments for progress estimates will be made per the lump sum breakdown specified in Section 1-09.3(2) including how this work relates to the Work and to the progress schedule. The lump sum breakdown must indicate that 20 percent of each be

1 paid upon approval of the plan (including leads) and 10 percent retained until all BMPs are removed and all required
2 documentation is accepted; 70 percent will be paid as work progresses as determined by the Engineer.

3 If the TVSPP is not included in the Bid form no plan is required and no separate payment will be made.

4 If the TDP is not included in the Bid form and the Contractor chooses to discharge water on-site, a TDP is required and
5 the cost of the TDP and any permits must be included in applicable Bid Items of work; no separate payment will be made for a
6 TDP when not included in the Bid form.

7 All fines for non-compliance are the sole responsibility of the Contractor. No payment will be made for fines, clean-up or
8 additional stormwater or erosion control measures caused by or resulting from the Contractor's operations, negligence or
9 omissions.

10 **SECTION 8-02 LANDSCAPE CONSTRUCTION**

11 **8-02.1 DESCRIPTION**

12 Work Included. Section 8-02 describes preparing soil; furnishing, planting, and maintaining lawns and planting beds; and
13 furnishing and installing paver blocks, grid blocks, cedar edging, bollards, benches, root barriers and tree grates.

14 Plant Material. Trees, whips, shrubs, ground covers, seedlings, cuttings, and sod are collectively referred to as, "plants"
15 or "plant Material."

16 **8-02.2 MATERIALS**

17 Materials must comply with the following specifications and provisions:

- 18 1. Erosion Control and Landscape Materials: Section 9-14.
- 19 2. Plant Names: Nomenclature for plants and varieties per the current edition of Standardized Plant Names as prepared
20 by the American Joint Committee on Horticulture Nomenclature.
- 21 3. Soil: Planting Soil must be used unless otherwise specified in the Contract. See Section 9-14.1(5).
- 22 4. Seed: The type of seed mix must be as specified in the Contract or as directed by the Engineer. See Section 9-14.2.
- 23 5. Compost: Soil amendment (organic matter to be mixed into the soil) must consist of fine compost as specified in
24 Section 9-14.4(8), unless otherwise approved by the Engineer for compatibility with management practices for the
25 Job Site or specified in the Contract.
- 26 6. Mulch: Planting mulch for topdressing must consist of arborist wood chip mulch as specified in Section 9-14.4(4)
27 unless otherwise specified in the Contract.
- 28 7. Rock Mulch: Topdressing required for tree pits in Right Of Way areas with high pedestrian volume is specified in
29 Section 8-02.3(9)A
- 30 8. Concrete: The concrete mix for wood bollard footings must be Class 3000, see Section 6-02.3(2).
- 31 9. Vertical Root Barrier: Root barriers must be an injection molded or extruded modular component made of high-
32 density polypropylene or polyethylene plastic as specified in Section 9-14.17.
- 33 10. Horizontal Root Barrier: Root Barrier to cover a 4' x 4' area centered 1 foot below the rootball to comply with utility
34 requirements must be Copolymer Polypropylene of 0.080-inch (2.032 mm) thickness, 50 percent post-consumer
35 recycled plastic, injection molded and ISO 9002 certified.
- 36 11. Watering Bags: Slow release watering bags must conform to the requirements specified in Section 9-14.18.

37 **8-02.3 CONSTRUCTION REQUIREMENTS**

38 **8-02.3(1) RESPONSIBILITY DURING CONSTRUCTION**

39 **8-02.3(1)A GENERAL**

40 The Contractor must prepare soil in compliance with the TVSPP as specified in Section 8-01.3(2)B, and must provide
41 adequate and proper care of all plant Material (both retained and newly installed) and landscape work, including irrigation,
42 done on the project from the time of installation to the end of the landscape establishment period as specified in Section 8-
43 02.3(12).

44 **8-02.3(1)B LANDSCAPE CONTRACTOR QUALIFICATIONS**

45 All landscaping must be performed by a licensed Landscape Contractor registered in the State of Washington. The
46 Contractor must be qualified for landscaping work through certification by the Washington Association of Landscape
47 Professionals (WALP) or by the Washington State Nursery and Landscape Association (WSNLA).

48 **8-02.3(2) TOPSOIL, PLANTING SOIL, AND TURF AREA SOIL**

49 **8-02.3(2)A GENERAL**

50 Topsoil, planting soil, turf area soil, compost or fertile mulch must be evenly spread and incorporated into subsoil as
51 specified in Section 8-02.3(15) for seeded lawn installation and as specified in Section 8-02.3(4) for areas to be planted.

1 Topsoil, planting soil, turf area soil, compost and/or fertile mulch must not be placed or worked when the ground or
2 topsoil is frozen, excessively wet or, in the opinion of the Engineer, in a condition detrimental to the Work.

3 **8-02.3(2)B TOPSOIL TYPE A – (IMPORTED)**

4 Topsoil Type A must be obtained from a source provided by the Contractor as specified in Section 9-14.1(2).

5 Should the Contractor propose a soil not meeting these specifications, the Contractor must provide a manufacturer's
6 certificate of compliance stating the proposed substitute soil complies with the organic matter specifications in Section 9-
7 14.1(2), meets regulatory and legal provisions, and must perform as at least as acceptably as Topsoil Type A. Material taken
8 from the Project Site and used as Reused Amended Site Soil will not be deducted from the Bid Item quantities for the
9 respective Bid Items.

10 **8-02.3(2)C REUSED AND AMENDED SITE SOIL**

11 Reused and amended site soil must be native topsoil taken from within the Project Site as specified in Section 9-14.1(3),
12 including the requirement to amend it if needed with compost to comply with the minimum organic matter specified in Section
13 9-14.1(3). Reused and amended site soil will not be considered as selected Material as specified in Section 2-10.2(1), and the
14 specifications of Section 2-10.2(1) will not apply.

15 When Reused and amended site soil is specified in the Contract, it must be the Contractor's responsibility to perform the
16 excavation operations in such a manner that sufficient Material be set aside to satisfy the needs of the project.

17 Reused and amended site soil must be amended with compost as specified in Section 9-14.4(8), to provide 5 percent
18 organic matter content for lawn areas, and 10 percent organic matter content for planting areas, using Loss-On Ignition test
19 method (ASTM D2974 or TMECC 03.07A). Compost amendment may be added at default rates of 22 percent for turf or 38
20 percent for planting beds; or calculated based on tests of the soil and compost, using the Soil Amendment Rate Calculator at
21 <http://your.kingcounty.gov/solidwaste/compost-calculator.htm>.

22 Upon completion of the Work, any topsoil remaining and not required for use on the project must be disposed, unless the
23 Engineer agrees otherwise.

24 Should a shortage of reused amended site soil occur and the Engineer has determined the Contractor has wasted topsoil
25 Material, the Contractor must furnish topsoil Type A at no expense to the Owner.

26 **8-02.3(2)D TURF AREA SOIL**

27 Turf Area Soil must be as specified in Section 9-14.1(6), and must be installed as specified in Section 8-02.3(4) 8-0, or in
28 the Contract.

29 **8-02.3(2)E PLANTING SOIL**

30 Unless the Contract specifies otherwise, Planting Soil must be as specified in Section 9-14.1(5) and must be installed as
31 specified in Section 8-02.3(4).

32 **8-02.3(2)F HIGH PERFORMANCE TURF SOIL**

33 High performance turf soil must be as specified in Section 9-14.1(7), and must be installed as specified in the Contract.

34 **8-02.3(3) PESTICIDES**

35 All pesticide use within the City of Seattle must be per the City of Seattle pesticide reduction strategy as documented
36 under the keyword "pesticide reduction" on the City of Seattle website <http://www.seattle.gov>.

37 Pesticides proposed for use by the Contractor must be submitted to the Engineer for review a minimum of 10 Working
38 Days before scheduled use. The submittal must include:

- 39 1. An MSDS for the product;
- 40 2. A manufacturer's certificate of compliance stating the pesticide is appropriate for intended application and the rate of
41 application;
- 42 3. Verification that the pesticide complies with all law and regulation and is registered in the State of Washington;
- 43 4. Verification that the pesticide is not a soil residual pesticide and is not toxic to landscaping and lawn not to be
44 controlled, unless the Contract specifies otherwise; and
- 45 5. Verification that the name of the pesticide applicator including a copy of current Washington State pesticide
46 application license for the intended application.
- 47 6. The SPU Chemical Use Request Form, provided in the Project Manual or by the Engineer. The form must be
48 submitted to the Engineer for approval by the pesticide review board, and must comply with the City of Seattle
49 pesticide use policies.

50 Pesticides must be applied per Chapter 16-228 WAC and the manufacturer's recommendations and must be carried out
51 by an experienced applicator licensed by the State of Washington for the class of pesticide used.

52 The Contractor must ensure pesticide application is confined to the areas designated.

53 Pesticide application will not be allowed during unreasonable wind conditions, when wet conditions exist, or when wet
54 weather is forecast within 24 hours of pesticide application, unless the pesticide manufacturer allows otherwise as provided in

1 the submittal. The Contractor must notify the Engineer at least 2 Working Days in advance, the location of the pesticide
2 application.

3 All pesticide or pesticide components must be delivered to the Project Site in unopened containers and must comply with
4 the spill prevention and control specifications in Section 1-07.5.

5 Post information on pesticide application on the Job Site for 24 hours post-application. Postings must include the name of
6 licensed applicator, pesticide used, time of application, method of application, and target vegetation.

7 Pesticide application must be restricted when near surface waters as specified in Section 1-07.5.

8 **8-02.3(4) PLANTING AREA PREPARATION**

9 Areas to receive plant Material must be cleared, grubbed, cultivated and graded to accommodate the Work before
10 planting and to provide the optimum conditions for plant and lawn, establishment and growth.

11 Planting area preparation must take into account as applicable, work requiring field inspection and Engineer's approval
12 within the driplines of trees and other vegetation to be kept; the incorporation of topsoil, planting soil, turf area soil,
13 decomposed organic amendment, fertile mulch, or other amendment; and the finish grade to accommodate the Work.

14 The Contractor must have on-site current copies the Washington State Noxious Weed List and Monitor List
15 (<http://www.nwcb.wa.gov>), and the King County Noxious Weed list ([http://www.kingcounty.gov/environment/animals-and-](http://www.kingcounty.gov/environment/animals-and-plants/noxious-weeds/laws/list.aspx)
16 [plants/noxious-weeds/laws/list.aspx](http://www.kingcounty.gov/environment/animals-and-plants/noxious-weeds/laws/list.aspx)). All weeds on these lists must be removed from the area of planting using the Integrated
17 Pest Management method recommended by the King County Noxious Weed Board consistent with the City of Seattle
18 Pesticide Reduction Program. Soil containing roots or seeds of noxious weeds must be disposed.

19 Weed clearing must be by non-chemical methods unless the Contract specifies otherwise, or the Contractor requests
20 and receives approval from the Engineer to apply pesticide as specified in Section 8-02.3(3).

21 Subgrade must be established at level specified on plan. Before placement of specified topsoil or amendment, subgrade
22 must be thoroughly scarified a minimum of 4 inches deep; by ripping, rototilling, plowing or discing. Finished subgrade must be
23 cleaned of all debris including concrete, stumps, sticks, roots and rocks or lumps larger than 3 inches; and inspected and
24 approved by the Engineer before soil mix is placed.

25 The Contract may require certain areas be built-up by embankment construction methodologies as specified in Section 2-
26 04, Section 2-10 and Section 2-11 before preparing for planting. Such areas will be identified in the Contract.

27 Imported topsoil mixes, per Section 9-14.1, must be added in 2 lifts of equal depth. The first topsoil lift must be thoroughly
28 blended with scarified subsoil, and compacted per Section 8-02.3(4) before placement of second lift. Where reused amended
29 site soil (Section 9-14.1(3) is specified, compost amendment must be thoroughly incorporated to create a homogenous blend 8
30 inches deep. The Contractor must apply and shape the lifts in such a manner that the planting area has a continuously sloped
31 final surface allowing for drainage from higher elevations to lower outer edges of the planting area. Where possible, ridges and
32 ridge lines must be the approximate centerpoint, or centerline, of the planting area.

33 Any amendments, excluding fertilizers to be applied in planting holes and on lawn starter, must be applied evenly on the
34 soil surface at rates specified by soil test per Section 9-14.1(A), using a calibrated spreader. Lime and other amendments
35 must be thoroughly blended into the top 8 inches of soil using rototiller.

36 The area must be rolled in 2 directions, the second rolling at right angles to the first. The roller must be of a standard,
37 water-filled type to apply 150 to 300 pounds per square foot ground pressure.

38 Soils and amendment must not be placed when the ground is frozen, excessively wet, or in a condition not amenable to
39 acceptable planting area preparation as determined by the Engineer.

40 The finished grade of planting area included any surface mulch top dressing must be 1 inch below the finished grade of
41 any surface improvement such as sidewalk and other pedestrian walking area.

42 **8-02.3(5) LAYOUT OF PLANTING**

43 Plants must be placed at spacings and locations as indicated on the Planting Plan. Plant layout must be approved by the
44 Engineer before installation of any plants. Unapproved plantings must be removed and replanted at the Contractors expense.

45 The Contractor is responsible for location layout and staking , subject to the approval of the Engineer, before planting or
46 construction of each item begins.

47 All plant Material must be inspected and determined by the Engineer to be acceptable for planting before planting. All
48 plants must be furnished disease and pest free, in good health and condition, true to form, and must be vigorous growers.

49 The Contractor must notify the Engineer at least 5 Working Days in advance of projected completion of staking and allow
50 2 Working Days after the projected Completion Date for review and any adjustments of the layout by the Engineer. Contracts
51 requiring plant placement based on field layout by the Engineer require 5 Working Days notice for field layout before the
52 Contractor's scheduled plant installation.

53 The Contractor must sequence the planting to minimize disturbance to new plantings and existing landscaping, and to
54 comply with the TVSP as specified in Section 8-01.

1 8-02.3(6) PLANTING**2 8-02.3(6)A GENERAL**

3 Plants brought to the planting site must be bare root, balled and burlapped, or in containers, as specified in the planting
4 schedule in the Contract for the particular type of planting Material.

5 Do not plant during freezing weather or when the ground is frozen or saturated. Do not plant during excessively wet
6 conditions. Do not plant on any Day in which temperatures are forecast to exceed 80 °F unless the Engineer approves
7 otherwise. Do not plant in areas that are below finished grade.

8 Planting trees, shrubs, and groundcovers within the City of Seattle limits must be performed during the period between
9 October 1st and April 30th. Outside the City of Seattle limits, dates to plant will be specified in the Contract. See Section 8-
10 02.3(14)A for dates to seed for lawn installation.

11 If groundwater is encountered upon excavation of planting holes, the Contractor must promptly notify the Engineer.

12 Containers may require vertical cuts down the full depth of the container to accommodate removal. All circling roots must
13 be loosened to ensure natural directional growth after planting. Plants must be removed from containers in a manner that
14 prevents damage to the root system.

15 8-02.3(6)B TREES

16 The Contractor must provide the Engineer a minimum 2 Working Days advance notice of the first trees to be planted.
17 The Engineer must be present to approve the planting method of the first trees. The approved method must be consistently
18 applied for all remaining tree plantings.

19 Tree planting holes must be excavated over a minimum surface area of 12 inches beyond the outside edge of the
20 rootball in all directions, and to a depth equal to the depth of the rootball less 2 inches. Tree pit excavation near a curb or
21 sidewalk must allow a horizontal clearance of at least 3 inches from the curb or sidewalk without undermining foundation
22 support of adjacent improvements.

23 Trees must be placed with the root crown 2 inches above surrounding curb and sidewalk finished grade where
24 applicable. In their final position, trees must have their root crowns positioned above the surrounding backfill as indicated on
25 the Standard Plans.

26 Before planting, twine and burlap and wire basket must be removed from the upper 2/3 of the root ball. However, the
27 Contractor must be prepared to remove all twine and burlap and wire basket before placing in planting holes at locations
28 directed by the Engineer. All trees grown in containers and root bags must be removed from container and inspected for
29 acceptability of root condition before planting.

30 Untangle circling roots to prevent strangulation of plants, and spread in direction of desired growth Containers may
31 require vertical cuts down the full depth of the container to accommodate removal. For ball and burlap and container trees,
32 roots showing at the edge of the root ball must be loosened without tearing and must be placed in a manner ensuring roots are
33 properly spread for lateral directional growth.

34 Backfill:

- 35 1. Backfill must be carefully placed and compacted in loose lifts not exceeding 6 inches.
- 36 2. Unless the Contract specifies otherwise, 2/3 excavated native soil must be mixed with 1/3 Compost per Section 9-
37 14.4(8) to form a thoroughly mixed homogeneous blend for backfill.
- 38 3. Backfill must be placed and compacted without voids. For bare root trees, backfill must be placed in a manner
39 ensuring roots are properly spread to avoid circling, and tamped or compacted ensuring that no voids exist. Water
40 settling of backfill will not be allowed.

41 Where no sidewalk and curb is present, the finished grade of the backfill must have a soil berm or soil saucer (watering
42 ring) as shown on Standard Plans 100a, 100b and 101. On Standard Plan 113, the mulch thickness to curb and sidewalk
43 finished grade will be considered the watering ring.

44 Water must be applied after installation as set forth in Section 8-02.3(12) item 4. If settling occurs, the Contractor must
45 add enough soil to cover the roots but must not rework the soil.

46 Provide 2 to 3 inches of mulch of the type specified in the Contract or otherwise specified in Section 8-02.2.

47 Materials must then be added to top dress the entire tree pit including the watering ring, with the depth tapered at the tree
48 to prevent contact at the trunk.

49 8-02.3(6)C SHRUBS AND GROUNDCOVERS

50 Planting holes for shrub and groundcover plants must be as shown on Standard Plans 110 and 111.

51 All plastic, burlap, ties, and other container material must be removed from the plant before planting.

52 Containers may require vertical cuts down the full depth of the container to accommodate removal. Untangle circling
53 roots to prevent strangulation of plants, and spread in direction of desired growth.

54 Backfill with soil removed from hole. Backfill must be firmly tamped or compacted without voids around the roots

55 Water must be applied after installation as specified in Section 8-02.3(12). If settling occurs, the Contractor must add
56 enough soil to cover the roots but must not rework the soil.

1 Mulch must be applied according to Section 8-01.3(6)C, or as otherwise directed by the Engineer, with the depth tapered
2 at the tree to prevent contact at the trunk.

3 **8-02.3(7) PRUNING AND STAKING**

4 **8-02.3(7)A PRUNING**

5 Pruning necessary for the Work is per the TVSPP, see Section 8-01. Pruning must be done in such a manner as to
6 maintain or to encourage the natural growth characteristics and proper form of the particular plant. Pruning must be done with
7 a sharp tool to produce a clean cut without bruising or tearing the bark. All completed pruning cuts must be in the living wood
8 where callous tissue can develop properly.

9 At the time of planting, all plants must be pruned to remove any minor broken or damaged twigs and branches. Notify
10 Project Engineer of any major broken or damaged limbs at planting, before attempting to repair through pruning.

11 When roots are encountered during construction and pruning is necessary per the TVSPP, all roots must be pruned a
12 minimum 4 inches from improvement limits defined and as determined by the Engineer to be necessary for construction forms
13 or safety systems.

14 All tree trimming must be done by an ISA Certified Arborist, or a trained arboricultural technician working under the
15 immediate supervision of an ISA Certified Arborist and must adhere to ANSI A300 standards. When major tree pruning work is
16 required, the Contractor must notify the Engineer 3 Working Days before start of pruning and provide the name of the
17 company or individual proposed for doing the pruning.

18 Tree pruning must be either minor or major as follows:

- 19 1. Minor pruning is limited to: removal of less than 10 percent of the foliage, or if foliage has not developed, less than 10
20 percent of the foliage buds including branches up to 1-1/2 inches diameter; and removal that does not adversely
21 impact the central leader, and does not significantly change the natural form of the tree being pruned.
- 22 2. Major pruning work is all other pruning work. All major pruning work must be done by an arborist with current
23 certification by the International Society of Arboriculturists, and must arrange in advance with the Engineer for
24 observing and approving the pruning of the first trees. The first pruning must be representative of all trees to be
25 pruned and must be adequate demonstration of the proper pruning method to apply to all trees that require pruning.

26 **8-02.3(7)B STAKING**

27 Unless otherwise specified in the Contract, all deciduous trees must be staked during planting as described in Standard
28 Plans 100a, 100b and 113.

29 Each tree must be staked with two 8-foot long, 2-inch diameter doweled treated wood stakes per Section 9-14.7. For
30 deciduous tree installation, the stake must penetrate a minimum of 1 foot into undisturbed subgrade. For coniferous tree, see
31 Standard Plan 101. Alternate methods of staking may be proposed by the Contractor and require approval of the Engineer.

32 Tress must be secured to trees using chain lock tree tie per Section 9-14.7, (or approved equal) installed to allow for
33 trunk growth.

34 Damaged stakes must be promptly removed and replaced. Trees and shrubs found out of plumb by wind or other cause
35 must be re-plumbed by loosening the soil around the root system and re-plumbing the tree or shrub, and backfilling and
36 compacting as necessary. Do not make adjustment by pushing, pulling or restraining the trunk or stem. If, in the opinion of the
37 Engineer, damage to the root system has occurred as a result of replumbing a tree or shrub, the tree or shrub must be
38 replaced at the Contractor's expense.

39 All tree stakes and guys must be removed at the end of 1 year, except as noted on plans or as directed by the Engineer.

40 **8-02.3(8) FERTILIZERS**

41 Fertilizers must be applied in a form and at a rate recommended by Certified Agronomist or Soil Scientist, based on soil
42 analysis by an independent accredited laboratory, as specified in Section 9-14.1(A) General Testing and Submittal
43 Requirements.

44 A minimum of 50 percent of nitrogen fertilizer must be applied in a slow- or controlled-release form; such as sulfur- or
45 polymer-coated urea, IBDU, trinitromethane (Nitroform), or organic forms.

46 All fertilizers must be furnished in standard unopened containers with weight, name of plant nutrients and manufacturer's
47 guaranteed statement of analysis clearly marked, all per state and federal law.

48 The Contractor must submit to the Engineer for approval at least 5 Working Days in advance, an analysis of the
49 proposed fertilizer, a 1-pound sample, and manufacturer's certificate of compliance indicating all Specifications are met.

50 **8-02.3(9) MULCH**

51 Mulch used as topdressing for tree pits and planting beds must be arborist wood chip mulch per Section 9-14.4(4),
52 unless otherwise specified in the Contract or specified under Section 8-02.2 Materials. Wood chips salvaged from clearing and
53 grubbing operations may be used as mulch for topdressing as approved by the Engineer.

54 Mulch that will be reused as a soil amendment must be Compost (i.e. compost) as described in Section 9-14.4(8),
55 applied and incorporated into soils as specified in Section 8-02.3(4).

1 8-02.3(9)A ROCK MULCH

2 Crushed rock mulch must consist of 200 pounds of 1/4 inch minus crushed rock as specified, mixed with 1 pound of soil
3 stabilizer as specified below. Contractor must submit a particle gradation (sieve) analysis from a certified test lab for the
4 approval of the Engineer.

5 Stabilizer must be an aggregate binder that is natural, nontoxic, non-staining, odorless, environmentally safe powder
6 specifically manufactured for binding aggregates to produce a firm stable surface. Stabilizer binder must be 'Stabilizer
7 Solutions Inc.' or approved equal.

8 Dry stabilizer and crushed rock must be thoroughly pre-blended while the materials are dry per the manufacturer's
9 recommendations. Mixing must be accomplished using a cement mixer, pug mill, or in any paddle type blender; leaving
10 material in blender for several passes of the mixing paddles. Bucket blending and screw type blenders and not approved
11 blending methods. Drop spreading of stabilizer over preplaced aggregate or mixing by rototilling may only be done with written
12 approval by the Engineer.

13 Do not place crushed rock mulch in wet conditions (no rain fall within the previous 24 hours) or at temperatures at or
14 below 40 °F and falling.

15 The prepared base must be free of weeds. Place the crushed rock mulch on the prepared base, and rake smooth to
16 desired grade and cross-section. Place material to minimum 2 inches of compacted depth. Top of the compacted crushed rock
17 mulch must be 1/4 inch below the adjacent top surface of concrete walk.

18 Crushed rock mulch must be lightly compacted. Do not use a vibratory compactor unless approved by the Engineer.
19 Compact material after tamping by foot does not leave an evident depression. During compaction, the crushed rock mulch
20 must be dampened with a limited quantity of clean water.

21 8-02.3(10) SOIL AMENDMENTS

22 Soil amendments must be applied during planting area preparation, see Section 8-02.3(4). The soil amendments must be
23 thoroughly mixed with soils and other Material as specified in the Contract to produce a homogeneous blend.

24 All amendments must be delivered to the Job Site in the original, unopened containers bearing the manufacturer's name
25 and guaranteed components analysis. Instead of containers, amendments may be furnished in bulk, with a manufacturer's
26 certificate of compliance indicating the components analysis complies with the Contract.

27 8-02.3(11) CLEANUP

28 Upon completion of planting, all excess Material must be disposed. Planting areas immediately adjacent to walks, curbs,
29 pavements, driveways, and other improvement must be graded and compacted to accommodate the depth of mulch cover,
30 with the mulch surface flush with the surface of adjacent improvement.

31 8-02.3(12) LANDSCAPE ESTABLISHMENT

32 Landscape Establishment must consist of the Contractor providing regularly scheduled, adequate and proper care for all
33 new planting for the landscape establishment period. The landscape establishment period must start on the date of written
34 notice from the Engineer of the acceptance of plantings and the automatic irrigation system (if included in the project), and
35 must end 365 Calendar Days thereafter--unless the Contract specifies otherwise.

36 Once all other Work is physically complete, Contract Time will not be assessed for the landscape establishment period.
37 No supplemental contract for landscape establishment will be allowed.

38 At least 5 Working Days before the beginning of the landscape establishment period, the Contractor must submit a weed
39 control plan for approval by the Engineer. The weed control plan must identify methods and timing intervals to assure weed
40 control throughout the plant establishment period. This weed control plan will be subject to revision dependent on results of the
41 implemented plan.

42 See Section 8-02.3(3) for specifications on application of pesticides.

43 All irrigation system components installed as part of the Work must be maintained and operated by the Contractor as part
44 of the landscape establishment work.

45 A watering schedule must be submitted indicating how and when every component of the landscaping receives water. If
46 there is an installed irrigation system, submittal must include a Microsoft Excel file describing the location of every irrigation
47 zone; including the irrigation equipment in each zone.

48 The Contractor must water plants as needed to promote healthy and vigorous growth:

- 49 1. Hand-watered trees: 15 gallons must be applied per tree per watering on a 3 Day schedule; or more frequently if
50 weather conditions justify. Slow release watering bags must be installed and maintained per the manufacturer's
51 recommendations for efficient hand watering of trees during the growing season. Use a single-bag installation for 1-
52 inch to 3-inch caliper trees. For trees 4-inch caliper or larger, a double-bag installation must be used. Remove all
53 sharp objects from the irrigated area before installation. Place the slow release watering bags on top of mulch, not
54 directly on soil. Place each bag around the tree trunk with the zippers on the uphill side of the tree. Wrap both sides
55 of bag until zippers meet and zip together from bottom to top. Lift tag to expose fill opening at top of bag. Fill bag to ¼
56 capacity. Gently lift up on straps at top of bag to expand bottom. Fill to the desired level and let empty. Fill 1-2 times

- 1 per week during the growing season during Landscape Establishment period, frequency based on adequate soil
- 2 moisture to support root growth and tree vigor.
- 3 2. Automatic irrigation installation: Contractor must be responsible to conduct an irrigation audit to set watering
- 4 frequency and timing, and must submit audit results by a Certified Irrigation Auditor to the Engineer for review and
- 5 approval. Automatic irrigation systems must be operated fully automatic during the plant establishment period, must
- 6 operate during the time period of 2:00 a.m. to 5:00 a.m., and must be coordinated with the work of Section 8-03. If
- 7 water restrictions are established, the Contractor must develop watering schedules in consultation with the Engineer.
- 8 See Section 2-12 for hydrant use specifications.
- 9 3. Adjustments Based on Weather: Change in the established watering schedule may be required to accommodate
- 10 weather and seasonal factors. The Contractor must monitor watering to ensure compliance with the Tree, Vegetation
- 11 and Soil Protection Plan (TVSPP), see Section 8-01.

12 Mulch must be applied to the required thickness and must be maintained by applying additional mulch when needed to
 13 maintain consistent depth. Final mulch application must be made in conjunction with the final progress estimate payment
 14 period, see Section 8-02.5.

15 Tree fastenings must be kept intact and effective in maintaining firm support for plant Material. Fastenings must be
 16 adjusted as needed by the Contractor to prevent trunk strangulation and non-plumb growth. Fastenings and stakes must be
 17 removed as indicated on Standard Plan 100a or at the completion of the first year establishment period, whichever is later.
 18 Reusable, doweled wood stakes must remain the property of the Owner and arrangements must be made by the Contractor to
 19 provide for their delivery to an Owner storage facility identified by the Engineer.

20 A general cleanup must be made after any landscape establishment work.

21 The Contractor must maintain all areas, whether mulched or not, in a weed-free condition during the landscape
 22 establishment period. Weed removal must be by mechanical control methods unless alternatives are approved by the
 23 Engineer in writing.

24 Replacement plants required during establishment must be planted within a time period set by the Engineer, which will
 25 depend on the season and availability of the replacement plants. Missing plants must be replaced by the Contractor in kind.
 26 Scheduling of plant replacement must be coordinated with the Engineer.

27 Plantings and landscaped areas will be inspected regularly by the Engineer during the landscape establishment period.
 28 Should the Engineer determine that the Contractor is not providing regular adequate and proper care of plant Material or is
 29 performing unacceptable landscape establishment work, the Engineer will provide written notice to the Contractor of such
 30 determination. The Contractor must reply to the Engineer within 7 Days of the date of written notice with proposed corrections.
 31 Such corrective measures must occur within 14 Days after the date of written notice unless the Engineer agrees otherwise.

32 Approximately 15 Days before the end of the landscape establishment period, the Contractor must request a final Job
 33 Site inspection by the Engineer. Conditions found unacceptable by the Engineer must be corrected by the Contractor within a
 34 10-Day period immediately following the inspection. After correction, the Contractor must notify the Engineer for a
 35 reinspection. Corrective work must include replacement of dead, missing, or unacceptable landscaping Material; weeding;
 36 pick-up of all litter; and repair and/or readjustment of the irrigation system. Necessary replanting must be arranged by the
 37 Engineer per the best planting time of the year.

38 **8-02.3(13) PLANT REPLACEMENT**

39 The Contractor is responsible for replacement of all dead and unacceptable plant material throughout the landscape
 40 establishment period.

41 All replacement plants must be of the same species and size as the plants they replace, and must be healthy and
 42 vigorous growers, unless the Engineer determines an equal value substitute plant be provided. Relocated trees larger than 4
 43 inches DBH that fail to survive must be replaced with a 3-1/2 to 4-inch caliper tree approved by the Engineer. Difference in
 44 value between relocated tree and replacement tree must be assessed by the Engineer per Section 8-02.3(22).

45 **8-02.3(14) LAWN INSTALLATION**

46 **8-02.3(14)A GENERAL**

47 Areas planted with sod or seeded lawn must be cleared, grubbed, cultivated and graded to accommodate the Work
 48 before planting and to provide the optimum conditions for lawn, establishment and growth.

49 Lawn installation must be by sodding unless "Seeded Lawn Installation" is specified in the Bid Form, and must include
 50 lawn establishment as specified in Section 8-02.3(15) when specified in the Bid Form. The Contractor may request the
 51 Engineer to approve the option of sodding instead of seeding for lawn installation; however, seeding instead of sodding will not
 52 be allowed.

53 In areas with automatic irrigation, lawn installation must not start until the sprinkler system is operational.

54 Seeding and fertilizing must be performed during the allowable time frames April 1 to May 31 or September 1 to October
 55 31. For seeding outside of the allowable time frames, written permission from the Engineer will only be given when completion
 56 of the project is imminent and the environmental conditions are conducive to acceptable growth as determined by the
 57 Engineer. Application of pre-germinated seed, moisture retention agents and/or provision for supplemental watering may be
 58 required by the Engineer if the Contractor schedules this portion of the Work outside the allowable time frames.

1 The Contractor must have on-site current copies the Washington State Noxious Weed List and Monitor List
2 (<http://www.nwcb.wa.gov>), and the King County Noxious Weed list (<http://dnr.metrokc.gov/wlr/lands/weeds/weedid.htm>). All
3 weeds on these lists must be removed from the area of planting using the Integrated Pest Management method recommended
4 by the King County Noxious Weed Board consistent with the City of Seattle Pesticide Reduction Program. Soil containing roots
5 or seeds of noxious weeds must be disposed.

6 Subgrade must be established at the level specified on the Drawings. Before placement of specified topsoil or
7 amendment, subgrade must be thoroughly scarified a minimum of 4 inches deep; by ripping, rototilling, plowing or discing.
8 Finished subgrade must be cleaned of all debris including concrete, stumps, sticks, roots and rocks or lumps larger than 3
9 inches; and inspected and approved by the Engineer before soil mix is placed.

10 Imported topsoil mixes, per Section 9-14.1, must be added in 2 lifts of equal depth. The first topsoil lift must be thoroughly
11 blended with scarified subsoil, and compacted per Section 8-02.3(14)A.11 before placement of second lift. No incorporation of
12 topsoil is required in high performance turf areas with sub-drainage. Where reused amended site soil (Section 9-14.1(3) is
13 specified, compost amendment must be thoroughly incorporated to create a homogenous blend 8 inches deep.

14 Fertilizer and lime must be applied as specified in Section 9-14.3(1), using a calibrated spreader set to apply fertilizer and
15 lime at rates recommended by testing laboratory or Agronomist.

16 After the addition of any amendment and application of lime, the area must be mechanically tilled to a depth of 4 inches
17 to achieve a homogeneous blend. Soil must then be raked by approved hand or mechanical methods to remove and dispose
18 of all large clods, rocks, debris, and litter larger than 1 inch in any dimension.

19 Do not place soils and amendment when the ground is frozen, excessively wet, or in condition not amenable to
20 acceptable planting area preparation as determined by the Engineer.

21 The finished grade of planting area must be 1 inch below the finished grade of any surface improvement such as
22 sidewalk and other pedestrian walking area.

23 The area must then be rolled in 2 directions, the second rolling at right angles to the first. The roller must be of a
24 standard, water filled type to apply 150 to 300 pounds per square foot ground pressure. The finished grade must comply with
25 the vertical clearance requirements adjacent to improvements as specified in Section 8-02.3(4).

26 **8-02.3(14)B SEEDED LAWNS**

27 Apply the Contract-specified lawn seed mix by hydroseeding, mechanical, or hand application methods as the area may
28 require as specified in Section 9-14.2.

29 Rake seed and fertilizer into the top 1/2 to 1 inch of soil to produce a uniform, dense lawn. Application of seeding may be
30 accomplished by hydroseeding as specified in Section 8-01.3(2)D, if approved by the Engineer.

31 For firming, roll the area in one direction.

32 Use sprinklers to provide 1-inch average application of water to seeded area without causing seed to be uncovered or
33 washed away, erosion or sedimentation.

34 Temporary flagging and warning signs must be installed preventing the public from disturbing or damaging newly
35 installed lawn.

36 The lawn establishment period as specified in Section 8-02.3(15) must follow the Engineer's acceptance of the newly
37 installed lawn.

38 **8-02.3(14)C SODDED LAWNS**

39 The sod strips must be placed within 48 hours after being cut.

40 The soil must be adequately pre-moistened by sprinkling water before laying the sod.

41 Sod must be placed so that it is in full contact with the soil without voids and with a snug fit with previously laid sod.
42 Joints must be staggered with adjacent sod strips with no voids.

43 On sloped areas, place sod along the contour. Where change in grade is variable, cut the sod to follow the contour as
44 reasonably as can be done.

45 When installing sod to restore partially disturbed lawn areas, set the root crown of the new sod flush with the root crown
46 of the adjacent lawn. Areas of existing lawn bordering on partial lawn restorations must be hand seeded and top dressed with
47 a mixture of 50 percent sand and 50 percent decomposed organic mulch amendment. Such areas, not more than 2 to 4 feet in
48 width, must provide a smooth transition between new and existing stands of grass.

49 Visible joints between sod strips must receive mixture of 50 percent sand and 50 percent decomposed organic mulch
50 amendment.

51 Firming: Following placement, the sod must be rolled with a smooth water-filled type roller. After rolling, the sod must
52 receive a minimum 1 inch depth of water. Lawn areas must have smooth finished grading.

53 Protection: Temporary flagging and warning signs must be installed to prevent the public from disturbing and damaging
54 newly sodded area.

55 Conditions: Soils and amendment must not be placed when the ground is frozen, excessively wet, or in condition not
56 amenable to acceptable planting area preparation, as determined by the Engineer.

57 Establishment: The lawn establishment period follows the Engineer's acceptance of the newly installed sod.

1 8-02.3(15) LAWN ESTABLISHMENT

2 Lawn establishment must consist of providing adequate and proper care for all public and private lawn areas installed
3 within the limits of the project. During the lawn establishment period, the Contractor must ensure the continuing healthy growth
4 of the lawn.

5 Adequate and proper care must include the labor, materials, and equipment necessary to keep installed lawn in a
6 presentable condition including, but not limited to: watering, mowing, trimming, cutting with an acceptable mulch mower, litter
7 and debris removal, edging, fertilization, weed control, repair and reseeding damaged areas, and repairing and keeping in
8 operation irrigation systems installed as part of the Work. Use of pesticides in conjunction with lawn establishment is specified
9 in Section 8-02.3(3). Lawn establishment work must be performed by personnel qualified in and experienced with, sustainable
10 turf management practices. As a part of lawn establishment:

- 11 1. The Contractor must submit at least 5 Working Days in advance, the proposed watering and mowing schedules to the
12 Engineer. The submittal must also identify the type of mower equipment to be used.
- 13 2. The lawn establishment period must start on acceptance by the Engineer based on both a uniform stand of grass
14 and upon completion of a first mowing, and extend for a minimum of 90 Days during the active growing season
15 (defined as consecutive Days from April 30th to October 30th).
- 16 3. Mow and edge to limit the maximum height of lawn to 3 inches. The cutting height must be 1-1/2 inches with all
17 cuttings kept using mulching mower equipment. At Engineer's direction, clippings may be collected in designated
18 high-traffic areas during periods of heavy growth. Collected clippings must be disposed at a WDOE permitted
19 composting facility
- 20 4. Apply a turf fertilizer with organic fertilizer or a slow release form of nitrogen at the end of the lawn establishment
21 period at the rate of application and formulation specified in Section 9-14.3(1). Following fertilizer application, the
22 lawn must be thoroughly watered with at least a 1 inch depth of water.
- 23 5. Watering must be accomplished as frequently as needed from March through September, with exception of periods
24 when rainfall is adequate to supply all water needs. When water application is by automatic irrigation system, then
25 watering must be done between the hours of 2:00 a.m. and 5:00 a.m. At a minimum, a uniform application of 1 inch of
26 water each week must be required over all lawn areas. The Contractor must be prepared to water more frequently if
27 very dry conditions persist.
- 28 6. Lawn areas will be inspected by the Engineer during the lawn establishment period. Should the Engineer determine
29 at any time that the Contractor is not providing adequate and proper care of the lawn or is performing unacceptable
30 lawn establishment work; the Engineer will provide written notice to the Contractor to correct and remedy such
31 unacceptable work or practice. The Contractor must make the necessary corrections within 5 Working Days of the
32 date of the written notice and must provide at least 2 Working Days advance notice of doing such corrective work.
- 33 7. Approximately 10 Days before the end of the lawn establishment period, the Contractor must request a final
34 inspection for acceptance of the established lawn. Conditions found unacceptable by the Engineer must be corrected
35 by the Contractor within 5 Working Days of such notice. When such correction is required, the lawn establishment
36 period must extend an additional 45 Days including performance of the requirements listed in items 1 through 4
37 above. Acceptance of lawn planting as specified here must be based on a healthy, full, vigorously growing, and well-
38 manicured stand of grass at the end of the lawn establishment period. Areas that are bare, have a poor stand of
39 grass, are dead or dying, have weeds, or have a spotty or non-uniform grade through any cause must be remedied
40 by regrading, removing and reseeding or resodding, refertilizing, removing, and rewatering, as appropriate. Upon
41 acceptance of lawn establishment by the Engineer, remove all temporary flagging and warning signs.

42 8-02.3(16) REMOVABLE PAVER BLOCKS IN TREE PITS

43 The Contractor must install paver blocks of the size and type specified at the locations shown and as specified in the
44 Contract.

45 Paver blocks must be installed after the trees have been planted and the tree pits backfilled and compacted to a finished
46 grade to allow the paver block surface to be flush with the top surface of adjacent sidewalk and curb. Use a bed of compacted
47 sand as a setting bed for the pavers.

48 Voids or joints between pavers must not be wider than 1/4 inch and all voids between pavers and sidewalk and between
49 pavers must be filled with sand. The installation method must provide a secure edge adjacent to sidewalk and curb and any
50 slack must be around the tree trunk for trunk growth.

51 If for any reason paver installations in the tree pits become loosened or dislodged during the Contract Time, the
52 Contractor must restore the paver installation to a condition acceptable to the Engineer. Excess sand and dirt must be swept
53 up and disposed.

54 8-02.3(17) TURF REINFORCING GRID BLOCKS

55 The Contractor must install grid blocks of the type specified at the locations and as specified in the Contract.

56 Areas receiving grid blocks must be excavated to an 8-inch depth plus the thickness of sand bedding and grid block
57 below the surface of adjacent sidewalk, curb, and other pedestrian traffic improvement, and then graded and compacted to a
58 minimum depth of 1 foot to 95 percent as determined by Section 2-11.

1 After the subgrade has been approved by the Engineer per Section 2-09, the Contractor must install a sub base of
2 Mineral Aggregate Type 1 to a compacted depth of 6 inches where the relative density must meet or exceed 95 percent as
3 determined in Section 2-11. Thereafter, a 2-inch sand setting bed must be spread and tamped or rolled on top of the crushed
4 rock base.

5 The grid blocks must then be placed on the sand bed and each block leveled with each adjacent block. The top of the
6 blocks must be laid flush with the top surface of adjacent sidewalks and curbs. After the blocks have been installed and
7 leveled, joint filling sand per Section 9-14.9(13) must be spread and worked into all voids.

8 The area receiving grid blocks must thereafter be seeded with grass seed of the type and in the quantity specified in the
9 Contract.

10 **8-02.3(18) EDGING**

11 **8-02.3(18)A EDGING, CEDAR**

12 The Contractor must install cedar edging as required and specified in the Contract. Edgings must be installed on edge
13 with the top of the form level with the top of the existing grades or the top of the existing adjacent concrete sidewalks and
14 curbs. Forms must be secured with 2" x 2" x 12" cedar stakes as specified in the Contract, driven to the inside of the forms and
15 attached to the cedar edging with eight-penny galvanized common nails.

16 **8-02.3(18)B EDGING, PAVER RESTRAINT SYSTEM**

17 Where a paver edge restraint system is shown on the Contract, the Contractor must prepare the soil subgrade, place and
18 compact the base course (if required), and install the paver edge restraint system per the manufacturer's instructions. The
19 edging must be black or dark in color. For added support, selected Material or planting soil must be placed against the
20 restraint system before pavers are installed. The paver restraint system must be inspected and approved by the Engineer
21 before any backfilling occurs.

22 **8-02.3(18)C EDGING, LANDSCAPE TIMBERS**

23 The Contractor must install 6" x 8" landscape timbers where required in the Contract. Timbers must be installed on the 8-
24 inch base with the top of the timber flush with the top of the concrete sidewalk or the interlocking pavers or finished surfacing
25 as specified in the Contract. Timbers must be secured with four No. 4" x 30" long reinforcing steel bars placed along the
26 centerline axis and driven flush with the timber surface. Reinforcing steel must be provided a minimum of 2 feet on center.
27 Each timber must have a minimum of 2 reinforcing steel bar. The Contractor must arrange the timber edging such that no
28 individual timber length is less than 4 feet.

29 **8-02.3(19) BOLLARDS**

30 **8-02.3(19)A GENERAL**

31 The Contractor must install bollards of the type and at the locations specified in the Contract. The Contractor must furnish
32 1 padlock and 2 keys for each removable bollard. Padlock cores must be provided as specified in the Contract. Bollards must
33 be set in excavated holes true to line and grade in a plumb position with suitable backfill thoroughly compacted around them.

34 **8-02.3(19)B WOOD BOLLARDS**

35 The tops of concrete footings for wood bollards must be formed and troweled level with surrounding surfaces.

36 **8-02.3(19)C CONCRETE BOLLARDS**

37 The Contractor must construct reinforced concrete bollards of the type and at the location specified in the Contract.

38 **8-02.3(19)D STEEL BOLLARDS**

39 The Contractor must construct steel bollards of the type and at the location specified in the Contract.

40 **8-02.3(20) BENCHES**

41 The Contractor must install benches of the type specified and as located in the Contract. The Contractor must provide at
42 least 4 Working Days advance notice before placement to the Engineer of proposed bench locations for verification

43 **8-02.3(21) TREE GRATES**

44 The Contractor must install tree grates at locations specified in the Contract. The tree pit opening in concrete sidewalk
45 must be sized to accommodate the tree grate. Tree grates must comply with Section 9-14.14.

46 The tree grate must be supported by an angle iron frame, with a horizontal tolerance of 1/4 inch between grate edges
47 and vertical legs of the angle iron support frame. This frame must be dimensioned for compatibility with the grate, and must
48 typically consist of legs that are 1" x 1" x 1/4" structural shapes, mitered and welded at the corners. To secure the steel frame
49 in place, anchors made of No. 4 reinforcing bars 6 inches long must be welded to the horizontal bottom leg of the angle iron
50 frame at 18-inch centers, and embedded in the concrete sidewalk. The grates must be sized to have a minimum of 1/2-inch
51 bearing on each horizontal angle frame leg. Top of grates must be flush with top of adjacent sidewalk. A continuous tooled
52 scribe line must be made in the concrete sidewalk, 6 inches from and parallel to each leg of steel angle around the tree
53 opening. Where tree grates are adjacent to curb, the scribe line must end at the curb.

1 Concrete sidewalk placed against the tree grate frame must have a thickened edge surrounding the grate. The thickened
 2 edge must be 8 inches wide with the depth of thickened edge nearest the grate being 8 inches deep for a width of 4 inches.
 3 The thickened edge thickness must taper to sidewalk thickness in the remaining 4-inch width.

4 When concrete collar is detailed on the Drawing instead of thickened edge, such collar must be no less than 8 inches
 5 deep by 8 inches wide, and must be separated from the sidewalk pavement by a through joint. The angle iron frame details
 6 and anchorage will be specified in the Contract.

7 **8-02.3(22) RELOCATE TREE**

8 The Contractor must perform tree relocation work per standard nursery practice. Tree removal work must be performed
 9 with the Engineer present. The tree must be relocated while in a dormant state. See dates to plant in Section 8-02.3(6)A.

10 The tree to be relocated must be hand watered as required for new trees in Section 8-02.3(12) if necessary to provide a
 11 fully hydrated condition for a minimum of 30 Days before digging.

12 The tree must be dug by hand or approved equipment. The Contractor must exercise extreme caution when working
 13 within the drip line of the tree to avoid damage to the trunk, branches or root structure. The Contractor must prevent damage
 14 to adjacent plant material. Should adjacent plant material become damaged, the Contractor must remove the damaged plant
 15 material and replace and establish new plant material as specified in Section 8-02.3(12) at no separate or additional expense
 16 to the Owner.

17 The root ball must be formed to encompass the entire fibrous root system within the minimum root ball diameters
 18 provided for corresponding tree trunk diameters in the table below. The depth of the root ball must be no less than 1/2 of the
 19 root ball diameter listed in the table. Exposed tree roots of 1-inch diameter and more must be cut clean before wrapping the
 20 root ball. The root ball and moisture protecting medium must be thoroughly wrapped with burlap, laced with 1/4-inch
 21 polypropylene rope, and must be kept continuously moist until planted.

| Tree Trunk Diameter | Min. Root Ball Diameter |
|---------------------|-------------------------|
| 2-4 inches | 2-1/2 feet |
| 4-5 inches | 4 feet |
| 5-7 inches | 5 feet |
| 7-10 inches | 6-7 feet |

23
 24 The Contractor must handle the tree by the root ball only. Under no circumstances will the Contractor be allowed to lift or
 25 remove the tree by the trunk. The tree must be carefully reset into the designated tree pit and planted in the same manner as a
 26 new tree. At all times, the tree root system must be kept moist.

27 The landscape establishment specifications in Section 8-02.3(12) must apply to relocated trees.

28 If a relocated tree is damaged and does not reasonably and acceptably establish itself after relocation, then the
 29 Contractor must replace the tree at the sole expense of the Contractor. Replacements for trees larger than 4-inch DBH, must
 30 be provided in a minimum 3-1/2 to 4-inch caliper size and must be installed as specified for new trees, see Section 8-02.3(6)B.
 31 When the replacement tree is smaller in caliper than the relocated tree to be replaced, then the Contractor must reimburse the
 32 Engineer for the difference in value between per the Guide For Establishing Values of Trees and Other Plants prepared by the
 33 Council of Tree and Landscape Appraisers current edition. The Contractor is responsible for removal and proper disposal of
 34 unacceptable trees.

35 **8-02.3(23) TREE ROOT PRUNING PROCEDURE**

36 See Sections 1-07.16(2) and 8-02.3(7).

37 **8-02.3(24) TUNNELING OR TRENCHING, AND TREE ROOTS**

38 See Sections 1-07.16(2) and 8-02.3(7).

39 **8-02.3(25) MOWING**

40 The Contractor must mow all grass growing areas and slopes 2-1/2 horizontal to 1 vertical or flatter except for naturally
 41 wooded and undergrowth areas. Prospective Bidders must verify the estimated acreage for mowing as shown on the Contract,
 42 the topography, irregularity of the area, slopes involved, and access limitations to determine the appropriate equipment to use.

43 Equipment and tools must be provided such as, but not limited to, tractor operated rotary or flail type grass cutting
 44 machines and tools or other approved equipment. Power driven equipment must not cause ruts or deformation of improved
 45 areas. Sickle type grass cutters will be permitted only on slopes of drainage ditches, berms, or other rough areas. The
 46 equipment and tools must be in good repair at all times and maintained so that a clean, sharp cut of the grass results.
 47 Equipment that pulls or rips the grass or damages the turf in any manner will not be allowed. The Engineer will be the sole
 48 judge of the adequacy of the equipment and methods of use.

49 Grass cutting equipment must be operated in such a manner and equipped with suitable guards as to avoid throwing
 50 rocks or debris onto the pedestrian and vehicular traffic areas or beyond the Right of Way.

1 The Contractor must return and disperse all lawn clippings to the lawn from all pedestrian and vehicular traffic areas, and
 2 from any other improvement. At Engineers direction, clippings may be collected in designated high-traffic areas during periods
 3 of heavy growth. Collected clippings must be disposed at a WDOE permitted composting facility.

4 Each mowing is considered as 1 coverage of all grass areas to be mowed within a defined area. The actual number of
 5 mowings will be based on the growth rate of the grass where mowing is required. Cutting must occur at a grass height of 3 to 4
 6 inches, producing 1-1/2 to 2-inch grass blade height.

7 Trimming around traffic facilities, Structures, curbs, tree pits, planting areas, or other features extending above ground
 8 must be accomplished by use of power driven or hand operated machinery and tools to achieve a neat and uniform
 9 appearance. Edging along curb and sidewalk interfaces is incidental to mowing and must be provided by the Contractor when
 10 directed to control encroachment of grass.

11 **8-02.3(26) TREE ROOT BARRIERS**

12 Vertical Root barriers must be installed between proposed trees and concrete sidewalk or curb as shown on the
 13 Standard Plans and Drawings per manufacturer's recommendations. Panels must be installed flush with the finished grade
 14 unless the root barrier is covered by a tree grate, covered by mulch, or out of pedestrian circulation routes, then the top barrier
 15 must be installed 1/2 inch to 9/16 inch above finished grade. Panels must be joined with locking strips or integral male/female
 16 sliding locks. Locking mechanism must have a close tolerance to restrict slippage between panels. Barriers must be installed
 17 with root deflectors facing inward.

18 Horizontal Root barriers must be installed as a component of tree pit preparation. Locations must be field approved by
 19 the Engineer. Root Barrier placement must be centered on the tree root ball and placed on level subgrade 1 foot below the
 20 root ball. Backfill operations must be executed to ensure compact soil conditions between the root barrier and bottom of the
 21 root ball to avoid settlement or instability of the tree during establishment.

22 **8-02.4 MEASUREMENT**

23 Measurement for "Tree, (Type), (Size)," for "Shrub, (Type), (Size)," and for "Ground Cover, (Type), (Size)" will be per
 24 each type and size plant Material accepted by the Engineer. See Section 9-14.6(1) for typical Bid Item plant descriptions.

25 Seeded lawn and sod installations will be measured by ground slope measurement in square feet of actual lawn
 26 completed, established, and accepted.

27 Measurement for "Planting Soil," "Compost," and for "Mulch, (Type)" will be per cubic yard.

28 "Tree Root Barrier," per linear foot Root barriers will be measured by the total length of panels installed in the field,
 29 measured parallel to the ground surface.

30 Measurement for concrete collar will be as specified in Section 8-14.4 for "Sidewalk, Thickened Edge."

31 Measurement for "Relocate (Item)" will be per each.

32 "Rock Mulch" will be measured by the cubic yard.

33 **8-02.5 PAYMENT**

- 34 1. "Tree, (Type), (Size)", per each
- 35 2. "Shrub, (Type), (Size)", per each
- 36 3. "Ground Cover, (Type), (Size)", per each

37 The Bid Item price for "Tree, (Type), (Size)", for "Shrub, (Type), (Size)", and for "Ground Cover, (Type), (Size)" must
 38 include all costs for the work required, and not otherwise provided for in other Bid Items in this Specification Section, to furnish,
 39 plant, fertilize, cultivate, mulch, stake and maintain the size and type of planting until the initial acceptance of the planting.

- 40 4. "Landscape Establishment, Minimum Bid (\$ _____)", per lump sum

41 The Bid Item price for "Landscape Establishment, Min. Bid (\$ _____)" must include all costs for the work required to
 42 establish the landscape including all costs for the work required in Section 8-02.3(12) and Section 2-12. Should the Contractor
 43 determine that the cost for this work is greater than the Bid Item lump sum minimum price listed in the Bid Form, the
 44 Contractor may Bid a higher Bid Item lump sum price by crossing out the Bid Item lump sum minimum price and extension
 45 shown on the Bid Form, writing in a higher Bid Item lump sum price and extension in the Bid Form, and initialing the change.
 46 Bids received on this Contract that contain a cost for landscape establishment of less than the Bid Item lump sum minimum
 47 price shown on the Bid Form will be changed to reflect the Bid Item lump sum minimum price allowed including the extension
 48 and must govern as becoming a part of the Bid. Payment will be made at the rate of 20 percent of the Bid Item lump sum price
 49 for "Landscape Establishment, Min. Bid (\$ _____)" at the following periods: May 31, July 31, September 30. The final 40
 50 percent will be paid at the end of the landscape establishment period and after the necessary corrections and replacements
 51 have been made. The Contractor must submit a statement on the 25th of May, 25th of July and the 25th of September
 52 including the schedule for work provided to maintain the plantings during that period.

- 53 5. "Planting Soil", per cubic yard
- 54 6. "Topsoil, (Type)", per cubic yard
- 55 7. "Turf Area Soil", per cubic yard

1 The Bid Item price for "Planting Soil", "Topsoil, (Type)", and for "Turf Area Soil" must include all costs for the work
2 required to furnish, mix, place and grade the specified type soil.

3 8. **"Mulch, (Type)", "Compost", per cubic yard**

4 The Bid Item price for "Mulch, (Type)" and "Compost" must include all costs for the work required to furnish, install and
5 rototill the specified mulch type or compost.

6 9. **"Paver Block, (Size)", per each**

7 The Bid Item price for "Paver Block, (Size)" must include all costs for the work required to furnish and install the specified
8 type paver block.

9 10. **"Grid Block", per square foot**

10 The Bid Item price for "Grid Block" must include all costs for the work required to furnish and place the grid including
11 crushed rock base, sand setting bed, planting soil and seed.

12 11. **"Edging, (Material)", per linear foot**

13 The Bid Item price for "Edging, (Material)" must include all costs for the work required to furnish and install the specified
14 type edging.

15 12. **"Bollard, (Type)", per each**

16 The Bid Item price for "Bollard, (Type)" must include all costs for the work required to furnish and install the specified type
17 bollard and must include the padlock for removable bollard.

18 13. **"Bench", per each**

19 The Bid Item price for "Bench" must include all costs for the work required to furnish and install the specified size and
20 type bench.

21 14. **"Tree Grate", per each set**

22 The Bid Item price for "Tree Grate" must include all costs for the work required to furnish and install the specified tree
23 grate including the thickened sidewalk edge or collar and iron frame as specified in the Contract. See Section 8-14.5 regarding
24 payment for sidewalk collar as "Sidewalk, Thickened Edge" to support the tree grate.

25 15. **"Relocate Tree", per each**

26 16. **"Relocate Shrub", per each**

27 17. **"Relocate Ground Cover", per each**

28 The Bid Item price for "Relocate Tree", for "Relocate Shrub", and for "Relocate Ground Cover" must include all costs for
29 the work required to remove, protect, store and replant the tree, shrub, or ground cover.

30 18. **"Sodding", per square foot**

31 19. **"Seeded Lawn Installation", per square foot**

32 The Bid Item price for "Seeded Lawn Installation" and for "Sodding" must include all costs for the work required to
33 prepare the area, seed or sod the lawn, and establish the lawn area. If no Bid Item for Lawn Establishment is included in the
34 Bid Form, all costs for lawn establishment must be included in the Bid Item price for the Bid Item "Sodding" or "Seeded Lawn
35 Installation" as applicable.

36 When the Bid Item "Seeded Lawn Installation" is included in the Bid Form, but the Contractor (with approval of the
37 Engineer) substitutes sodding instead of seeding for lawn installation, payment will be at the Bid Item price Bid for "Seeded
38 Lawn Installation" and no additional or separate payment will be made.

39 Any incidental work required to complete the seeded lawn installation or sod installation, as specified here but not
40 specifically mentioned, is incidental to, and all costs must be included in, the Bid Item price of the Bid Item.

41 20. **"Lawn Establishment, Minimum Bid (\$ _____)", per lump sum**

42 The Bid Item price for "Lawn Establishment, Min. Bid (\$ _____)" must include all costs for the work required to establish
43 the lawn including all costs to provide and apply water, to mow and to edge. To prevent unbalanced Bids, the Bid Item lump
44 sum price Bid for "Lawn Establishment" must not be less than the Bid Item lump sum minimum price noted in the Bid Form.
45 Should the Contractor determine that the cost for this work is greater than the Bid Item lump sum minimum price listed in the
46 Bid Form, the Contractor may bid a higher lump sum price by crossing out the Bid Item lump sum minimum price and
47 extension shown on the Bid Form, writing in a higher Bid Item lump sum price and extension in the Bid Form, and initialing the
48 change. Bids received on this Contract which contain a cost for lawn establishment of less than the Bid Item lump sum
49 minimum price shown on the Bid Form will be changed to reflect the Bid Item lump sum minimum price allowed including the
50 extension and must govern as becoming a part of the Bid.

51 Payment will be made in 2 payments at the rate of 50 percent of the Bid Item price for "Lawn Establishment, Min. Bid (\$
52 _____)". The first payment will be processed based on the Contractors statement including a 60 Day schedule for mowing,
53 edging, and other work provided to maintain the lawn as required by the Contract. The second and final payment will be
54 processed at the end of the lawn establishment period based on the Contractors statement including a schedule for mowing,
55 edging, and other work provided to complete the Contract terms.

56 21. **"Relocate (Item)", per each**

1 The Bid Item price for "Relocate (Item)" must include all costs for the work required to remove and relocate the specified
2 item.

3 **22. "Tree Root Barrier" per linear foot**

4 The Bid Item price "Tree Root Barrier" paid per linear foot for root barriers must include full payment for furnishing all
5 labor, materials, tools, equipment, and incidentals, and for doing all work involved in installing root barriers, complete in place,
6 as shown on the Standard Plans and Drawings, as specified in the Standard Specifications and these Special Provisions, at
7 locations determined by the Engineer.

8 **23. "Rock Mulch", per cubic yard**

9 Payment for "Rock Mulch" must include all work required to furnish and install crushed rock mulch per Section 8-02.3(9)A
10 in the tree pit or the location show in Drawings.

11 **24. Other payment information**

12 When the Bid Form does not include a Bid Item for lawn establishment and mowing and edging is required, all costs for
13 mowing and edging must be included in the applicable Bid Items and no separate or additional payment will be made. If the
14 Bid Form does not contain either a lawn establishment or a mowing Bid Item, payment will be as specified in Section 1-
15 04.1(2).

16 Payment for clearing and grubbing will be as specified in Section 2-01.5.

17 Payment for establishing the subgrade of planting areas before actual planting by excavation or embankment
18 construction will be as specified in Section 2-10.

19 Payment for fill Material of the type specified will be as specified in Section 4-01.5.

20 All costs for fertilizer and other soil amendments specified in the Contract but not set forth in the Bid Form as a separate
21 Bid Item must be included in the Bid Item price of the applicable Bid Item.

22 Any incidental work required to complete the specified roadside planting, but not specifically mentioned in these
23 Specifications is incidental to the roadside planting, and all costs must be included in the Bid Item prices of the Bid Items.

24 **SECTION 8-03 IRRIGATION SYSTEM**

25 **8-03.1 DESCRIPTION**

26 Section 8-03 describes furnishing and installing a complete and functional sprinkler irrigation system as specified in the
27 Contract.

28 The Contractor or Subcontractor must be a Washington State licensed irrigation contractor. The irrigation system must
29 be installed by an irrigation sprinkler installer and must be installed according to the local plumbing codes. A plumbing permit
30 will not be required for irrigation work in the street Right of Way. At least 3 Working Days before backfilling, the Contractor
31 must provide notice to the Engineer for SPU' Customer Service Division to inspect and approve the piping and back flow
32 prevention devices.

33 Electrical work must be performed by a licensed electrical contractor. Required permits for electrical work except
34 irrigation, and except street lighting and signals, must be obtained as specified in Section 1-07.6. The Contractor must obtain a
35 class 2 electrical permit from the Seattle Department of Construction and Inspections, when required in the Contract. The
36 Contractor must become thoroughly familiar with the electrical environment within the Project Site and with the relevant work.

37 Excavations over 4 feet deep are subject to the provisions of Section 7-17.3(1)A7a.

38 **8-03.2 MATERIALS**

39 Materials must comply with the following Sections:

| Material | Section |
|--------------------------------|-----------------|
| Irrigation System Materials | Section 9-15 |
| Backflow Prevention Assemblies | Section 9-30.13 |
| Electrical Conduit | Section 9-34.3 |
| Geotextile | Section 9-37 |

41 **8-03.2(1) APPLICABLE ELECTRICAL CODES**

42 See Section 8-30.1(2).

43 **8-03.3 CONSTRUCTION REQUIREMENTS**

44 **8-03.3(1) GENERAL**

45 The Contractor must coordinate installation and operation of the irrigation system with landscaping construction.
46

1 The Contractor must check and verify all pertinent dimensions at the Project Site before proceeding with the Work.
 2 Before installing the irrigation system, the Contractor must carefully note all finish grades. Finish grades changed in the course
 3 of the Work must be restored so that the terrain conforms to the finished grade.

4 The Contractor must furnish the necessary equipment for proper execution and completion of all irrigation work and must
 5 make the connections to the water and electrical services. After payment for the new service has been received, SPU Water
 6 Operations will furnish and install the water service, water meter and meter box. The Contractor must be responsible to
 7 request service coordination with the Engineer and must allow 8 weeks for installation by SPU Water Operations.

8 After installation of the water service and meter, an acceptable backflow prevention assembly (BPA) between the water
 9 meter and the irrigation system must be installed and tested. The Contractor must use only a Washington State Department of
 10 Health approved backflow prevention assembly for the intended application. Contact SPU Inspection Services for inspection of
 11 the installation after the BPA is installed and tested. All backflow assemblies are required to be tested annually by backflow
 12 device testers certified by the Washington State Department of Health. See Sections 9-30.13 and 1-07.28 item 7D.

13 The Contractor must provide a minimum 5 Working Days advance notice to the Engineer for inspection and approval of
 14 electrical installations before Seattle City Light will make the final service connection to the hot line. Thirty Days advance
 15 notice is required for the inspection and service connection by SCL.

16 Where indicated on the Drawings, piping and wiring must be installed within plastic pipe sleeves of sufficient inside
 17 diameter to allow easy withdrawal and reinserting of the piping or wire. Pipe sleeves and piping must have a minimum of 12
 18 inches soil cover for water pipes, and electrical conduit including conduit sleeves must have a depth of soil cover of 18 inches
 19 or depth of soil cover conforming to the applicable electrical code for electrical wire or conduit with electrical wire, whichever is
 20 greater. The detect-a-tape must be installed 6 inches above the piping or conduit, and 4 inches above the sleeve as indicated
 21 on Standard Plan 128.

22 **8-03.3(2) LAYOUT OF IRRIGATION SYSTEM**

23 Before construction begins, the Contractor must stake the irrigation system layout following the schematic design shown
 24 on the Drawings. Alterations of the design and changes in the layout may be expected to conform to ground conditions and to
 25 obtain full and adequate coverage of sprinkler water. The Contractor is responsible for informing the Engineer of any
 26 anticipated coverage inadequacies. However, the system as planned must not be changed without the prior authorization of
 27 the Engineer.

28 **8-03.3(3) EXCAVATION**

29 All pipe must be laid in trenches that must be no wider than necessary to lay pipe and install equipment (see Standard
 30 Plan 128). The top 6 inches of topsoil, when such exists, must be kept separate from other subsoil and must be used as the
 31 topmost 6-inch layer when backfill is made. Trench bottoms must be relatively smooth and be of suitable Material free from
 32 rocks, stones, or other deleterious material that might damage the pipe. All trenches must be excavated 4 inches below the
 33 required depth and backfilled to the required depth with sand or other suitable Material free from rocks or stones as approved
 34 by the Engineer.

35 If possible, all trenches must be on a straight line between sprinkler heads or other appurtenances and must be without
 36 abrupt changes in grade.

37 Care must be exercised by the Contractor when excavating trenches near existing trees. In addition to the requirements
 38 of Section 1-07.16(2), where roots are 2 inches or more in diameter, the pipe trench must be hand excavated and tunneled.
 39 When 2 inches or larger tree roots are exposed, they must be wrapped with heavy burlap for protection and be kept moist to
 40 prevent drying. No cutting of tree roots larger than 2 inches will be allowed. Where excavating near trees exposes tree roots 2
 41 inches or less in diameter, the Contractor must clean cut the exposed roots at the trench wall to minimize further damage to
 42 the root. Tree roots must not be removed by pulling them from the soil. Trenches with exposed tree roots must be backfilled
 43 within 24 hours. Trenches with burlapped roots must have the burlap removed before backfilling.

44 **8-03.3(4) PIPING**

45 All lateral lines and power supply lines must be a minimum of 18 inches below finished grade measured from the bottom
 46 of the pipe, and all mainlines and sleeved pipe must be a minimum 24 inches below finished grade measured from the bottom
 47 of the conduit (see Standard Plan 128). All irrigation pipe placed under pavement, without exception, must be placed in
 48 sleeves. Such sleeves must extend a minimum of 1 foot beyond the limits of pavement. All jacking operations must be
 49 performed per an approved jacking plan which must be submitted to the Engineer at least 5 Working Days in advance for
 50 review. Where possible, mains and laterals or section piping must be placed in the same trench and horizontally separated by
 51 6 inches. Bedding Material must extend from 4 inches below to 6 inches above laterals, mainlines, and sleeves with the
 52 exception that power supply lines do not require 4-inch excavation or bedding below the power conduit.

53 Mainlines and lateral lines are defined as follows:

54 Mainlines: All pressurized supply pipe and fittings between the water meter and the irrigation control valves.

55 Lateral lines: All supply pipe and fittings between the irrigation control valves and the connections to the irrigation
 56 heads. Swing joints, thick walled pipe, flexible risers, rigid pipe risers, and associated fittings are not considered part
 57 of the lateral line but incidental components of the irrigation heads.

58 Pipe pulling will not be allowed for installation and placement of irrigation pipe.

1 All sleeves required but not used in this Contract must be capped and their locations marked with metal stakes and
2 painted blue to provide reference for the as built Drawings submitted to the Engineer upon completion of the irrigation work,
3 see Section 8-03.3(12).

4 **8-03.3(5) JOINTING**

5 During construction, pipe ends must be plugged or capped to prevent entry of dirt, rocks, or other debris.

6 All galvanized steel pipe must have sound, clean cut, well fitted standard pipe threads. All pipe must be reamed to the full
7 diameter and have all burrs removed before assembly. Threaded joints must be constructed using either a non-hardening,
8 non-seizing multipurpose sealant or thread seal tape or paste as recommended by the pipe manufacturer. All threaded joints
9 must be made tight with wrenches without the use of handle extensions. Joints that leak must be cleaned and remade with
10 new Material. Caulking or thread cement for making joints tight will not be permitted.

11 PVC pipe, couplings, and fittings must be installed per the manufacturer's recommendation. The outside of the PVC pipe
12 must be chamfered to a minimum of 1/16 inch at approximately 22 degrees. Pipe and fittings must be joined by solvent
13 welding. Solvents used must penetrate the surface of both pipe and fitting to produce complete fusion at the joint. Use solvent
14 and cement only as recommended by the pipe manufacturer.

15 PVC pipe ends must be cut at 90 degrees to their longitudinal axis and cleaned of all cutting burrs before cementing. Use
16 approved reaming tool. Pipe ends must be wiped clean with a rag and lightly wetted with PVC primer. A light coat of cement
17 must be applied on the inside of the fitting and a heavier coat on the outside of the pipe. The pipe must be inserted into the
18 fitting and given a quarter turn to seat the cement. Excess cement must be wiped from the outside of the pipe. Pipe must be
19 tested as indicated elsewhere in these Standard Specifications. No backfilling will be permitted, except at the midsection of
20 pipe lengths, leaving joints exposed until the pressure test is completed and approved.

21 When connecting plastic pipe to metal pipe, install a female threaded Schedule 80 PVC coupling onto the metal pipe first;
22 then glue the plastic pipe into the other end of the PVC coupling. No PVC pipe may be threaded or connected to a threaded
23 fitting without an adapter.

24 Due to the nature of PVC pipe and fittings, the Contractor must exercise care in their handling, loading, unloading and
25 storing to avoid damage. The pipe and fittings must be stored under cover. Pipe must be transported on a vehicle bed long
26 enough to support its entire length so as not to subject it to undue bending or concentrated external loads. Pipe that has been
27 dented or damaged must be set aside until such damage has been cut out and the pipe sections rejoined with a coupling.

28 Solvent welded joints must be given at least 15 minutes set up time before moving or handling. Pipe must be partially
29 center loaded to prevent arching and slipping. No water must be permitted in pipe until a period of at least 10 hours has
30 elapsed for solvent weld setting and curing.

31 Backfilling must be done when pipe is not in an expanded condition due to heat or pressure. Cooling of the pipe can be
32 accomplished by operating the system for a short time before backfilling or by backfilling in the early part of the morning before
33 the heat of the Day.

34 Before pressure testing, solvent welded joints must be given at least 24 hours curing time.

35 **8-03.3(6) INSTALLATION**

36 Final position of planting bed sprinkler heads must be as shown on Standard Plans 121 and 126 unless specified
37 otherwise in this Section, with depth of planting mulch adjusted to expose heads in planting beds. Final position of turf
38 sprinkler heads must be flush with finish grade. All sprinklers adjacent to walks, curbs, and pavement must be placed 6 inches
39 clear of the edge unless otherwise specified in Contract.

40 Shrub sprinkler heads must be placed on permanent risers approximately 12 inches above finished grade, except pop up
41 risers must be used when located adjacent to walks or driveways. All risers must have approved flexible swing joints.

42 Final position of valve boxes, capped sleeves, and quick coupler valves in planting beds must be between 1/2 and 1 inch
43 above finished grade or mulch. Final position of valve boxes must be flush with finish grade. The geotextile placed under the
44 Mineral Aggregate Type 4 for the quick coupler valve as indicated on Standard Plan 121 must be a nonwoven low survivability
45 underground drainage geotextile as specified in Section 9-37.

46 Drip irrigation emitters must be installed per the manufacturer's recommendations.

47 The irrigation Drawings are diagrammatic and are not intended to show exact locations of existing or proposed pipe
48 valves or controllers. New items must be located in landscaped areas as closely as possible to adjacent curbs or paving.

49 **8-03.3(7) ELECTRICAL WIRE AND CONTROLLER INSTALLATION**

50 Wiring between the automatic controller and automatic valves can share a common neutral. Separate control conductors
51 must be run from the automatic controller to each valve. A white colored wire must be used for the neutral as specified in the
52 National Electrical Code. Wires must be taped together with electrical tape at 5-foot intervals and attached to the irrigation
53 mains by at least 3 wraps of electrical tape at 10-foot intervals.

54 Wire must be common to each valve in the system. A loop must be provided at each valve in any wire that passes or
55 ends at that valve. Loop knot end of spare wire at valves where wire dead ends.

56 Splice insulation must consists of electrical conductors twisted and bonded by approved pressure connectors and
57 contained in a rigid plastic epoxy filled mold. Splices will be permitted only at junction boxes, valve boxes, pole bases or

control cabinets. An additional 2-foot minimum length of conductor must be left at each junction box and automatic control valve to facilitate splicing and inspection.

Electrical service must be provided at controller enclosures as shown on the Drawings.

A diagram of the wiring schedule must be pasted in the controller cabinet to facilitate the selection of valves to be operated.

The minimum size of wire is determined strictly by the following table:

| No. of Valves | Maximum Length of Common Wire | | | |
|---------------|-------------------------------|----------|----------|----------|
| | 500 ft. | 1000 ft. | 2000 ft. | 3000 ft. |
| 1 | 14 | 14 | 14 | 14 |
| 2 | 14 | 14 | 14 | 10 |
| 3 | 14 | 14 | 10 | 8 |
| 4 | 14 | 14 | 10 | 8 |
| 5 | 14 | 10 | 8 | 6 |
| 6 | 14 | 10 | 6 | 6 |
| 7 | 14 | 8 | 6 | 4 |
| 8 | 14 | 8 | 6 | 4 |
| 9 | 14 | 8 | 4 | 4 |
| 10 | 10 | 6 | 4 | 2 |
| 11 | 10 | 6 | 4 | - |

NOTE: Wire sizes in above table are AWG.

The control wires must be color coded as follows:

| Wire Type | Color |
|------------------------|--------|
| Neutral or common wire | White |
| Lead-in wire | Black |
| Extra wire | Orange |

Automatic irrigation installations include an automatic controller inside a weatherproof and tamperproof metal housing as described in Section 9-15.4. See Section 8-03.1 electrical contractor qualification requirements. When the Contractor is required to provide power supply to the controller as specified in the Contract, all electric work must be installed by an electrician licensed in the State of Washington.

Completion of irrigation work may require inspection and approval of the electrical system by SDCI. It is the Contractor's responsibility to arrange for this inspection.

8-03.3(8) BACKFLOW PREVENTION ASSEMBLY (BPA)

Backflow prevention assemblies as specified in Section 9-30.13 must be furnished and installed in an approved vault as indicated on Standard Plan 125. The installation must be verified acceptable by the Engineer. The Contractor must notify the Engineer at least 3 Working Days in advance to have SPU Customer Service perform the inspection, also see Section 1-07.28 item 7D for notification requirements. All backflow prevention assemblies must have acceptable drainage outlets and must not be submerged in water. Any drainage problems encountered during system layout or installation must be immediately brought to the attention of the Engineer. The double check valve backflow prevention assembly is the only BPA that will be allowed installed below ground surface.

8-03.3(9) FLUSHING AND TESTING

After BPA installation and approval of the Engineer, all flushing and pressure testing must be completed before backfilling irrigation system trenches.

The Contractor must notify the Engineer at least 24 hours before conducting pressure tests.

All gauges used in the testing of water pressures must be certified calibrated within the last 6 months by an independent ASTM (or other acceptable reference standards organization) accredited testing laboratory for use on the project.

Automatic controllers must be tested for a consecutive 2 week period under normal operating conditions. If adjustments are required, the Contractor must carry them out per the manufacturer's directions and continue tests until operation is acceptable.

1 Flushing must be accomplished as follows:

- 2 1. All main supply lines must receive 2 fully open flushings to remove debris that may have entered the line during
3 construction: the first one before placement of valves; the second one after placement of valves and before testing.
- 4 2. All main supply lines must be purged of air and tested with a minimum static water pressure of 150 psi for 60 minutes
5 without introduction of additional service or pumping pressure. Testing must be done with 1 pressure gauge installed
6 on the line at a location specified by the Engineer. The Contractor must be prepared to install an additional pressure
7 gauge when so directed by the Engineer. Lines which show loss of pressure exceeding 5 psi at the ends of test
8 periods specified in the Contract will be rejected. The Contractor must correct rejected installations and must retest
9 them for acceptance.
- 10 3. All lateral lines must receive 1 fully open flushing before placement of sprinkler heads, emitters, and drain valves. The
11 flushing must be of sufficient duration to remove any dirt or debris that may have entered the lateral lines during
12 construction.
- 13 4. All lateral lines must be purged of air and tested under operating line pressure with risers capped and drain valves
14 closed. The operating line pressure must be maintained for 30 minutes through open valves and pressure regulating
15 devices. Lines which show leaks at the end of the specified test periods must be rejected. When conditions exist
16 which prevent effective visual inspection of lateral lines, the Engineer may require that the lines be tested by use of
17 pressure gauges. In that event, static water pressure, equal to operating line pressure, must be maintained in the
18 lines for 30 minutes with valves closed and without introduction of additional service pressure. Lateral lines which
19 show loss of pressure exceeding 5 psi at the end of specified test periods will be rejected. The Contractor must
20 correct and retest lateral line installations that have been determined unacceptable.

21 Throughout the life of the Contract, the Contractor must repair, flush, and test, all main and lateral lines that have
22 sustained a break or disruption of service. Upon restoration of the water service, the affected lines must be brought up to
23 operating pressure. The Contractor must then conduct a thorough inspection of all components such as but not limited to
24 sprinkler heads or emitters, located downstream of the break, disruption of service, and repair. This inspection is required to
25 ensure that the entire irrigation system is operating properly. A minimum 2 Working Days advance notice to the Engineer is
26 required.

27 **8-03.3(10) ADJUSTING SYSTEM**

28 Before system operation inspection per Section 8-03.3(13), the Contractor must adjust and balance all sprinklers to
29 provide adequate and uniform coverage. Spray patterns must be balanced and fogging minimized by adjusting individual
30 sprinkler heads with the adjustment screws or replacing nozzles to produce a uniform pattern. Sprinkler spray on pavement,
31 walks, or Structures will not be permitted. The Contractor must provide the Engineer at least 2 Working Days advance notice
32 for this inspection. See Section 1-05.11(3) for general requirements regarding operational testing.

33 Inadequacies not rectified by adjusting or replacing nozzles must be corrected by the Contractor to an acceptable
34 condition at the Contractor's sole expense.

35 **8-03.3(11) BACKFILL**

36 The Contractor may start backfilling (except at joints, fittings, risers and valves) as soon as the section of piping and
37 wiring has been inspected and approved by the Engineer. Once the system has been tested against leaks, and the "as built"
38 location of the risers, fittings, and valves have been recorded by the Engineer, the remaining trench openings may be
39 backfilled. All backfill Material placed within 6 inches of the pipe must be sand or selected Material approved by the Engineer.
40 Backfilling from the bottom of the trench to approximately 6 inches above the pipe must be done by continuous compacting in
41 a manner that does not damage pipe or wiring and must proceed evenly on both sides of the pipe. The remainder of the
42 backfill must be thoroughly compacted, except that heavy equipment must not be used within 18 inches of any pipe. The top 6
43 inches of backfill must consist of either topsoil or the upper 6 inches of excavated Material if found suitable by the Engineer.

44 Detectable marking tape must be placed in the trench 6 inches directly above, parallel to, and along the entire length of
45 all nonmetallic water pipes and all nonmetallic and aluminum conduits placed under existing or future pavement. The width of
46 the tape must be as recommended by the manufacture for the maximum burial depth to be encountered on the project.

47 The Contractor must provide 24 hour notice to the Engineer each time an inspection or a check on system location is
48 required. If any part of the sprinkler system is backfilled before being approved for correct location or before full inspection or
49 testing have been carried out, the trench must be re-excavated, the system uncovered and left exposed until it is approved for
50 backfilling by the Engineer.

51 Restoration of ground surface must include the resetting of removed sod. The Contractor is responsible for sod survival.

52 **8-03.3(12) AS BUILT DRAWINGS, O&M MANUAL, AND SYSTEM ORIENTATION**

53 Upon physical completion of the irrigation work including flushing and testing, and at least 5 Working Days before the
54 training and orientation session, the Contractor must submit preliminary as-built drawings, schematic circuit diagrams, or other
55 drawings as necessary so that the Engineer can prepare corrected Drawings to show the irrigation work as constructed. The
56 as-built drawings must be reproducible and on sheets conforming in size to the provisions of Section 1-05.3(11).

57 Before system operation testing (Section 8-03.3(13), the Contractor must conduct a training and orientation session
58 covering the operation, adjustment, and maintenance of the irrigation system. The preliminary as built drawings will be
59 reviewed and all features are to be explained. At this session, the Contractor must provide the Engineer with an Operations

1 and Maintenance Manual (O&M Manual) per Section 1-05.11(3). The Contractor must provide written notice to the Engineer at
 2 least 2 weeks before the training and orientation session. The date and time of the training session is subject to approval of
 3 the Engineer.

4 The Operations and Maintenance Manual (O&M Manual) must include the following:

- 5 1. Catalogues of Materials used;
- 6 2. Parts lists;
- 7 3. Summary of all operations (including but not limited to spring start up and winterization techniques, controller
 8 programming, valve cleaning, sprinkler adjustment, backflow prevention); and
- 9 4. Names and addresses of local distributors.

10 Upon system operation and approval of all tests, acceptance of the system will be contingent upon the Contractor
 11 providing:

- 12 a. Signed and approved sprinkler, plumbing, electrical and health department permits;
- 13 b. Reproducible final as-built drawings and all catalogue cuts, manufacturer's instructions and maintenance and
 14 operating information;
- 15 c. All necessary keys and tools to activate, operate and drain the system; and
- 16 d. Provide all needed instructions to insure that it continues to operate normally after departure of the Contractor.

17 **8-03.3(13) SYSTEM OPERATION INSPECTION**

18 After the training and orientation session per Section 8-03.3(12), the irrigation system must be completely tested and fully
 19 operable in the automatic mode before planting in the sprinkled area except where otherwise specified in Contract. The
 20 Contractor must, in the presence of the Engineer, do a water coverage test for each sprinkler zone in the system. The
 21 Contractor must change nozzles and make all necessary adjustments to obtain full coverage with minimum overspray. All
 22 balancing and adjusting of the system must have been completed before requesting system operation testing. The Contractor
 23 must be fully responsible for all maintenance, repairs, tests, inspections, and the automatic operation of the system until Work
 24 is considered complete as determined by the final inspection specified in Section 1-05.11. The Contractor's responsibility also
 25 includes draining the system before winter and reactivating it in the spring and at other times when directed by the Engineer.
 26 This responsibility continues through the landscape establishment period if a landscape establishment Bid Item is included in
 27 the Bid Form. Irrigation system maintenance must include restoration of the ground surface to compensate for settling of
 28 trenches.

29 For the life of the Contract, the Contractor is responsible for having annual inspections and tests performed on all cross
 30 connection control devices as required and specified by the Washington State Department of Health.

31 Adjustments made in the irrigation system during the system operational testing must be shown on the final as-built
 32 record set of drawings and must be submitted to the Engineer for approval within 5 Working Days after the date of system
 33 operation testing accepted by the Engineer.

34 **8-03.4 MEASUREMENT**

35 Bid Items of Work completed under the Contract will be measured as provided in Section 1-09.1, Measurement of
 36 Quantities, unless otherwise provided for by individual measurement paragraphs in this Section.

37 **8-03.5 PAYMENT**

- 38 1. **"Irrigation System, Automatic"**, per lump sum

39 The Bid Item price for "Irrigation System, Automatic" must include all costs for the work required to furnish, install, and
 40 test a complete working system including, but not limited to, excavation, backfill, controller, vaults, valves, valves boxes,
 41 conduit, wiring, quick couplers, risers, sprinkler heads and piping. If a hose bib assembly is included in the Contract with an
 42 irrigation system and no "Hose Bib Assembly" Bid Item is in the Bid Form, payment for the hose bib assembly is considered
 43 included in the Bid Item price for the Bid Item "Irrigation System, Automatic".

- 44 2. **"Irrigation System", Manual**", per lump sum

45 The Bid Item price for "Irrigation System", Manual" must include all costs for the work required to furnish, install and test a
 46 complete working system including, but not limited to, excavation, backfill, valves, valve boxes, vaults, quick couplers, risers,
 47 sprinkler heads and piping.

- 48 3. **"Hose Bib Assembly"**, per each

49 The Bid Item price for "Hose Bib Assembly" must include all costs for the work required to furnish and install the type and
 50 size of hose bib assembly specified when not installed as a component of an automatic irrigation system.

- 51 4. **"Sleeve, (Material), (Schedule), (Size)"**, per linear foot

52 The Bid Item price for "Sleeve, (Material), (Schedule), (Size)" must include all costs for the work required to furnish and
 53 install the sleeve of the type and size specified.

- 54 5. **"Valve Box, Plastic"**, per each

1 The Bid Item price for "Valve Box, Plastic" must include all costs for the work required to furnish and install the valve box
2 of the type specified when "Irrigation System, Manual" and "Irrigation System, Automatic" is not in the Bid Form.

3 **6. Other payment information**

4 All costs of annual inspections and tests performed on cross connection control devices during the life of the Contract
5 must be included in the Bid Item prices for the complete irrigation system.

6 All costs associated with furnishing and installing the service tap, water meter and meter box will be at Owner expense.

7 Payment for submittals will be made as specified in Section 1-05.3.

8 **SECTION 8-04 CEMENT CONCRETE CURB, CURB AND GUTTER**

9 **8-04.1 DESCRIPTION**

10 This work must consist of constructing Portland cement concrete curb, and curb and gutter.

11 **8-04.2 MATERIALS**

12 Materials must comply with the specifications of the following Sections:

| Material | Section |
|--|----------------|
| Non-Roadway Cement Concrete | Section 5-05 |
| Non-Roadway Cement Concrete, w/25% pozzolans | Section 5-05 |
| Premolded Joint Filler | Section 9-04.1 |
| Reinforcing Steel | Section 9-07 |

14
15 The cement concrete must be as specified in Section 5-05. Concrete mix for curb and gutter Type 410B and curb Type
16 410C must be Non-Roadway Cement Concrete or Non-Roadway Cement Concrete W/25% pozzolans per Section 5-05.
17 Slump of the concrete mix must not exceed 3-1/2 inches.

18 Epoxy grout for curb dowel anchored in concrete must be ASTM C 881, Type 1 epoxy grout.

19 Dowels and reinforcing steel must be #3 deformed steel billet bars, ASTM A 615, Grade 60.

20 Forms may be of wood or metal or any other material at the option of the Contractor, provided that the forms as set result
21 in a curb, or curb and gutter of the specified thickness, cross-section, grade and alignment shown on the Drawings.

22 **8-04.3 CONSTRUCTION REQUIREMENTS**

23 **8-04.3(1) GENERAL**

24 Excavation work to install forms for concrete curb and gutters within the dripline of trees must be accomplished by hand
25 methods. Where curb or curb and gutter construction is in an area with exposed tree roots 2 inches or greater in diameter, the
26 Contractor must work with the Engineer as specified in Section 1-07.16(2).

27 The subgrade must be prepared as specified in Section 2-09 and properly compacted to the specified grade and width
28 per Section 2-11. The compacted subgrade must extend at least 1 foot beyond each edge of the curb and gutter sections to
29 provide a solid base for erecting forms.

30 Curb associated with monolithic curb and sidewalk must be as specified in Section 8-14.

31 The opening of new pavement placed with new curb must be as specified in Section 5-05.

32 **8-04.3(1)A ERECTING FORMS**

33 Before erecting forms, the Contractor must bring the subgrade to the required line, grade and compaction. Curbs must
34 not be set until the subgrade has been compacted to within 1 inch of established grade.

35 Forms, wood or steel, must be staked securely in place, true to line and grade.

36 Sufficient support must be provided to the form to prevent movement. Forms must be clean and well-oiled before setting
37 in place. After the forms are set, the top of the form must not depart from grade more than 1/8 inch when checked with a 10-
38 foot straight edge. The alignment must not vary more than 1/8 inch in 10 feet. Immediately before placing the concrete, forms
39 must be carefully inspected for proper grading, alignment and rigid construction. Adjustments and repairs as needed must be
40 completed before placing concrete.

41 Where approved by the Engineer, curb and curb and gutter may be constructed using approved slip-form equipment. The
42 curb must be constructed to the same requirements as the cast-in-place curb.

43 **8-04.3(1)B PLACING CONCRETE**

44 The subgrade must be properly compacted and brought to specified grade before placing concrete. The subgrade must
45 be thoroughly dampened immediately before the placement of concrete. Concrete must be placed and consolidated into the

1 forms to provide a dense, compacted concrete free of rock pockets. The exposed surfaces must be floated, finished, and
2 brushed longitudinally with a fiber hair brush approved by the Engineer, see Section 5-05.

3 The rate of concrete placement must not exceed the rate at which the various placing and finishing operations can be
4 acceptably performed as specified in this Section.

5 **8-04.3(1)C DOWELS**

6 Dowels must be placed in the pavement slab as detailed on Standard Plan 411.

7 The dowel bars must be set while the concrete is still plastic enough to not require hammering them into place.

8 **8-04.3(1)D STRIPPING FORMS AND FINISHING**

9 The face form of the curb must be stripped early enough in the curing process to allow correction of all irregularities that
10 may appear.

11 Forms may be removed on the Day following the pour if the concrete has set sufficiently to keep its true shape and
12 removal causes no chipping or spalling. When forms are removed before the expiration of the curing period, the concrete must
13 be protected and cured. The exposed surface of the curb must be brushed with a fiber hair brush.

14 **8-04.3(1)E CURING**

15 Liquid membrane curing compound must be type 1D per Section 9-23.2 and applied to all exposed surfaces immediately
16 after finishing. However, liquid curing compound as specified in Section 5-05 may be used with approval of the Engineer.

17 If, at any time during the curing period any of the forms are removed, a coat of curing compound must be applied
18 immediately to the exposed surface. The curing compound must be applied in sufficient quantity to obscure the natural color of
19 the concrete. Additional coats must be applied if the Engineer determines that the coverage is not adequate. The concrete
20 must be cured for the minimum period of time set forth for pavement in Section 5-05.

21 **8-04.3(1)F EXPANSION AND DUMMY JOINTS**

22 Joints must be constructed in the manner shown on Standard Plans 410 and 411 at locations to match joints in new
23 concrete pavement, unless otherwise specified in the Contract. In no case must joint spacing exceed 15 feet center to center.
24 All expansion and construction joints must extend entirely through the curb section. Joint filler in the curb must be normal to
25 the pavement and in full butt contact with the pavement joint. Joints must match existing transverse joints or cracks in existing
26 pavement.

27 Locations of joints associated with depressed curbs for curb ramps must comply with Section 8-14.3(7).

28 **8-04.3(1)G FINISHED WORK**

29 When checked with a 10-foot straight edge, grade must not deviate more than 1/8 inch, and alignment must not vary
30 more than 1/4 inch.

31 **8-04.3(2) CURB BLOCK OUTS AT CURB RAMPS**

32 Where new cement concrete curb is to be constructed and a new curb ramp is also to be constructed, the Contractor
33 must block out the new curb at the locations of the new curb ramps as shown on the Standard Plans unless the Drawings
34 indicate otherwise. New curb ramps must be constructed monolithic with curb as shown on Standard Plans 422a and 422b.

35 New curb installation with no sidewalk must have depressed curb for future curb ramp installation. Typically, curb ramps
36 are paired with each curb ramp on opposite sides of a vehicular pavement.

37 **8-04.3(3) TYPE 410B CURB AND GUTTER**

38 Curb and gutter must be constructed as shown on Standard Plan 410 on a compacted subgrade prepared per applicable
39 subgrade Specifications for cement concrete pavement in Section 5-05. When extruded curb and gutter is called for, it may be
40 extruded as a unit as specified in Section 8-06, or the curb may be extruded on the gutter section in which case steel dowels
41 must be provided as specified in Section 8-04.3(1)C.

42 Premolded joint filler must be as shown on Standard Plan 411.

43 **8-04.3(4) TYPE 410C CURB**

44 **8-04.3(4)A CEMENT CONCRETE CURB ON EXISTING PAVEMENT**

45 Cement concrete curb constructed on an existing pavement must be doweled into the existing pavement as shown on
46 Standard Plans 410 and 411 where indicated on the Drawings or designated by the Engineer.

47 Drilling holes into concrete pavement, or concrete pavement base, for # 3 dowel pins must be as specified in Section 5-
48 05. After cleaning the hole of all debris, place #3 dowel pins into the hole and fill with epoxy grout in the manner specified in
49 Section 5-05. Holes must be spaced as indicated on the Standard Plans. The distance from the top of the finished curb to the
50 top of the dowel must be 1 inch. The epoxy resin system used must be Type I as specified in Section 9-26.

51 Premolded joint filler must be placed as shown on Standard Plan 411.

8-04.3(4)B CEMENT CONCRETE CURB ON NEW PAVEMENT

Doweled curb on new pavement must be constructed as shown on Standard Plans 410 and 411.

The pavement width must extend to the back of the curb. The pavement where the curb is to be placed must be roughened or otherwise treated so that a permanent bond can be secured between the curb and the pavement. Do not use curing compound on the pavement where curb will be constructed.

Dowels, as detailed in Standard Plans 410 and 411 must be placed at 28 inches on center in the fresh concrete pavement.

Premolded joint filler must be placed as shown on Standard Plan 411.

8-04.3(5) MOUNTABLE CURB

Mountable curb for traffic circles must be constructed with the alignment and configuration as shown on the Drawings.

The extended depth cement concrete mountable curb to be installed adjacent to asphalt pavement must have the same dimensions as other mountable curb, except the depth of curb must be extended an additional 7 inches, or more to match the greater depth of adjacent asphalt pavement.

8-04.4 MEASUREMENT

Measurement for new curb and gutter, and new curb of the type specified, will be by the linear foot along the front face of the curb for the length constructed, excluding that portion installed monolithically with new driveways or curb ramps unless otherwise specified in the Contract. Alley access ramps are considered driveways.

Unless otherwise specified in the Contract, no measurement will be made for curb where curb is placed monolithically with new driveways or new curb ramps, (See Standard Plans 422a, 422b, and 430 or Drawing details).

8-04.5 PAYMENT

1. "Curb, Cement Concrete", per linear foot
2. "Curb, Cement Concrete, Mountable", per linear foot
3. "Curb and Gutter, Cement Concrete", per linear foot
4. "Curb, Cement Concrete, w/25% Pozzolans" per linear foot
5. "Curb, Cement Concrete, Mountable, w/25% Pozzolans" per linear foot
6. "Curb and Gutter, Cement Concrete, w/25% Pozzolans" per linear foot

The Bid Item price for "Curb, Cement Concrete...", for "Curb, Cement Concrete, Mountable...", and for "Curb and Gutter, Cement Concrete..." must include all costs for the work required to construct the curb or curb and gutter of the size and type specified.

Payment for Type 410C curb does not include the pavement slab on which it is placed. That portion of the pavement slab underneath Type 410C curb that is new will be paid for as concrete pavement as specified in Section 5-05.5.

SECTION 8-05 RESERVED**SECTION 8-06 EXTRUDED CURB****8-06.1 DESCRIPTION**

This Work must consist of constructing extruded asphalt concrete and cement concrete curb per these Specifications at locations shown on the Drawings and to the dimensions shown on Standard Plan 412. Except as noted otherwise in Section 8-06, all requirements for cement concrete curb as specified in Section 8-04 must apply to extruded cement concrete curb.

8-06.2 MATERIALS

Materials must comply with the requirements of the following Sections:

| Materials | Section |
|--|--------------|
| Non-Roadway Cement Concrete HES, High Strength | Section 5-05 |
| Non-Roadway Cement Concrete, High Strength | Section 5-05 |
| HMA | Section 5-04 |
| Reinforcing Steel, Tie Bars | Section 9-07 |

Extruded asphalt concrete curb must consist of a hot mix asphalt concrete as specified in Section 5-04 and must be of the HMA Class specified in the Contract.

The concrete mix design for extruded cement concrete curb must be Non-Roadway Cement Concrete HES, High Strength or Non-Roadway Cement Concrete, High Strength as specified in Section 5-05.

1 8-06.3 CONSTRUCTION REQUIREMENTS**2 8-06.3(1) PREPARATION OF PAVEMENT SURFACE****3 8-06.3(1)A EXTRUDED ASPHALT CONCRETE CURB**

4 The asphalt pavement must be dry and cleansed of loose or deleterious material. Immediately after cleaning the
5 pavement surface, a tack coat of CSS-1h must be applied only to the area of the pavement where the curb is to be placed at
6 the rate of 0.08 to 0.20 gallons per 15 square feet of curb area contact surface with pavement, depending on the width of curb
7 and age of pavement.

8 8-06.3(1)B EXTRUDED CEMENT CONCRETE CURB

9 The pavement must be dry and cleansed of loose or deleterious Materials before curb placement. At the Contractor's
10 option, concrete curbs must be anchored to the existing pavement either by placing steel dowel bars 1 foot on each side of
11 every joint or by using an adhesive. Dowel bars must comply with the dimensions shown on Standard Plans 411 and 412. The
12 adhesive must comply with Section 9-26 for Type II epoxy resin.

13 8-06.3(2) EQUIPMENT FOR LAYING CURB**14 8-06.3(2)A EXTRUDED ASPHALT CONCRETE CURB**

15 The machine for laying the curb must be of the self-propelled type, equipped with a Material hopper, distributing screw,
16 and adjustable curb forming devices capable of laying and compacting the hot mix asphalt concrete to the lines, grades and
17 cross-section shown on the Drawings and as shown on Standard Plan 412. Curbs must be placed in an even homogenous
18 manner, free of honeycombs.

19 8-06.3(2)B EXTRUDED CEMENT CONCRETE CURB

20 Extruded cement concrete curb must be placed, shaped and compacted true to line and grade with an approved
21 extrusion machine. The extrusion machine must be capable of shaping and thoroughly compacting the concrete to the
22 required cross-section.

23 8-06.3(3) MIXING AND PLACING**24 8-06.3(3)A EXTRUDED ASPHALT CONCRETE CURB**

25 The HMA asphalt concrete mixture must be homogeneously mixed to as specified in Section 5-04.3(7) and must be
26 delivered to the hopper of the laying machine at a temperature no lower than 200 °F nor higher than 300 °F. Each hopper load
27 of the asphalt concrete mix must be run through the curb laying machine, properly adjusted to form a well compacted asphalt
28 concrete curb.

29 8-06.3(3)B EXTRUDED CEMENT CONCRETE CURB

30 The cement concrete mixture must be homogeneously mixed to conform with Section 5-05 when delivered to the hopper
31 of the curb machine. Each hopper load of cement concrete must be run through the curb laying machine, adjusted properly to
32 form and compact the cement mix for the concrete curb.

33 8-06.3(4) JOINTS**34 8-06.3(4)A EXTRUDED ASPHALT CONCRETE CURB**

35 Asphalt concrete curb construction at the specified temperature must be a continuous operation in one direction so as to
36 eliminate curb joints. If joints are required and approved by the Engineer, the joints between successive Days work must be
37 carefully made in such a manner as to ensure a continuous bond between the old and new sections of the curb. The contact
38 surface of the previously constructed curb must be painted with a thin, uniform coat of tack coat or cutback emulsion
39 immediately before placing the fresh asphalt concrete curb against it.

40 8-06.3(4)B EXTRUDED CEMENT CONCRETE CURB

41 Joints in the extruded cement concrete curb must be spaced at 15-foot intervals or must match existing transverse joints
42 or cracks in existing pavement. Joints must be cut vertically. Do not place joints at location of curb dowels.

43 8-06.3(5) CURING EXTRUDED CEMENT CONCRETE CURB

44 Liquid membrane curing compound must be type 1D per Section 9-23.2 and applied to all exposed surfaces immediately
45 after finishing. However, liquid curing compound as specified in Section 5-05 may be used with approval of the Engineer.

46 8-06.3(6) PROTECTION FROM TRAFFIC

47 The newly laid extruded asphalt concrete curb must be protected from traffic by barricades or other suitable means until
48 the heat of the asphalt concrete mixture has been dissipated and the mixture has attained its proper degree of hardness.

49 The newly placed extruded cement concrete curb must be protected from traffic by barricades or other suitable means for
50 at least 72 hours when it has attained its required strength of 2500 psi.

51 See Sections 1-07.23 and Section 1-10.

1 8-06.3(7) SUBSTITUTIONS

2 The Contractor may substitute extruded cement concrete curb for extruded asphalt concrete curb if approved by the
3 Engineer, as specified in Section 1-05.3(6). Asphalt curb cannot be substituted for Portland cement concrete curb.

4 8-06.4 MEASUREMENT

5 Extruded concrete curb will be measured by the linear foot along the front face of the curb and returns.

6 8-06.5 PAYMENT

- 7 1. "Extruded Curb, HMA (Class)", per linear foot
- 8 2. "Extruded Curb, Cement Concrete", per linear foot
- 9 3. "Extruded Curb, Cement Concrete, HES (Time)", per linear foot

10 The Bid Item price for "Extruded Curb..." must include all costs for the work required to furnish and install the Material
11 type extruded curb.

- 12 4. Other information

13 Extruded cement concrete curb substituted for extruded asphalt curb as specified in Section 8-06.3(7) must be at the
14 Contractor's sole expense and at no additional or separate cost to the Owner.

15 SECTION 8-07 PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB**16 8-07.1 DESCRIPTION**

17 This Work must consist of furnishing and installing precast cement concrete traffic curb and block traffic curb of the
18 design and type, and at the locations, specified in the Contract. See Section 8-04.3(5) for traffic control circle.

19 8-07.2 MATERIALS

20 Materials must comply with the requirements of the following Sections:
21

| Materials | Section |
|---|--------------------|
| Non-Roadway Cement Concrete, High Strength | Section 5-05 |
| Non-Roadway Cement Concrete, High Strength, w/ 25% Pozzolans | Section 5-05 |
| Grout | Section 9-04.3(2)B |
| Precast & Block Traffic Curb, Water Repellent Compound, Sodium Metasilicate | Section 9-18 |
| Paint | Section 9-29 |

22
23 Unless otherwise approved by the Engineer, Cement Concrete must be Non-Roadway Cement Concrete, High Strength
24 or Non-Roadway Cement Concrete, High Strength, W/ 25% Pozzolans as specified in Section 5-05.

25 Glass traffic beads must comply with Section 8-22.2.

26 8-07.3 CONSTRUCTION REQUIREMENTS**27 8-07.3(1) INSTALLING CURBS**

28 See Section 8-04 for cement concrete curb and curb and gutter.

29 Precast traffic curb and block traffic must be secured to underlying pavement as indicated on Standard Plan 413a. 413C
30 curb must be anchored to the underlying pavement every other 1-inch diameter hole with an 8-inch length of No. 4 rebar (1/2-
31 inch reinforcing steel) fully grouted into the hole. The holes without rebar must be completely filled with grout. The remaining
32 hole above the rebar must be a minimum 1 inch and must be filled with grout. All traffic curb in contact with pavement must
33 have the entire contact area between the curb bottom and the pavement filled with a 1/2-inch thickness bed of grout. The
34 anchor grooves along the bottom of the curb must also be completely filled with the grout.

35 Before the grout bed is laid, the pavement surface must be cleaned of all dirt or other deleterious material including but
36 not limited to oil, grease, tar, other "oily" substance, and other material that may impair good bonding. The pavement surface
37 must be flushed with water and cleaning agents as necessary using a stiff brush to produce a surface capable of bonding new
38 curb to pavement with the grout.

39 Pavement surfaces covered with oil, grease, tar, or other oily substance must be cleaned as follows:

- 40 1. The pavement must be flushed with water.
- 41 2. While the pavement is still wet, sodium metasilicate must be evenly distributed over the pavement surface at a rate of
42 1 to 2 pounds per 100 square feet of pavement surface.
- 43 3. The sodium metasilicate must remain on the pavement for at least 15 minutes. Areas where patches of oil, tar, or
44 grease occur must be scrubbed with a stiff brush or broom.

1 4. The pavement surface must then be thoroughly rinsed.
 2 5. Steps 2 through 4 must be repeated until a surface is obtained that can provide an acceptable grout bond.
 3 All joints between adjacent pieces of curb, except joints for expansion and/or drainage as described in the Standard
 4 Plans and in the Contract, must be filled with grout. The Contractor must provide the Engineer at least 1 Working Day advance
 5 notice of this grouting.

6 Joints between adjacent units of block traffic curb must not be filled with mortar.

7 The alignment and the top surface of adjoining sections of curb must be true and even with a maximum tolerance of 1/16
 8 inch.

9 For traffic circles and median islands (radii greater than 10 feet), all 8-inch straight block curb (dual sloped) must have 1-
 10 inch diameter holes for anchoring the curb to the pavement as shown for precast curb on Standard Plan 413a.

11 Nosing pieces, connecting dividers, and radial sections as detailed on the Standard Plans and Drawings must be
 12 required at the ends of the curb lines for all types traffic curbs at transitions from precast traffic curb to radial or block traffic
 13 curb and at radial traffic curb installation with radii less than 10 feet.

14 **8-07.3(2) PAINTING OF CURBS**

15 Concrete traffic curbs must be painted with 2 full coats of approved traffic paint as specified on the Drawings. The second
 16 coat must have glass traffic paint beads uniformly sprinkled in the wet paint at the rate of 12 pounds per 100 linear feet of
 17 curbing. The glass beads must be applied as specified in Section 8-22.3(3)G.

18 **8-07.4 MEASUREMENT**

19 Measurement for "Curb, Traffic, Precast" and "Curb, Traffic, Block (type faces)" will be by the linear foot along the top
 20 surface of the curb and return. The nosing pieces and dividers will be measured as traffic curb.

21 Measurement for painting curb will be by the linear foot of curb whether 1 face or more than 1 face.

22 **8-07.5 PAYMENT**

23 1. "Curb, Traffic, Precast", per linear foot

24 2. "Curb, Traffic, Block, (type faces)", per linear foot

25 The Bid Item prices for "Curb, Traffic, Precast" and for "Curb, Traffic, Block" must include all costs for the work required
 26 to furnish and install the specified type traffic curb.

27 3. **Other payment information.**

28 Payment for painting precast curb will be as specified in Section 8-22.5

29 **SECTION 8-08 PLASTIC LANE MARKERS AND TRAFFIC BUTTONS**

30 **8-08.1 DESCRIPTION**

31 This Work must consist of furnishing and installing plastic lane markers and traffic buttons with an epoxy adhesive as
 32 specified in these Specifications and Standard Plans 700 and 710.

33 Color of Type 1, Type 2A, and Type 2B lane markers and traffic buttons must match the color of the pavement markings
 34 on which they are installed. The color of applicable pavement markings are set forth in Section 8-22.

35 **8-08.2 MATERIALS**

36 Materials must comply with the requirements of the following Sections:
 37

| Materials | Section |
|---|--------------|
| Lane Markers Type 1 & Type 2, and Plastic Traffic Buttons | Section 9-21 |
| Adhesive | 9-26.2 |

38

39 **8-08.3 CONSTRUCTION REQUIREMENTS**

40 **8-08.3(1) GENERAL**

41 Location and spacing must be as indicated on the Drawings or designated by the Engineer. The Engineer will provide
 42 necessary control points. The Contractor is responsible for preliminary spotting of plastic buttons and lane markers from the
 43 control points before installation. Approval by the Engineer of the layout must be obtained before traffic button or markers are
 44 installed.

45 **8-08.3(2) SURFACE PREPARATION**

46 Traffic buttons and lane markers must be bonded to clean and dry pavement with an adhesive as specified here.

47 All sand, dirt and loose extraneous Material must be removed from the marker lane location.

1 Large areas of tar, grease or foreign Materials may require sand blasting, steam cleaning or power brooming to
2 accomplish complete removal. Application of traffic buttons and lane markers must not proceed until the cleaned surface has
3 been approved by the Engineer.

4 **8-08.3(3) ADHESIVE PREPARATION**

5 At the time of use, the contents of Packages A and B specified in Section 9-26 must be thoroughly blended by mixing to
6 produce a uniformly distributed mixture. One volume or weight of Package A must be mixed with one volume or weight of
7 Package B until a uniform gray color is achieved without visible streaks of white or black. Formulation may be changed, if
8 approved by the Engineer.

9 Catalyst must be added to the base just before use. Unused mixed adhesive must be discarded when catalytic action
10 has caused stiffening and reduction of workability or a small ball of jelled resin has formed in the center of the container.

11 The adhesive must be maintained at a temperature between 60 °F and 85 °F before use and during application.

12 **8-08.3(4) APPLICATION PROCEDURE**

13 Do not apply traffic buttons and lane markers to pavement if the ambient air temperature is below 40 °F or if the
14 pavement is moist.

15 The mixed adhesive must be applied to the base of the traffic button and lane marker with a quantity sufficient to overfill
16 all voids between the base of the traffic button or lane marker and the pavement, such that as the traffic button and marker is
17 worked into final position, the excess adhesive is forced out to form a bead rim around the entire perimeter of the traffic button
18 or lane marker.

19 Traffic buttons and lane markers must be spaced and aligned as indicated on Standard Plan 710 unless otherwise
20 indicated on the Drawings or designated by the Engineer. A displacement of not more than 1/2 inch left or right of the
21 established guide line will be permitted. Improperly placed buttons must be removed and replaced at the Contractor's
22 expense.

23 Bonding is considered acceptable when adhesive develops a minimum bond strength in tension of not less than 10
24 pounds per square inch for plastic traffic buttons, and not less than 2 pounds per square inch for lane markers Type 1, Type
25 2A and Type 2B. Traffic must be prevented from disturbing traffic buttons and lane markers until the minimum bonding
26 strength has been achieved.

27 Where it is required that both paint striping and Lane Marker Type 1 are to be installed on the same alignment, the
28 Contractor must install the lane markers before the application of the paint striping.

29 At the option of the Contractor, a hot melt bitumen adhesive may be used to cement markers to the pavement instead of
30 epoxy adhesive. The bitumen adhesive must be as specified in Section 9-02.1(8).

31 Do not place markers using bitumen adhesive when the pavement or air temperature is 50 °F or cooler.

32 Bitumen adhesive must be indirectly heated in an applicator with continuous agitation. The adhesive must be applied at a
33 temperature between 400 °F and 425 °F. Markers must be placed immediately after application of the adhesive.

34 Do not place lane markers over any pavement joint.

35 **8-08.4 MEASUREMENT**

36 Bid Items of Work completed under the Contract will be measured as provided in Section 1-09.1, Measurement of
37 Quantities, unless otherwise provided for by individual measurement paragraphs in this Section.

38 **8-08.5 PAYMENT**

- 39 1. "Lane Marker, (Type)", per each
- 40 2. "Plastic Traffic Button, (Type)", per each

41 The Bid Item prices for "Lane Marker, (Type)" and for "Plastic Traffic Button, (Type)" must include all costs for the work
42 required to furnish and install the specified type traffic buttons and lane markers.

43 **SECTION 8-09 RESERVED**

44 **SECTION 8-10 FLEXIBLE DELINEATOR POSTS**

45 **8-10.1 DESCRIPTION**

46 This Work must consist of furnishing and placing flexible delineator posts of the type specified on the Drawings per these
47 Specifications and at the locations indicated on the Drawings or where designated by the Engineer.

48 **8-10.2 MATERIALS**

49 Flexible delineator posts and reflective sheeting must be made of approved Materials and must be purchased from
50 manufacturers listed in the Contract.

51 All posts must be a minimum length of 72 inches. Posts must be painted white or brown as called for on the Drawings.

52 All flexible delineator posts must have a permanent mark identifying the manufacturer's recommended burial depth.

1 **8-10.3 CONSTRUCTION REQUIREMENTS**

2 Flexible delineator posts must be installed plumb and per the manufacturer’s recommendations. The Contractor must
3 submit to the Engineer, the manufacturer’s recommended installation procedure at least 5 Working Days before installation.
4 Use only one type of flexible delineator post on each project.

5 If the ground adjacent to the posts is disturbed in any manner, it must be backfilled to the level of the pre-existing surface
6 and thoroughly compacted. When applicable, the new surfacing on the ground adjacent to the post must be restored with in
7 kind Material matching the pre-existing Material.

8 **8-10.4 MEASUREMENT**

9 Flexible delineator posts will be measured by each post furnished and installed.

10 **8-10.5 PAYMENT**

11 1. “Flexible Delineator Post”, per each

12 The Bid Item price for “Flexible Delineator Post” must include all costs for the work required to furnish and install the
13 delineator post of the type specified, including reflectorizing and any excavating and backfilling that may be required.

14 **SECTION 8-11 GUARDRAIL**

15 **8-11.1 DESCRIPTION**

16 Section 8-11 describes constructing, changing, removing and resetting guardrail and anchors of the kind and type
17 specified in the Contract and in the WSDOT C Series Standard Plans, in conformity with the lines and grades shown on the
18 Drawings.

19 **8-11.2 MATERIALS**

20 Materials must comply with the requirements of the following Sections:

| Materials | Section |
|--|-------------------|
| Guardrail Elements, Posts, Blocks, Hardware, and Anchors | 9-16.4 and 9-16.8 |

22
23 **8-11.3 CONSTRUCTION REQUIREMENTS**

24 **8-11.3(1) BEAM GUARDRAIL**

25 **8-11.3(1)A ERECTION OF POSTS**

26 The posts must be set plumb and to the true line and grade of the roadway with spacing as indicated on the Drawings.
27 When the Drawings require that the ends of a section of guardrail be curved outward or downward, the end posts must be set
28 to accommodate the curve. End treatment must be per the appropriate WSDOT Standard Plans unless the Contract indicates
29 otherwise.

30 The dimensions of posts to be installed must be as shown on the WSDOT C Series Standard Plans unless a detailed
31 modified design is approved by the Engineer. The length of posts for beam guardrail Type 1 with long posts must be as shown
32 on the Drawings.

33 Posts may be placed in dug or drilled holes. Ramming or driving the post will be permitted only if approved by the
34 Engineer and if no damage to the pavement, shoulders, adjacent slopes, and the post results therefrom.

35 In broken rock embankments, the pre punching of holes will be permitted only before final shoulder or median
36 compaction, surfacing, and paving.

37 The posts must be protected from traffic at all times by attaching the rail elements or by a method approved by the
38 Engineer.

39 **8-11.3(1)B ERECTION OF RAIL**

40 All metal work must be fabricated in the shop. No punching, cutting, or welding must be done in the field, except that
41 holes for special details in exceptional cases may be drilled in the field when approved by the Engineer. The rail must be
42 erected so that the bolts at expansion joints are at the centers of the slotted holes.

43 Rail plates must be assembled with the splice joints lapping in the direction of the traffic.

44 Galvanized rail plates must be fastened to the posts with galvanized bolts, washers, and nuts of the size and kind shown
45 on the Drawings. Weathering steel rail plates must be fastened to the posts with weathering steel bolts, washers, and nuts of
46 the size and kind showing on the Drawings, and must not be galvanized.

47 All bolts, except where otherwise required at expansion joints, must be drawn tight. Bolts through expansion joints must
48 be drawn up as tight as possible without being tight enough to prevent the rail elements from sliding past one another

1 longitudinally. Bolts must be sufficiently long to extend at least 1/4 inch beyond the nuts. Except where required for
2 adjustments, bolts must not extend more than 1/2 inch beyond the nuts.

3 After completing the installation of weathering steel beam guardrail, the Contractor must wash the rail with clean water
4 under high pressure. If the rail is contaminated by oil or grease, sandblast as necessary to clean the rail.

5 **8-11.3(1)C ANCHOR INSTALLATION**

6 All excavation, backfilling and compaction required for installation of anchors must be performed as specified in Section
7 2-04, Section 2-10 and Section 2-11.

8 Bolts must be tightened to the tension specified. The anchor cable must be tightened sufficiently to eliminate all slack.

9 Where additional posts are required, field drilling of the rail will be permitted when approved by the Engineer.

10 Type 2 concrete anchors may either be pre cast or cast in place at the option of the Contractor.

11 **8-11.3(1)D GUARDRAIL SHOP DRAWINGS**

12 At least 5 Working Days in advance, the Contractor must submit to the Engineer, additional detailed Shop Drawings of
13 rail punchings, fittings, and assemblies to verify integrity and constructability.

14 **8-11.3(2) GUARDRAIL CONSTRUCTION EXPOSED TO TRAFFIC**

15 Any section of beam guardrail that is removed for modification must be put back in place within 5 Calendar Days of the
16 date the guardrail was removed.

17 The Contractor's operations must be conducted in such a manner that fixed objects including beam guardrail posts must
18 be protected from traffic at all times by attachment of the rail elements and all associated hardware or by a method approved
19 by the Engineer.

20 At the end of each Day, guardrail sections having an exposed end toward oncoming traffic must have a Type G terminal
21 end section bolted securely in place.

22 **8-11.3(3) ACCESS CONTROL GATES**

23 Access control gates must be placed to line and grade as shown on the Drawings or as established by the Engineer.
24 After the posts have been set, the holes must be backfilled with suitable Material and Material thoroughly tamped.

25 **8-11.3(4) RAISING GUARDRAIL**

26 Guardrail must be raised to the height shown on the Drawings, measured from the top of the rail to the finished shoulder
27 surface. The Material around each post must be tamped to prevent settlement of the raised rail.

28 **8-11.4 MEASUREMENT**

29 Measurement of beam guardrail and beam guardrail Type 1 long posts will be by the linear foot measured along the line
30 of the completed guardrail, including expansion sections, and will also include the terminal section for Type F connections.

31 Measurement of beam guardrail transition sections will be per each for the type of transition section installed. Terminal
32 sections, except Type F connections, will be considered part of the transition section and will be included in the measurement
33 of the transition section.

34 Measurement of beam guardrail anchors of the type specified will be per each for the completed anchors, including their
35 attachment to the guardrail.

36 Measurement of raising beam guardrail, and removing and resetting beam guardrail will be by the linear foot measured
37 along the line of guardrail actually raised or removed and reset. This includes transition sections, expansion sections, and
38 terminal sections.

39 **8-11.5 PAYMENT**

- 40 1. "Beam Guardrail, (Type)", per linear foot
- 41 2. "Beam Guardrail, (Type), Long Post", per linear foot
- 42 3. "Weathering Steel Beam Guardrail, (Type)", per linear foot

43 The Bid Item prices for "Beam Guardrail, (Type)", for "Beam Guardrail, (Type), Long Post", and for "Weathering Steel
44 Beam Guardrail, (Type)" must include all costs for the work required to furnish and install the beam guardrail, including all
45 standard and CRT ("controlled releasing terminal") treated timber posts to which the guardrail is attached.

- 46 4. "Beam Guardrail Anchor, (Type)", per each

47 The Bid Item price for "Beam Guardrail Anchor, (Type)" must include all costs for the work required to furnish and install
48 the specified type anchor, including excavation, backfilling, compaction, disposal of surplus excavated Material, and surface
49 restoration. Where Type 2 anchors are required, the additional depth of post embedment must be included in the Bid Item
50 price of the anchor. 10" x 10" treated timber posts (or steel alternate) will be paid separately as outlined here.

- 51 5. "Beam Guardrail Transition Section, (Type)", per each

1 The Bid Item price per each for "Beam Guardrail Transition Section, (Type)" must include all costs for the work required
2 to furnish and install posts, terminal sections, and attaching the transition section to masonry Structures.

3 6. "Access Control Gate", per each

4 The Bid Item price for "Access Control Gate" must include all costs for the work required to furnish and install the access
5 control gate as specified, including excavating, backfilling, compacting and surface restoration.

6 7. "Removing and Resetting Beam Guardrail", per linear foot

7 The Bid Item price for "Removing and Resetting Beam Guardrail" must include all costs for the work required to remove,
8 relocate, and install the beam guardrail with posts.

9 8. "Raising Existing Beam Guardrail", per linear foot

10 The Bid Item price per linear foot for "Raising Existing Beam Guardrail" must include all costs for the work required to
11 remove and reset or raise the guardrail and for backfilling and compacting holes.

12 **SECTION 8-12 CHAIN LINK FENCE AND WIRE FENCE**

13 **8-12.1 DESCRIPTION**

14 This Work must consist of furnishing and constructing chain link fence and wire fence of the types specified the Contract,
15 in conformity with the Standard Plans 450a, 450b, and 450c; and at the locations, lines, and grades shown on Drawings or as
16 established by the Engineer.

17 **8-12.2 MATERIALS**

18 Materials must comply with the requirements of the following Sections:
19

| Materials | Section |
|---|--------------|
| Cement Concrete Class 3000 | Section 6-02 |
| Chain Link Fence, Wire Fence, and Gates | Section 9-16 |

20
21 Chain link fence must be of diamond woven wire mesh mounted on steel posts. All fence and gate without barbed wire
22 must have knuckled selvage at the top and bottom edges whether the edges are free, have tension wire, or have a rail. Unless
23 the Contract specifies otherwise, all fence and gate with barbed wire must have twisted and barbed selvage at the top and
24 bottom edges whether the edges are free, have tension wire, or have a rail.

25 Wire fence must be of barbed wire or barbed wire combined with wire mesh fastened to posts. Steel posts and steel
26 braces, or wood posts and wood braces may be used, provided only one type must be selected for use in any Contract.

27 Gates must consist of a steel frame or frames covered with chain link or wire mesh.

28 **8-12.3 CONSTRUCTION REQUIREMENTS**

29 **8-12.3(1) GENERAL**

30 Clearing of the fence line may be required. Clearing must be as specified in Section 2-01.3(1).

31 For chain link type fences, the clearing width must be approximately 10 feet. For wire type fences, the clearing width
32 must be approximately 3 feet. Grubbing will not be required except where short and abrupt changes in the ground contour
33 require cuts or fills to properly grade the fence line. All stumps within the clearing limits must be removed or close cut.

34 Grading of the fence line sufficient to prevent short and abrupt breaks in the ground contour and to improve the aesthetic
35 appearance of the top of the fencing when installed must be required. It is expected that in the performance of this work,
36 machine operations will be required for chain link fencing, and hand work will be required for wire fencing except where
37 sufficient width exists for machine work.

38 The fence must be constructed close to and inside the Right of Way line unless otherwise specified in the Contract.
39 Deviations in alignment to miss obstacles will be permitted only when approved by the Engineer and only when such deviation
40 is not visible to the traveling public or adjacent property owners.

41 **8-12.3(2) CHAIN LINK FENCE AND GATES**

42 **8-12.3(2)A POSTS**

43 Posts must be placed in a vertical position and, except where otherwise specified in the Contract, must be spaced at 10-
44 foot centers. Spacing must be measured parallel to the slope of the ground.

45 All posts, except line posts for Type 3 fence, must be set in concrete to the dimensions shown on Standard Plans 450a
46 and 450c. All concrete footings must be crowned so as to shed water. Line posts on Type 3 fence must be set in undisturbed
47 earth either by driving or drilling, except as specified. Driving must be accomplished in such a manner as not to damage the
48 post. Voids around the post must be backfilled with suitable Material and thoroughly tamped.

1 Concrete footings must be constructed to embed the line posts on Type 3 fence at grade depressions where the
2 Engineer determines tension on the fence may pull the post from the ground.

3 Where solid rock is encountered without an overburden of soil, line posts must be into the solid rock set a minimum depth
4 of 14 inches, and end, corner, gate, brace, and pull posts a minimum of 20 inches. The holes must have a minimum width 1
5 inch greater than the largest dimension of the post section to be set. The posts must be cut before installation to lengths that
6 provide the required length of post above ground, or if the Contractor so elects, an uncut length of post set at a greater depth
7 into the solid rock.

8 After the post is set and plumbed, the hole must be filled with grout consisting of 1 part Portland cement and 3 parts
9 clean, well graded sand. The grout must be thoroughly worked into the hole so as to leave no voids. The grout must be
10 crowned to carry water from the post.

11 Where solid rock is covered by an overburden of soil or loose rock, the posts must be set to the full depth shown on the
12 Standard Plans unless penetration into solid rock reaches the minimum depths specified above, in which case the depth of
13 penetration may be ended. Concrete footings must be constructed from the solid rock to the top of the ground. Grouting will be
14 required on the portion of the post in solid rock.

15 Pull posts, as shown on Standard Plans 450a and 450c, must be braced to adjacent line posts and spaced at 1000-foot
16 maximum intervals for Type 1, 3 and 6 fence and at 500-foot maximum intervals for Type 4 fence.

17 End, gate, corner, and pull posts must be braced to the adjacent brace posts in the manner shown on Standard Plans
18 450a and 450c. Changes in line amounting to 2-foot tangent offset or more between posts are considered as corners for all
19 types of fence.

20 Steep slopes or abrupt topography may require changes in various elements of the fence. The Contractor is responsible
21 for providing all posts of sufficient length to accommodate the chain link fabric and ornamental tops adapted to receive the top
22 rail.

23 All posts for chain link fence Types 1 and 6 must be fitted with an approved top designed to fit securely over the post and
24 carry the top rail. All round posts for chain link fence Types 3 and 4 must have approved tops fastened securely to the posts.
25 The base of the top fitting for round posts must carry an apron around the outside of the posts.

26 **8-12.3(2)B TOP RAIL**

27 Top rails must pass through the ornamental tops of the line posts, forming a continuous brace from end to end of each
28 stretch of fence. Lengths of tubular top rail must be joined by sleeve couplings. Top rails must be securely fastened to terminal
29 posts by pressed steel fittings or other appropriate means.

30 **8-12.3(2)C TENSION WIRE**

31 Use one continuous length of tension wire between pull posts. Sufficient tension must be applied to avoid excess sag
32 between the posts. Tension wires must be tied or otherwise fastened to end, gate, corner, or pull posts using approved
33 methods.

34 **8-12.3(2)D CHAIN LINK FABRIC**

35 Chain link fabric on Type 1, 3, 4, and 6 fence must be placed on the face of the post as indicated on the Drawings.

36 Chain link fabric on Type 1, 3, 4, and 6 fences must be placed approximately 1 inch above the ground and on a straight
37 grade between posts by excavating high points of ground. Filling of depressions will be permitted only upon approval of the
38 Engineer.

39 The fabric must be stretched taut and securely fastened to the posts. Fastening to end, gate, corner, and pull posts must
40 be with stretcher bars and fabric bands spaced at intervals of 15 inches or less or by weaving the fabric into the fastening
41 loops of roll formed posts. Fastening to line posts must be with tie wire, metal bands, or other approved method attached at
42 14-inch intervals. The top and bottom edge of the fabric must be fastened with the wires spaced at 24-inch intervals to the top
43 rail, or top and bottom tension wires as may be applicable.

44 Rolls of wire fabric must be joined by weaving a single strand into the ends of the rolls to form a continuous mesh.

45 **8-12.3(2)E CHAIN LINK GATES**

46 Chain link fabric must be fastened to the end bars of the gate frame by stretcher bars and fabric bands and to the top and
47 bottom bars of the gate frames by tie wires in the same manner as specified for the chain link fence fabric, or by other
48 standard methods if approved by the Engineer.

49 Welded connections on gate frames where the spelter coating has been burned must be thoroughly cleaned by wire
50 brushing and all traces of the welding flux and loose or cracked spelter removed. The clean areas must then be painted with 2
51 coats of galvanizing repair paint, Formula A-9-73.

52 The drop bar locking device for the wire gates must be provided with a 12-inch round by 18-inch deep footing of Class
53 3000 concrete, crowned at the top and provided with a hole to receive the locking bar. The depth of the penetration of the
54 locking bar into the footing must be as specified by the manufacturer of the locking device. A lock approved by the Engineer
55 must be installed on all locking gates. 4 keys must be supplied with each lock.

1 8-12.3(3) WIRE FENCE AND GATES**2 8-12.3(3)A POSTS**

3 Line posts must be spaced at intervals not to exceed 14 feet. All intervals must be measured center to center of posts. In
4 general, in determining the spacing of posts, measurements will be made parallel to the slope of the existing ground, and all
5 posts must be placed in a vertical position except where otherwise specified in Contract.

6 Line posts may be driven in place provided the method of driving does not damage the post. Steel corner, gate, and pull
7 posts must be set in Class 3000 concrete footings to the dimensions shown on WSDOT Standard Plans and crowned at the
8 top to shed water.

9 Class 3000 concrete footings must be constructed to embed the lower part of steel line posts, and wood anchors must be
10 placed on wood posts at grade depressions wherever the Engineer determines tension on the line wires tend to pull the post
11 from the ground. The concrete footings must be 3 feet deep by 12 inches in diameter and crowned at the top.

12 Where solid rock is encountered without an overburden of soil, line posts must be set into the solid rock a minimum depth
13 of 14 inches, and end, corner, gate, and pull posts a minimum depth of 20 inches into the solid rock. The hole must have a
14 minimum dimension 1 inch greater than the largest dimension of the post section to be set. The posts must be cut before
15 installation to lengths which provide 4-1/2 feet of post above ground, or if the Contractor so elects, 6-foot posts set 18 inches
16 into the solid rock may be used.

17 After the post is set and plumbed, the hole must be filled with grout consisting of 1 part Portland cement and 3 parts
18 clean, well graded sand. The grout must be thoroughly worked into the hole so as to leave no voids. The grout must be
19 crowned to carry water away from the post. Where posts are set in the above manner, anchor plates and concrete footings will
20 not be required.

21 Where solid rock is covered by an overburden of soil or loose rock, the posts must be set to the full depth of 2-1/2 feet
22 unless the penetration into solid rock reaches the minimum depths specified above, in which case the depth of penetration
23 may be ended. When the depth of the overburden is greater than 12 inches, anchor plates will be required on the steel line
24 posts, and concrete footings must be constructed from the solid rock to the top of the ground on steel end, gate, corner, and
25 pull posts. When the depth of overburden is 12 inches or less, anchor plates and concrete footings will not be required.
26 Grouting will be required on the portion of the post in solid rock.

27 Steel braces must be anchored to soil or loose rock with a Class 3000 concrete footing not less than 18 inches on any
28 one side and set in solid rock to a minimum depth of 10 inches in the same manner as specified above for posts. The braces
29 must be set on the diagonal as shown on Standard Plans 450a and 450c and connected to the post with an approved
30 connection.

31 Wood braces must be dapped 1/4 inch into the posts and must be fastened to each post with three 20d galvanized nails.

32 Wire braces must consist of a 9-gage wire passed around the wood posts to form a double wire. The wire must be
33 fastened to each post with 2 staples and fastened together to form a continuous wire. The wires must then be twisted together
34 until the wire is in tension.

35 Where the new fence joins an existing fence, the 2 must be attached in an acceptable manner, end or corner posts being
36 set as necessary.

37 Pull posts must be spaced not more than 1000 feet apart, but spacing must be such as to use standard rolls of wire mesh
38 with a minimum of cutting and waste.

39 Changes in alignment of 30 degrees or more are considered as corners, and corner posts must be installed. Where the
40 Engineer determines that a change in alignment of less than 30 degrees materially lessen the strength of the fence, the line
41 post at the angle must be supported by the addition of braces or wires in an acceptable manner.

42 8-12.3(3)B BARBED WIRE AND WIRE MESH

43 After the pull posts have been placed and securely braced, the barbed wire and mesh must be pulled taut, with no slack,
44 and each longitudinal wire must be cut and securely fastened to the pull post with devices customarily used for the purpose.
45 Wire or mesh must not be carried past a pull post, but must be cut and fastened to the pull post independently for the adjacent
46 spans.

47 After the tensioning of the wire or mesh between 2 pull posts, all longitudinal wires must be properly fastened at proper
48 height to each intervening line post.

49 Wire mesh and barbed wire must be placed on the face of the post which is away from the highway, except that on
50 horizontal curves, the mesh and wires must be fastened to the face on the outside of the curve.

51 Where unusual ground depressions occur between posts, the fence must be guyed to the ground by a 9-gage galvanized
52 wire attached to a deadperson of approximately 100 pounds buried 2 feet in the ground. The guy wire must be securely
53 attached to each strand of barbed wire and to the top and bottom wires of the wire mesh fabric as to maintain the entire fence
54 in its normal shape. If necessary to guy the fence in solid rock, the guy wire must be anchored in a grouted hole 2 inches in a
55 diameter and 10 inches deep. The operation of guying must leave the fence snug with the ground.

1 8-12.3(3)C VERTICAL CINCH STAYS

2 Vertical cinch stays must be installed midway between posts on both types of fence. The wire must be twisted in such a
3 manner as to allow weaving into the horizontal fence wires to provide rigid spacing. All barbed wires and the top, middle, and
4 bottom wire of the wire mesh must be woven into the stay.

5 8-12.3(3)D WIRE GATES

6 The wire mesh fabric must be taut and securely tied to the frame and stays per recognized standard practice for wire
7 gate construction.

8 Welded connections on gate frames must be treated as specified for chain link fence gates.

9 The drop bar locking device for double wire gates must be provided with a footing of Class 3000 Concrete 12 inches in
10 diameter and 12 inches deep, crowned on top and provided with a hole to receive the locking bar. The diameter and depth of
11 the hole in the footing must be as specified by the manufacturer of the locking device.

12 8-12.4 MEASUREMENT

13 Chain link fence, and wire fence, will be measured by the linear foot of completed fence, along the groundline, exclusive
14 of openings.

15 8-12.5 PAYMENT

16 1. "Chain Link Fence, (Type)", per linear foot

17 2. "Wire Fence, (Type)", per linear foot

18 The Bid Item prices for "Chain Link Fence, (Type)" and for "Wire Fence, (Type)" must include all costs for the work
19 required to furnish and install a complete fence including posts, fabric, tension wire, concrete footings, excavation, backfill and
20 compaction, and all incidentals.

21 3. "Chain Link Gate, Single 6 Ft. Wide", per each

22 4. "Chain Link Gate, Double 14 Ft. Wide", per each

23 5. "Chain Link Gate, Double 20 Ft. Wide", per each

24 6. "Wire Gate, Single, 14 Ft. Wide", per each

25 7. "Wire Gate, Double, 20 Ft. Wide", per each

26 The Bid Item prices for chain link gate and wire gate of the size and type specified must include all costs for the work
27 required to furnish and install a complete gate including posts, fabric, concrete footings, excavation, backfill and compaction,
28 and all incidentals including locks and keys.

29 8. **Other payment information**

30 When there is no "Clearing", "Grubbing", or "Clearing and Grubbing" Bid Item included in the Bid Form, all costs for the
31 required clearing and grubbing must be included in the applicable fence and gate Bid Item price.

32 SECTION 8-13 MONUMENT CASES**33 8-13.1 DESCRIPTION**

34 This Work consists of furnishing and setting monument frame and cover castings, and removing and resetting monument
35 castings which may be covered over, damaged, or otherwise rendered useless due to construction activities.

36 8-13.2 MATERIALS

37 Materials must comply with the requirements of the following Section:

38

| Materials | Section |
|---------------------------|--------------|
| Monument Frame and Covers | Section 9-22 |

39

40 The Engineer may specify in the Contract a gray iron casting monument case and cover complying with Standard Plans
41 020a and 020b per AASHTO M36, Class 35B. The cover and seat must be machined so as to have perfect contact around the
42 entire circumference and full width of bearing surface. Dipping, painting, plugging, welding, or repairing defects are not
43 permitted.

44 8-13.3 CONSTRUCTION REQUIREMENTS**45 8-13.3(1) REFERENCE POINTS – GENERAL**

46 The Contractor must not remove or destruct any monument until the monument has been tied out. The Contractor must
47 carefully protect all reference points to the monuments. The Contractor must provide advance notices as specified in Sections
48 1-07.16(1)A and 1-07.28 for notification information.

1 The survey monument will be furnished by the SPU Land Survey Section and must be set by the land surveyor.

2 The Contractor is responsible for furnishing and installing required castings and Materials as specified in the Contract.

3 **8-13.3(2) FURNISH AND PLACE MONUMENT CASTINGS**

4 Where indicated on the Drawings, the Contractor must furnish and install monument frame and cover per Standard Plan
5 020 when specified in the Contract, monument frames and covers to the lines and grades established by the Engineer.
6 Monument castings installed in concrete pavement or in rigid concrete pavement base must comply with Section 7-05.3(1)N.

7 **8-13.3(3) ADJUST EXISTING MONUMENT CASTINGS TO GRADE**

8 Existing monument castings must be adjusted to grades as specified in Section 7-20.3(3). Monument castings installed in
9 concrete pavement or in rigid concrete pavement base must comply with Section 7-05.3(1)N.

10 **8-13.3(4) RESET OR RELOCATE MONUMENT CASTINGS**

11 See Section 8-13.3(1).

12 The Contractor must carefully remove monument castings as required during construction and must store the castings in
13 a secure place.

14 Monument castings designated for removal and not reused on the project, must be carefully removed and salvaged as
15 specified in Section 2-02.3(7).

16 The monument castings must be reset by the Contractor at street grade in locations designated by the Engineer.
17 Monument castings installed in concrete pavement or in rigid concrete pavement base must comply with Section 7-05.3(1)N.

18 The Contractor must replace lost or damaged castings with new castings.

19 **8-13.3(5) MISSING AND BROKEN CASTINGS, AND EXTRA WORK**

20 The Contractor must notify the Engineer when a monument casting or monument appears to be missing, damaged,
21 substandard, or, adversely impacted. The Engineer will make final determination of damaged, substandard, or adversely
22 impacted monument castings, monuments, or both. If extra work is required by the Engineer it must be addressed as specified
23 in Section 1-04.3.

24 Missing or damaged monument castings, monuments, or both, resulting from Contractor operations must be replaced
25 and installed at no cost to the Owner as specified in Section 8-13.3(2).

26 Monument castings, monuments, or both, not identified on the Drawings but found during construction to be missing,
27 damaged, or substandard must be replaced as specified in Section 8-13.3(2).

28 Monument castings, monuments, or both, not identified on the Drawings for relocate or reset which are adversely
29 impacted by extra work or by specified work must be reset or relocated as specified in Section 8-13.3(4).

30 **8-13.4 MEASUREMENT**

31 Bid Items of Work completed under the Contract will be measured as specified in Section 1-09.1 unless otherwise
32 provided in this Section.

33 **8-13.5 PAYMENT**

- 34 1. **"Monument Frame and Cover"**, per each

35 The Bid Item price for "Monument Frame and Cover" must include all costs for the work required to furnish and set the
36 monument castings.

- 37 2. **"Reset Monument Frame and Cover"**, per each

38 The Bid Item price for "Reset Monument Frame and Cover" must include all costs for the work required to remove, store,
39 and reset the monument castings.

- 40 3. **"Relocate Monument Frame and Cover"**, per each

41 The Bid Item price for "Relocate Monument Frame and Cover" must include all costs for the work required to remove,
42 store and reset the monument casting in a new location.

- 43 4. **"Relocate or Reset Monument and Monument Frame and Cover"**, per each

44 The Bid Item Price for "Relocate or Reset Monument and Monument Frame and Cover" must include all costs for the
45 work required to survey in the new Owner furnished monument, and to furnish and install a new frame and cover at a location
46 to be determined by the Engineer. Costs for this Bid Item must also include filing a DNR "Remove or Destroy a Survey
47 Monument Permit" per Chapter 332-120 WAC and providing a copy of this permit to the Engineer.

- 48 5. **Other payment information**

49 Lost or damaged castings, and castings damaged during installation resulting from the Contractor's operations must be
50 replaced, or replaced and reinstalled, respectively, by the Contractor with a new Type 020 casting at no cost to the Owner.

1 **SECTION 8-14 CEMENT CONCRETE SIDEWALK**

2 **8-14.1 DESCRIPTION**

3 Section 8-14 describes cement concrete sidewalks, thickened edge for sidewalk, monolithic curb and sidewalk, curb
4 ramps and detectable warnings, and bus shelter footings, including excavation and subgrade preparation.

5 **8-14.2 MATERIALS**

6 Materials must comply with the requirements of the following Sections:
7

| Materials | Section |
|---|--------------------|
| Non-Roadway Cement Concrete | Section 5-05 |
| Non-Roadway Cement Concrete, w/25% pozzolans | Section 5-05 |
| Non-Roadway Cement Concrete, w/25% pozzolans, High Strength | Section 5-05 |
| Patterned Cement Concrete Treatment | Section 5-05.3(20) |
| Colored Cement Concrete Treatment | Section 5-05.3(20) |
| Exposed Aggregate Cement Concrete Treatment | Section 5-05.3(21) |
| Premolded Joint Filler | Section 9-04.1(1) |
| Detectable Warning | Section 9-36 |

8

9 Cement Concrete Sidewalk monolithic with handrail must be Non-Roadway Cement Concrete, High Strength, see
10 Section 8-18.2 and Standard Plans 442, 443a and 443b.

11 "Six Inch Sidewalk, Cement Concrete" must be Non-Roadway Cement Concrete, High Strength.

12 "Six Inch Sidewalk, Cement Concrete, W/25% pozzolans" must be Non-Roadway Cement Concrete, W/25% pozzolans,
13 High Strength.

14 Except for "Six Inch Sidewalk," all new concrete sidewalk and curb ramp must be with concrete Non-Roadway Cement
15 Concrete or Non-Roadway Cement Concrete, W/25% pozzolans (when "W/25% pozzolans" is included in Bid Item
16 description), and the slump of all concrete mixes must not exceed 3-1/2 inches.

17 Patterned cement concrete is defined as additional work necessary to imprint cement concrete with a pattern, and is
18 referenced by "Patterned" and "Running Bond Used Brick" or (other pattern) in the Bid Item description.

19 Colored cement concrete is defined as additional work necessary to color cement concrete with a color, and is
20 referenced by "Colored" and a Federal Standard 595B "F (color code)" in the Bid Item description.

21 **8-14.3 CONSTRUCTION REQUIREMENTS**

22 **8-14.3(1) GENERAL**

23 The curb and gutter section must be placed before the placement of the sidewalk section. Where sidewalk construction is
24 in an area with exposed tree roots 2 inches or greater in diameter, the Contractor must comply with Sections 1-07.16(2),
25 Section 8-01 and Section 8-02.

26 Tree grates for tree pits installed in the sidewalk must have a concrete collar as specified in Section 8-02.3(21).

27 **8-14.3(2) EXCAVATION AND SUBGRADE**

28 Excavation for sidewalks must be as described in Section 2-04. Unsuitable material in the subgrade must be removed to
29 a depth determined by the Engineer and then backfilled with suitable Material.

30 Embankments must be constructed per Section 2-10 and compacted by Method B as specified in Section 2-11.

31 Before the forms are set, the subgrade must be graded to within 1 inch of established grade and the area between the
32 sidewalk and the adjacent private property line must be shaped to line, grade, and section shown on the Drawings and in
33 accordance with Section 1-05.5.

34 Compaction of the subgrade must be to 95 percent as determined by Section 2-11.

35 If the Drawings call for sidewalk drains or the Engineer directs sidewalk drains to be installed, they must be installed
36 before forms are placed. Sidewalk drains must be installed according to Section 7-01 and Standard Plan 241b.

37 **8-14.3(3) FORMS AND FINE GRADING**

38 Forms must conform to requirements specified in Section 5-05.3. Wood forms must be 2 inches by 4 inches (nominal) in
39 lengths of not less than 10 feet. Steel forms may be used upon approval of the Engineer. Forms must be staked to a true line
40 and grade. A subgrade template must then be set on the forms and the fine grading completed so that the compacted
41 subgrade must be a minimum of 3-1/2 inches below the top of the forms. The subgrade must be thoroughly dampened before
42 the time the concrete is placed.

1 Forms must be provided around all street name sign posts and traffic sign posts that are placed in concrete areas. Forms
2 used for this purpose must provide a 1-foot square or 1-foot diameter blockout, as approved by the Engineer.

3 Forms for the curb section of monolithic curb and sidewalk must be as specified in Section 8-04.3(1)A.

4 **8-14.3(4) PLACING AND FINISHING CONCRETE**

5 **8-14.3(4)A PLACING CONCRETE**

6 The concrete must be spread uniformly between the forms and thoroughly consolidated to a minimum thickness of 3-1/2
7 inches. Through joints and contraction joints must be located and constructed as specified in Section 8-14.3(6). In construction
8 of through joints, the premolded joint filler must be adequately supported straight and vertical until the concrete is placed on
9 both sides of the joint.

10 Whenever castings are located in the sidewalk area, joints must be installed at the casting location to control cracking of
11 the sidewalk. Concrete sidewalk placed around fire hydrant must be placed around the reinforced concrete shear block with
12 3/8-inch premolded joint filler as detailed on Standard Plans 310a or 311a. Place a 3-inch deep by 3/8-inch thick premolded
13 joint filler between concrete sidewalk and shear block. Concrete sidewalk placed to accommodate a tree pit with a tree grate
14 must include a concrete collar with reinforcing steel and a joint with 3/8-inch premolded joint filler, or a concrete thickened
15 edge, see Section 8-02.3(21). If spacing of joints or scoring is such that installation of premolded joint filler would be
16 unsuitable, the Contractor must install rebar to strengthen the sidewalk section as required by Section 5-05.3(9) for castings in
17 the pavement area.

18 Contraction joints must be formed by first cutting a groove in the concrete with a tee bar to a depth equal to, but not
19 greater than the joint filler Material, and then working the premolded joint filler into the groove. Premolded joint filler for both
20 through and contraction joints must be positioned in true alignment at right angles to the line of the sidewalk and be normal to
21 and flush with the surface. Where the sidewalk is contiguous with the curb, it must be constructed with a thickened edge as
22 shown on Standard Plan 420.

23 After the concrete has been thoroughly consolidated and leveled, it must be floated with floats and finished at the proper
24 time with a metal float. Joints must be edged with a 1/4-inch radius edger and the sidewalk edges must be tooled with a 1/2-
25 inch radius edger.

26 Additional requirements for placing concrete in cold weather must be as specified in Section 5-05.3(14).

27 Placing concrete for the curb section of the monolithic curb and sidewalk must be as specified in Section 8-04.3(1)B.

28 Temperature and time requirements for batching and placement must be as specified in Section 5-05.

29 **8-14.3(4)B FINISHING CONCRETE**

30 The surface must be brushed with a fiber hair brush of an approved type in a transverse direction except that at driveway
31 and alley crossings it must be brushed in a longitudinal direction. The placing and finishing of all sidewalks must be performed
32 as acceptable to the Engineer, and the tools used must be acceptable to the Engineer. After brush finish, the edges of the
33 sidewalk and all joints must be lightly edged again with an edging tool to give it a finished appearance.

34 Sidewalk 120 feet in length or less must be scored to match the pattern of existing sidewalk to which new sidewalk joins
35 unless otherwise specified in Contract. All other sidewalk must be divided into panels by scoring 1/4-inch deep "V grooves" in
36 the manner indicated on Standard Plan 420. Unless existing pattern differs, all "V" grooves and joints must have a 2-inch wide
37 troweled perimeter as shown on typical sidewalk detail on Standard Plan 420; this includes Business District 2' x 2' pattern.

38 Additional requirements for finishing concrete in cold weather must be as specified in Section 5-05.3(14).

39 **8-14.3(5) CURING AND PROTECTION**

40 The curing Materials and procedures must be as specified in Section 5-05; however with Liquid membrane curing
41 compound must be type 1D per Section 9-23.2 or must be manufactured specifically for colored concrete, unless otherwise
42 approved by the Engineer. Curing compound must be applied to all exposed surfaces immediately after brushing and must be
43 maintained for a period of 5 Days.

44 The Contractor must have readily available sufficient protective covering, such as waterproof paper or plastic membrane,
45 to securely cover the sidewalk pour of an entire Day in event of rain or other unsuitable weather.

46 The sidewalk must be protected against damage or defacement of any kind until it has been accepted by the Owner.

47 Additional requirements for curing in hot weather must be as specified in Section 5-05.3(13)C. Additional requirements
48 for curing in cold weather must be as specified in Section 5-05.3(14).

49 Curing for the curb section of the monolithic curb and sidewalk must be as specified in Section 8-04.3(1)E.

50 **8-14.3(6) THROUGH AND CONTRACTION JOINTS**

51 Standard locations for through joints for sidewalks are:

- 52 1. At street margins produced and at 30-foot or 28-foot intervals.
- 53 2. To separate concrete driveways, stairways, curb ramps and their landings from sidewalks.
- 54 3. Around the vertical barrel of fire hydrants, around utility poles and large diameter underground utility cover castings
- 55 when located in the sidewalk area.

1 4. Longitudinally between concrete walks, curbs, paved planting strips and solid masonry or concrete walls where they
2 abut.

3 5. To match as nearly as possible the through joints in the adjacent pavement and curb when sidewalk abuts curb.

4 Transverse contraction joints must be constructed with 3/8-inch premolded joint filler 2 inches in depth, and set at
5 intervals of 15 feet or less. Where obstacles or shortened sidewalk lengths or non-regular shaped sidewalks are encountered,
6 the location of joints must be as specified in Contract. At no time must joint spacing exceed 15 feet.

7 Through joints as shown on the Standard Plans must be 3/8-inch thick premolded joint filler. The joint filler width must be
8 cut to a width equal to the full depth of the concrete sidewalk plus 1/2 inch. When installed, the premolded joint filler must be
9 placed with top edge 1/8 inch below the finished surface of the concrete in a plane perpendicular to the surface and with the
10 bottom edge embedded in the subgrade. All joints must be in straight alignment, except where placed in curved locations as
11 required by the Drawings.

12 Construction joints for sidewalks must conform to the applicable requirements for through joints. Construction joints
13 formed by placing a header board transversely across the subgrade must be made at the end of each Day's paving or when
14 placing of concrete is discontinued for more than 45 minutes. The header board must be located to conform to the spacing for
15 the joints and must be left in place until the placing is resumed. The header must have a strip of premolded joint filler
16 imbedded against the hardened concrete when paving is resumed.

17 **8-14.3(7) CURB RAMP**

18 Curb ramp alignment must be as indicated on the Drawings, or as directed in the field. Curb passing through the curb
19 ramp must be monolithic with the curb ramp unless the curb ramp is built within a curb and gutter section. Curb ramps must be
20 constructed separately from the sidewalk to produce a definite break line between the ramp and the sidewalk. Bond-breaking
21 material such as polyethylene film, roofing paper, or other material as approved by the Engineer must be installed between the
22 curb ramp and the sidewalk with 1/4-inch concrete edging as specified in Section 8-14.3(4)A.

23 The Contractor must notify the Engineer 2 Working Days in advance of placing concrete for each curb ramp to allow the
24 Engineer the opportunity to inspect the curb ramp layout. The Contractor must not place concrete for a curb ramp until the
25 Engineer has either inspected and accepted the layout or waived the layout inspection. The Contractor is responsible for the
26 curb ramp installation regardless of the Engineer's inspection, see Section 1-05.7.

27 Concrete for curb ramps must not be overlaid or topped. The adjacent sidewalk "V" groove scoring pattern must not
28 extend into the ramp or sidwaling surfaces. The subgrade for curb ramps must be graded and formed to provide a minimum
29 concrete depth of 6 inches adjacent to the curb and tapering to a minimum depth of 3-1/2 inches at the back terminus.

30 Where existing sidewalk or existing curb ramp are replaced with new curb ramp and a detectable warning plate,
31 construction of the new curb ramp must be complete and connected to the existing pedestrian routes within 5 Calendar Days
32 of the removal of the existing curb ramp. In no case may this work extend into or through a Non-Working Day without approval
33 of the Engineer. The only exception to the 5 Day requirement is when the product specified requires a length of time longer
34 than 5 Days for acceptable performance. This time extension must be approved by the Engineer.

35 All curb ramp and curb ramp retrofit must have a detectable warning plate or detectable warning retrofit plate installed
36 per the manufacturer's written instructions. The Contractor must ensure the concrete supporting the detectable warning plate
37 is a plane and that the concrete base is completely bonded to and fully supporting of the detectable warning. Voids, pockets,
38 and other irregularities in the supporting concrete base are unacceptable.

39 The detectable warning plate must be oriented as shown on Standard Plans 422a through 422i.

40 **8-14.3(7)A SUBMITTAL**

41 The Contractor must submit to the Engineer, per Section 1-05.3, the following detectable warning plate information for
42 approval before starting curb ramp and curb ramp retrofit Work:

- 43 1. A description of the detectable warning plate proposed including the manufacturer's name, address, phone number,
44 and web-site addresses as available. (Note – acceptable Materials are specified in Sections 9-36.2 and 9-36.3).
- 45 2. For "or equal" products other than acceptable Materials specified see Section 9-36.4 for additional submittal
46 requirements; See Section 9-36.1 for detectable warning material and performance requirements.
- 47 3. Shop Drawings showing fabrication details, dimension details, composite structural system, joint and edge detail;
48 preparation of the concrete surface to receive the plate; Supplies used for installation, support, and bonding; and
49 installation instructions for placement with new curb ramp concrete and for curb ramp retrofit as the Work requires.
50 Where a curb ramp construction or curb ramp retrofit requires more than 3 Days to complete, provide written
51 instruction from the manufacturer stating in detail the reasons for more than 3 Days.
- 52 4. Manufacturer's certificate of compliance indicating the product complies with these Specifications including material
53 test reports from a testing laboratory accredited by a recognized designated standards organization such as ASTM.
- 54 5. Manufacturer's warranty against breakage, fading, and deformation (minimum 1 year).

55 **8-14.3(7)B CURB RAMP**

56 Curb ramps must be installed at locations shown on the Drawings or as shown in the Standard Plans.

1 Side curbs are curbs that are adjacent to curb ramps, but are not adjacent to street paving. Unless otherwise shown on
 2 the Drawings, side curbs must have a width of 6 inches. Depth of side curb below the ramp surface must be 6 inches. Height
 3 of side curb above the ramp surface must vary from flush to 6 inches. Side curbs must be constructed monolithically with the
 4 ramp.

5 All ramp surfaces must be brush finished as shown on the Standard Plans.

6 Curb ramps are defined as beginning at a point flush with the pavement or gutter and terminating at a point flush with the
 7 sidewalk. The Standard Plans show the areas that are considered part of the curb ramp Bid Items.

8 **8-14.3(7)C RESERVED**

9 **8-14.3(7)D DETECTABLE WARNING PLATE RETROFIT**

10 Where specified in the Contract, existing curb ramp without a detectable warning plate must be retrofitted with a
 11 detectable warning plate. Detectable warning plates used for retrofits may also be used in through cuts of traffic islands, or on
 12 edges of platforms. Curb ramps detectable warning plate retrofits must be located as shown on the Standard Plans. Other
 13 installations must be applied at locations and dimensions detailed in the Drawings. Detectable warning plate retrofits must be a
 14 surface applied detectable warning plate system as defined in Section 9-36.3.

15 The Contractor must submit to the Engineer for approval, see Section 1-05.3, information on the detectable warning
 16 retrofit plate as follows:

- 17 1. Complete description of the Material including Shop Drawings showing fabrication details, composite structural
 18 system, and Supplies used for installing the plate. If not one piece, a complete description of the jointing, spacing of
 19 joints, joint details and how the plate will satisfy the ADA requirements;
- 20 2. Complete description of preparation of the surface to receive the retrofitted plate including detailed instruction on the
 21 installation and bonding procedure. Also include any curing and time to cure requirements;
- 22 3. Manufacturer's certificate of compliance indicating Material testing and performance complies with Sections 8-14.3(7)
 23 and 9-36.3, and additional testing indicating performance of the bond between the plate and existing curb ramp
 24 material over a period of time. Also include information on the test laboratory providing the test information, including
 25 a letter of certification from a designated recognized testing standards organization stating the test laboratory is
 26 accredited; and,
- 27 4. Manufacturer's warranty (minimum 1 year) against breakage, fading, deformation, and loss of bonding strength.

28 **8-14.3(8) PATTERNED, COLORED, AND EXPOSED AGGREGATE TREATMENTS**

29 The following 3 treatments may be used in areas paid as cement concrete sidewalk. Patterned and Colored can be
 30 combined for artistic sidewalks as long as the patterns do not conflict with ADA accessibility, Patterned and Colored or
 31 Exposed Aggregate and Colored may be combined for architectural landscaping in roadway traffic islands and in non-
 32 pedestrian areas. Payment for the extra effort required to create these 3 treatments will be per Section 8-14.5.

- 33 1. Patterned Cement Concrete Surface Treatment: Patterned cement concrete is defined as additional work necessary
 34 to imprint cement concrete with a pattern, and is referenced by "Patterned" and "Running Bond Used Brick" or (other
 35 pattern) in the Bid Item description and call-outs for locations on the Drawings. Other patterns may be shown on the
 36 Drawings or on Drawing Details in the Appendix of the Contract. This extra work is described in Section 5-05.3(20).
- 37 2. Colored Cement Concrete Treatment: Colored cement concrete is defined as additional work necessary to color
 38 cement concrete with a color, and is referenced by "Colored" and a Federal Standard 595B "F (color code)" in the Bid
 39 Item description and call-outs for locations on the Drawings. This extra work is described in Section 5-05.3(20).
- 40 3. Exposed Aggregate Cement Concrete Surface Treatment: Exposed aggregate cement concrete is defined as
 41 additional work necessary to expose aggregate on the surface of cement concrete. This extra work is described in
 42 Sections 5-05.3(21).

43 Exposed aggregate is an architectural finish on concrete surfaces, and must not be used on new sidewalks, walkways, or
 44 any pedestrian access unless approved by SDOT. It may be used for repair of existing exposed aggregate concrete sidewalks
 45 only. It may be used for vertical or sloped features and within architectural landscaping such as within traffic inlands.

46 **8-14.3(9) BUS SHELTER FOOTING**

47 The Contractor must construct a bus shelter footing according to the details shown on the Drawings. Before construction,
 48 the Contractor must notify METRO at least 10 Working Days in advance so that coordinating the installation of the bus shelter
 49 by METRO forces is accommodated, see Section 1-07.28 or contact information.

50 **8-14.3(10) STRIPPING FORMS AND FINISHING – MONOLITHIC CURB AND SIDEWALK**

51 Stripping forms and finishing for the curb section of the monolithic curb and sidewalk must be as specified in Section 8-
 52 04.3(1)D.

53 Unless otherwise accepted by the Engineer, the concrete must be cured for at least 72 hours by one of the methods
 54 specified in Section 5-05.3(13)B.

8-14.4 MEASUREMENT

Measurement for "Sidewalk, Cement Concrete...", "Six Inch Sidewalk ..." and "Bus Shelter Footings...", per square yard will be by the square yard for the surface of concrete placed. Deductions will be made for blocked out areas, castings, or other discontinuities in the sidewalk 9 square feet or larger.

Measurement for "Sidewalk, Thickened Edge" will be by the linear foot along the face of the thickened edge for the length constructed. Measurement of thickened edge will not be made through curb ramps, driveways, or alley access ramps.

Measurement for Mineral Aggregate of the Type specified will be as specified in Section 4-01.4.

Measurement for monolithic curb and sidewalk will be considered as 3 component sections as follows:

1. The first component, "Sidewalk, Cement Concrete" will be that portion of the combined section not including the area within 6 inches of the curb face and will be the square yards of actual sidewalk constructed.
2. The second component, "Curb, Cement Concrete", will be that portion of the combined section beginning at back of curb and extending to the face of the curb, and will be the actual linear feet of curb constructed, as measured along the front curb face.
3. The third component, "Sidewalk, Thickened Edge", will be the triangular cross-sectional portion of the combined section below the bottom of sidewalk and butting against the back of the curb section. The thickened edge will be the actual linear feet of thickened edge constructed, as measured along the face of the thickened edge.

Measurement for "Curb Ramp" will be per square yard and include the areas of monolithic curb, side curb, and back curb, as shown by the pay limits depicted in the Standard Plans.

Measurement for "Detectable Warning Plate" will be by the square foot area of detectable warning plate installed in new curb ramps and cut through islands.

Measurement for "Detectable Warning Plate Retrofit" will be by the square foot area of detectable warning plate installed in existing curb ramps.

Measurement for "Patterned Cement Concrete Treatment, Sidewalk, (pattern)" will be by the square yard of area where imprinting tools is applied.

Measurement for "Colored Cement Concrete Treatment, Sidewalk, (color), F(color code)", will be by the square yard of area of color cement concrete.

Measurement for "Exposed Aggregate Cement Concrete Treatment, Sidewalk", will be by the square yard of area of exposed aggregate cement concrete.

8-14.5 PAYMENT

1. "Sidewalk, Cement Concrete", per square yard

2. "Sidewalk, Cement Concrete, W/25% pozzolans", per square yard

The Bid Item price for "Sidewalk, Cement Concrete" and "Sidewalk, Cement Concrete, W/25% pozzolans" includes all costs for the work required to construct the sidewalk as specified including the earth work required to excavate Material from the top surface of the sidewalk to the sidewalk subgrade, subgrade preparation, and furnishing and installing all Materials.

Payment for the volume of earth work involved in excavating Material above the top surface of the sidewalk will be made as specified in Section 2-04.52-05.5

3. "Sidewalk, Thickened Edge", per linear foot

4. "Sidewalk, Thickened Edge, W/25% pozzolans", per linear foot

The Bid Item price for "Sidewalk, Thickened Edge" and "Sidewalk, Thickened Edge, W/25% pozzolans" must include all costs for the work required to construct the thickened edge where required.

5. "Curb Ramp", per square yard

6. "Curb Ramp, W/25% pozzolans", per square yard

The Bid Item price for "Curb Ramp" and "Curb Ramp, W/25% pozzolans" must include all costs for the work required to construct the curb ramp and side wings complete and in place, including excavation, sidewalk thickened edge, monolithic curb, side curb, back curb, and brushed or coursed textural surface finish as shown on the Standard Plans.

Payment for the removal of existing concrete walk, curb, or curb and gutter must be made separately as specified in Section 2-02.

Unless otherwise specified, no separate payment for new curb, side curb, thickened edge, or back curb within the payment limits shown on the Standard Plans for curb ramps will be made.

7. "Detectable Warning Plate" per square foot

The Bid Item price for "Detectable Warning Plate" must include all costs for the work required to furnish and install the detectable warning plate.

8. "Detectable Warning Plate Retrofit", per square foot

The Bid Item price for "Detectable Warning Plate Retrofit" must include all costs for the work required to prepare the existing curb ramp surface (or specified surface), and to furnish and install the detectable warning retrofit plate.

- 1 9. "Bus Shelter Footing", per square yard.
- 2 10. "Bus Shelter Footing, W/25% pozzolans", per square yard
- 3 The Bid Item price for "Bus Shelter Footing" and "Bus Shelter Footing, W/25% pozzolans" must include all costs for the
- 4 work required to construct the bus shelter footing.
- 5 11. "Patterned Cement Concrete Treatment, Sidewalk, (pattern)", per square yard.
- 6 The Bid Item price for "Patterned Cement Concrete" must include all costs for additional work as described in Section 5-
- 7 05.3(20) and necessary to imprint cement concrete with a pattern referenced in the Bid Item description.
- 8 12. "Colored Cement Concrete Treatment, Sidewalk, (color), F(color code)", per square yard
- 9 The Bid Item price for "Colored Cement Concrete" must include all costs for additional work as described in Section 5-
- 10 05.3(20) and necessary to color cement concrete with a color referenced in the Bid Item description.
- 11 13. "Exposed Aggregate Cement Concrete Treatment, Sidewalk", per square yard
- 12 The Bid Item price for "Exposed Aggregate Cement Concrete" must include all costs for additional work as described in
- 13 Section 5-05.3(21) and necessary to expose aggregate of cement concrete per the Contract.
- 14 14. "Six -Inch Sidewalk, Cement Concrete", per square yard
- 15 15. "Six -Inch Sidewalk, Cement Concrete, W/25% pozzolans", per square yard
- 16 The Bid Item price for "Six Inch Sidewalk, Cement Concrete" and "Six Inch Sidewalk, Cement Concrete, W/25%
- 17 pozzolans" must include all costs for the work required to construct the sidewalk as specified including the earth work required
- 18 to excavate Material from the top surface of the sidewalk to the sidewalk subgrade, subgrade preparation, and furnishing and
- 19 installing all Materials.
- 20 Payment for the volume of earth work involved in excavating Material above the top surface of the sidewalk will be made
- 21 as specified in Section 2-04.
- 22 All costs for reinforcing bars constructed around castings must be included in the Bid Item price for "Six Inch Sidewalk,
- 23 Cement Concrete" and "Six Inch Sidewalk, Cement Concrete, W/25% pozzolans."
- 24 Other payment information.
- 25 Payment for imported Mineral Aggregate of the Type specified for sidewalk fill will be made as specified in Section 4-
- 26 01.5.
- 27 Payment for sidewalk drains will be made as specified in Section 7-01.5.
- 28 Payment for monolithic curb and sidewalk or monolithic curb, gutter and sidewalk will be made for the Bid Item
- 29 measurements as described in Section 8-14.4.
- 30 Payment for relocations of signs will be made as specified in Section 8-21.5.
- 31 Costs for finishes, edging, joints, premolded joint filler, and other minor work incidental to Section 8-14 constructions
- 32 must be included in the applicable Bid Item prices.
- 33 Payment for thicken edge for the concrete collar around tree grate will be paid as "Sidewalk, Thickened Edge."
- 34 Payment for furnishing and installing the removable concrete panels for tree pits will be paid under applicable Bid Items
- 35 as cement concrete sidewalk.

SECTION 8-15 RIPRAP

8-15.1 DESCRIPTION

This Work must consists of furnishing and placing riprap protection, including the furnishing and placing of geotextile and filter blanket protection of the type specified at the locations and to lines and dimensions shown on the Drawings or established by the Engineer. Riprap will be classified as heavy loose, light loose, hand placed, sack, and concrete slab riprap.

8-15.2 MATERIALS

Materials must comply with the requirements of the following Sections:

| Materials | Section |
|----------------------------|--------------|
| Cement Concrete Class 3000 | Section 6-02 |
| Mineral Aggregates | Section 9-03 |
| Riprap and Quarry Spall | Section 9-13 |
| Geotextile | Section 9-37 |

Filter Material must comply with the gradation requirements for Mineral Aggregate Type 13, shoulder ballast.

The geotextile must be as specified in Section 9-37, Permanent Erosion Control, High Survivability. The filtration Class of the geotextile will be specified in the Contract.

1 Concrete for fire hydrant concrete slab and wall applications must be Class 3000 (see Standard Plan 313).

2 **8-15.3 CONSTRUCTION REQUIREMENTS**

3 **8-15.3(1) GENERAL**

4 The foundation for riprap must be excavated below probable scour or to the elevation shown on the Drawings. No stones
5 must be laid or concrete placed until the foundation is approved by the Engineer. Excavation below the level of the intersection
6 of the slope to be riprapped and the adjacent original ground, or the channel floor, or the slope, is classified as ditch
7 excavation as defined in Section 2-05. Before placing riprap, the slopes must be dressed to the lines and grades as indicated
8 on the Drawings or as established by the Engineer.

9 Where specified in Contract, the slope or the area to be protected must first be covered with a geotextile. A filter blanket
10 must be required for hand placed riprap, sack riprap and concrete slab riprap. A filter blanket is a layer of selected aggregate,
11 or a Mineral Aggregate Type, of specified thickness placed over the geotextile as a cushioning medium on which the riprap is
12 placed.

13 **8-15.3(2) LOOSE RIPRAP**

14 Loose riprap must be placed in such a manner that all relatively large stones must be essentially in contact with each
15 other, and all voids filled with the finer Materials to provide a well graded compact mass. Dump the stone on the slope in a
16 manner that ensures the riprap attains its specified thickness in 1 operation. Use care when dumping or placing, to avoid
17 disturbing the underlying Material. Placing in layers parallel to the slope is not permitted. A 12-inch tolerance for loose riprap is
18 allowed from slope plane and grade line in the finished surface.

19 **8-15.3(3) HAND PLACED RIPRAP**

20 The stones must be laid by hand on prepared slopes to such thickness as may be directed by the Engineer. The riprap
21 must be started at the toe of the embankment by digging a trench and placing a course of the largest stones therein. Each
22 stone must be placed so that it must rest on the slope of the embankment and not wholly on the stone below, and it must be
23 thoroughly tamped or driven into place. The exposed face of all hand placed riprap must be made as smooth as the shape and
24 size of the stones allow and must not vary more than 3 inches from a plane surface on the required slope.

25 **8-15.3(4) SACK RIPRAP**

26 Sack riprap that complies with Section 9-13.4 must be deposited in the trench and on the slope of the embankment to be
27 protected as shown on the Drawings.

28 The concrete must be placed in the sacks to a uniform volume leaving sufficient room for effectively tying the sacks. The
29 sacks must then be placed in longitudinal rows in the trench and on the slope to lie parallel with the slope. In placing the sacks
30 on the slope, their outside faces must be laid against a heavy timber header or screed so that each layer is true to line and
31 grade. The tied end of the sack must be turned under and the sack firmly pressed into place against the header or screed.
32 Each sack must rest equally on 2 sacks below it such that vertical joints must be staggered in succeeding horizontal rows. Do
33 not place sack riprap in freezing weather, and work damaged by frost must be removed and replaced by the Contractor at no
34 additional cost to the Owner.

35 **8-15.3(5) CONCRETE SLAB RIPRAP**

36 Concrete slab riprap except Standard Plan 313 applications must consist of concrete placed in slabs 4 inches thick
37 unless otherwise specified in the Contract.

38 A trench of the dimensions shown on the Drawings or as established by the Engineer must be dug at the toe of the slope.
39 The forms must be of the depth of the concrete to be placed.

40 The panel length must be 10 feet unless otherwise shown on the Drawings, and the concrete panels must be placed in
41 layers. The joints between panels in one layer must alternate with the joints in progressive layers to present a staggered and
42 regular joint pattern among all layers. Care must be taken not to injure the concrete in place when constructing the fill in
43 panels. Expansion joint Material will not be required at the joints.

44 The concrete must be placed and rodded true to the plane of the embankment and must be finished smooth by troweling
45 or other methods approved by the Engineer. The edges must be tooled to a 1/2-inch radius.

46 The riprap must be protected from flood waters and tides during the hardening of the concrete.

47 Weep holes must be constructed every 10 feet. All Material placed in back of the riprap and within 18 inches of weep
48 holes must be gravel backfill for drains.

49 **8-15.3(5)A CONCRETE SLAB FOR HYDRANT WALL REQUIREMENTS**

50 Concrete slab for use on fire hydrant wall requirements as shown on Standard Plan 313 must be no less than 3'-0" in
51 length and no less than 1'-6" in width. The depth of concrete slab must be no less than 3-1/2 inch. The side of each concrete
52 slab to be visible on the face of the hydrant wall must be straight. Broken concrete sidewalk meeting the dimension
53 requirements of this Specification Section are acceptable. All concrete slab must be intact with no visible cracking. The
54 minimum depth of filter layer behind the concrete slab wall must be no less than a 6-inch thickness of Mineral Aggregate Type
55 2. The concrete slabs need not be cemented together. If the concrete slabs are required to be cemented together, 3-inch

1 diameter weep holes are required with a spacing along the wall face not exceeding 5 feet with each weep hole located within 1
2 foot above finished grade on the outside face of the wall.

3 The concrete slab wall must be constructed in horizontal layers with vertical joint spacing offset between adjacent layers.
4 Each horizontal layer must have uniform thickness and each individual concrete slab must be set stable with no rocking.

5 **8-15.3(6) QUARRY SPALLS**

6 Quarry spalls must be placed in ditches and channels, and on slopes to be protected as specified in the Contract. After
7 placement, the quarry spalls must be compacted by tracked equipment making a minimum of 3 passes. On steep slopes, the
8 Contractor must compact the quarry spall as approved by the Engineer.

9 **8-15.3(7) FILTER BLANKET**

10 When required, a filter blanket must be placed on the prepared slope or area to the thickness specified on the Drawings
11 using methods which do not cause segregation of particle sizes within the bedding. The surface of the finished layer must be
12 even and free from mounds or windrows. Additional layers of filter Material, when required, must be placed using methods
13 which do not cause mixing of the Materials in the different layers.

14 **8-15.4 MEASUREMENT**

15 Loose riprap will be measured by the ton of riprap actually placed.

16 Hand placed riprap and filter Material will be measured by the cubic yard actually placed.

17 Sack riprap will be measured by the cubic yard. The number of cubic yards of sack riprap placed must be computed from
18 the number of sacks of cement actually used in the concrete mix and the yield per batch of concrete as determined from actual
19 measurement.

20 Concrete slab riprap will be measured by the cubic yard based on the dimension of all slabs in-place as a whole.

21 Quarry spall and Mineral Aggregate will be measured by the ton actually placed.

22 Weepholes will not be measured.

23 Geotextile will be measured by the square yard as specified in Section 2-15.4.

24 **8-15.5 PAYMENT**

25 1. "Heavy Loose Riprap", per ton

26 2. "Light Loose Riprap", per ton

27 3. "Hand Placed Riprap", per cubic yard

28 4. "Sack Riprap", per cubic yard

29 5. "Concrete Slab Riprap", per cubic yard

30 The Bid Item prices for "Heavy Loose Riprap", for "Light Loose Riprap", for "Hand Placed Riprap", for "Sack Riprap", and
31 for "Concrete Slab Riprap" must include all costs for the work required to furnish and install the riprap of the type specified
32 including all excavation and backfill above the level of the intersection of the slope to be riprapped and the adjacent original
33 ground or the channel floor or channel slope as specified in Section 8-15.3(1). When it is necessary to dump and sort
34 individual loads, payment will be made only for that portion accepted by the Engineer.

35 6. "Quarry Spalls", per ton

36 The Bid Item price for "Quarry Spalls" must include all costs for the work required furnish and install quarry spall.

37 7. **Other payment information**

38 Payment for ditch excavation as defined in Section 8-15.3(1) will be made as specified in Section 2-05.5.

39 Payment for "Geotextile" will be made as specified in Section 2-15.5.

40 Payment for Mineral Aggregate will be as specified in Section 4-01.5.

41 All cost for weep holes must be included in the appropriate Bid Item prices

42 **SECTION 8-16 CONCRETE SLOPE PROTECTION**

43 **8-16.1 DESCRIPTION**

44 Section 8-16 describes constructing concrete slope protection, in conformity with and at the locations, lines, and grades,
45 as shown on Drawings and as established by the Engineer.

46 **8-16.2 MATERIALS**

47 Materials must comply with the requirements of the following Sections:
48

| Materials | Section |
|---------------------------|----------------|
| Concrete Class 3000 | Section 6-02 |
| Wire Mesh | Section 9-07.7 |
| Concrete Slope Protection | Section 9-13 |

1

2 **8-16.3 CONSTRUCTION REQUIREMENTS**3 **8-16.3(1) FOOTING AND PREPARATION OF SLOPE**

4 The footing for the slope protection must be constructed as specified in Section 2-04 and Section 6-02.

5 The surface on which application is to be made must be thoroughly compacted and neatly trimmed to line and grade as
6 necessary to conform to the detail on the Drawings.7 **8-16.3(2) PLACING SEMI OPEN CONCRETE MASONRY UNITS**8 The concrete masonry units must be placed in a uniform plane, as indicated on the Drawings, in such a manner that they
9 rest firmly and evenly against the slope with no rocking. The concrete masonry units must be placed in horizontal parallel
10 courses, and successive courses must break joints with the preceding course to form a running bond.11 **8-16.3(3) CAST IN PLACE CEMENT CONCRETE**12 The wire mesh must lap a minimum of 1 mesh spacing, and laps must be securely fastened at the ends. During the
13 placement of the concrete, the reinforcement must be supported in place so as to provide a minimum of 1-1/4 inches of cover.14 Where Class 3000 cement concrete is to be placed on the slope, the method of depositing and compacting must result in
15 a compact, dense, and impervious concrete which shows a uniformly plane surface.16 The newly constructed concrete must be finished by a wood float and must be striated with a rustication joint as shown
17 on the Drawings.

18 Curing must be performed as specified in Section 6-02.

19 **8-16.3(4) PNEUMATICALLY PLACED CONCRETE**20 Workers: Only workers experienced in pneumatically placed concrete must be used; and acceptable evidence of such
21 experience must be submitted when requested by the Engineer.22 Equipment: The Contractor must submit to the Engineer 2 copies of the manufacturer's specifications and operating
23 instructions for the equipment used. Before placement of any portion of the slope protection, the type of equipment and
24 method of operation must be approved by the Engineer.

25 Proportions of Materials: The sand/cement ratio must be 4-1/2 parts sand to 1 part cement based on loose dry volume.

26 Water must be maintained at a constant pressure which must be at least 15 psi above atmospheric pressure at the
27 nozzle. For lengths of hose up to 100 feet, pneumatic pressure at the gun must be 45 psi or greater. Pressure must be
28 increased 5 psi for each additional 5-foot increment over 100 feet of hose required. A steady pressure must be maintained.29 Method of Application: Portland cement and sand must be mixed dry, passed through a cement gun and conveyed by air
30 through a flexible tube, hydrated at a nozzle at the end of the flexible tube, and deposited in place by air pressure.

31 All surfaces must be wetted, but application must not be made on any surface on which free water exists.

32 Reinforcement: The wire mesh must lap a minimum of one mesh spacing, and laps must be securely fastened at the
33 ends. During the placement of the concrete, the reinforcement must be held so as to provide a minimum of 1-3/4 inches of
34 cover at the recess.35 Finishing: The newly constructed concrete must be finished by a wood float and must be striated with a rustication joint
36 as shown on the Drawings.

37 Curing: Curing must be as specified in Section 6-02.

38 Protection of Facilities: During the construction, the Contractor must protect all retaining walls, columns and Structures
39 from concrete splash or overspray. Suitable covering must be provided if the Engineer determines such protection is
40 necessary.41 Test Cylinders: 2 test cylinders must be made for each full Day's operation. The Contractor must furnish the cylinders 6
42 inches in diameter and 12 inches high made of 3/4-inch mesh hardware cloth. The test cylinder must be filled with concrete by
43 utilizing the same pneumatic application described above. Contact the SPU Materials Laboratory at (206) 386-1236 for
44 coordinating pick up of the test cylinders and for testing requirements.45 The cylinders will be tested for the minimum compressive strength for Class 3000, see Section 6-02.3 at the age of 28
46 Days, unless another Class of concrete is specified in the Contract.

1 **8-16.4 MEASUREMENT**

2 Measurement for concrete slope protection will be by the square yard and will include the actual area of the slope
 3 protection face covered except the footings. Footings will be measured by the cubic yard within neat lines indicated on the
 4 Drawings, see Section 2-04.4.

5 **8-16.5 PAYMENT**

6 1. **“Concrete Slope Protection”**, per square yard
 7 The Bid Item price for “Concrete Slope Protection” must include all costs for the work required to construct the slope
 8 protection including the work required to construct the footing.

9 **SECTION 8-17 CURB WALL AND SUPPORT WALL**

10 **8-17.1 DESCRIPTION**

11 Section 8-17 describes constructing Portland cement or hydraulic cement concrete support walls and curb walls at
 12 locations and in conformity with the lines and grades, shown on the Drawings.

13 **8-17.2 MATERIALS**

14 Materials must comply with the requirements of the following Sections:
 15

| Materials | Section |
|----------------------------|----------------|
| Class 4000 Cement Concrete | Section 6-02 |
| Mineral Aggregate | Section 9-03 |
| Reinforcing Steel | Section 9-07.2 |
| Geotextile | Section 9-37 |

16

17 **8-17.3 CONSTRUCTION REQUIREMENTS**

18 **8-17.3(1) GENERAL**

19 Where shown on the Drawings, the Contractor must construct curb wall and support wall as shown on Standard Plan 800
 20 and 801 and if applicable the support wall as shown on Standard Plan 403.

21 After removal of forms, all lips and edgings must be removed. Bolts or concrete ties must be removed and the holes filled
 22 with 1:2 mortar and floated to an even uniform surface. If in the opinion of the Engineer an acceptable surface has been
 23 obtained, no further finishing must be done. If, however, the surface is unacceptable, these surfaces must be thoroughly
 24 washed with water and a 1:1 mortar applied with brush and completely worked into the small air holes and other crevices.
 25 After initial set, the surface must be rubbed with a damp sack.

26 **8-17.3(2) CURB WALL**

27 Curb wall must be constructed as indicated on Standard Plan 801.

28 **8-17.3(3) SUPPORT WALL**

29 Support wall must be constructed as indicated on Standard Plan 800.

30 **8-17.4 MEASUREMENT**

31 Measurement for support wall and curb wall will be per cubic yard of concrete based on neat lines indicated on Standard
 32 Plans 800, and 801 and if applicable Standard Plan 403.

33 There will be no measurement for the edge wall shown on Standard Plan 403 if it is less than 1 foot high. If the edge wall
 34 shown on Standard Plan 403 is greater than 1 foot in height, than a support wall per Standard Plan 800 will be measured, see
 35 Section 8-19.4.

36 **8-17.5 PAYMENT**

37 1. **“Wall, Cement Concrete, Support, Type 800”**, per cubic yard
 38 The Bid Item price for “Wall, Cement Concrete, Support, Type 800” must include all costs for the work required to
 39 construct the wall as shown on Standard Plan 800 or as applicable on Standard Plan 403. Payment for excavation, for
 40 disposal of materials, backfill, geotextile, and for reinforcing steel (including steel extending into pavement slab) for the support
 41 wall must be considered included in the Bid Item price.
 42 2. **“Wall, Cement Concrete, Curb, Type 801”**, per cubic yard
 43 The Bid Item price for “Wall, Cement Concrete, Curb, Type 801” (including reinforcing steel extending into pavement
 44 slab) must include all costs for the work required to construct the wall as shown on Standard Plan 801 or as applicable on

1 Standard Plan 403. Payment for excavation, for disposal of materials, backfill, geotextile, and for reinforcing steel for curb wall
2 is considered included in the Bid Item price.

3 For additional payment information for support wall constructed as part of an alley see Section 8-19.5.

4 **SECTION 8-18 CEMENT CONCRETE STAIRWAYS, LANDINGS, AND STEPS**

5 **8-18.1 DESCRIPTION**

6 This Work must consist of constructing, on a prepared compacted subgrade, cement concrete stairways, landings, steps,
7 and handrails, and bike path handrails, and such subsidiary work as may be necessary, per these Specifications and in
8 conformity with the lines, grades, and cross-sections indicated on the Drawings. See Standard Plans 440a, 440b, 441, 442,
9 and 443.

10 **8-18.2 MATERIALS**

11 Materials must comply with the requirements of the following Sections:
12

| Materials | Section |
|---|--------------|
| Cement Concrete Class 3000 | Section 6-02 |
| Non-Roadway Cement Concrete, High Strength | Section 5-05 |
| Aggregates | Section 9-03 |
| Joint & Crack Sealing Materials, and Non-Shrink Grout | Section 9-04 |
| Concrete Curing Materials and Admixtures | Section 9-23 |

13
14 The concrete mix must be Class 3000 for steps, stairways and landings. Cement Concrete Sidewalk monolithic with
15 handrail must be Non-Roadway Cement Concrete, High Strength, see Section 8-14. For minor sidewalk segments constructed
16 adjacent to stairway landings, cement concrete Class 3000 may be used with approval of the Engineer.

17 Galvanized steel pipe railing must be fabricated from standard weight steel pipe per ASTM A 53. After fabrication, the
18 railings must be hot dipped galvanized per ASTM A 123. Gripping handrail must be standard steel pipe per ASTM A 53 and
19 must be 1 inch nominal diameter (1.315 inch outside diameter) as specified in the American Institute of Steel Construction
20 Manual.

21 Aluminum paint for handrails must be Formula D-1-57 aluminum paint.

22 Wood for railings must be as indicated on the Drawings.

23 Reinforcing Steel must be ASTM A 615, Grade 60.

24 **8-18.3 CONSTRUCTION REQUIREMENTS**

25 **8-18.3(1) SITE PREPARATION AND GRADING**

26 At locations where cement concrete stairways, landings, or steps are to be constructed, the area must be cleared,
27 grubbed, excavated, graded, and prepared as specified in Division 2, to the limits indicated on the Drawings or established by
28 the Engineer.

29 **8-18.3(2) SUBGRADE PREPARATION AND FORMS**

30 The necessary subgrade preparation and compaction required in the construction of cement concrete stairways,
31 landings, and steps must comply with the requirements for pavement subgrade preparation set forth in Section 2-09.

32 Forms must be as specified in Section 5-05.3(7)B except that wood side forms must be not less than 2 inches nominal in
33 thickness and must be straight and true.

34 **8-18.3(3) REINFORCING STEEL**

35 Reinforcing steel for cement concrete stairways must be placed as shown on Standard Plans 440a through 443. The
36 reinforcing steel must be assembled and securely tied with annealed wire of not less than No. 16 gauge at each bar lap or
37 crossing and be rigidly supported above the subgrade during the concrete placement.

38 **8-18.3(4) HANDRAIL**

39 Handrails must be of welded steel pipe construction, fabricated and installed as indicated on Standard Plans 440a, 440b,
40 442, 443a, and 443 unless the Contract specifies otherwise. Welds must be made by certified welders and each weld must be
41 ground and buffed to a smooth surface. Rails must be hot dip galvanized according to ASTM A 123 after fabrication. If field
42 welds are required, they must be coated with a zinc alloy solder to a minimum thickness of 2.0 mils per ASTM A 780.

43 Either the railing must be placed completely assembled at the time when stairway concrete is placed, or recesses must
44 be provided in the concrete for grouting the railing posts after the concrete has been placed, finished, and cured. The installed
45 railing must be in true alignment, on proper grade, and with posts plumb.

1 **8-18.3(5) PLACING, FINISHING, AND CURING CONCRETE**

2 Placing, finishing and curing concrete must conform to the applicable requirements in Section 5-05.3.

3 Front and side edging of concrete stair treads must be to a radius of 1/2 inch.

4 Landings for stairways must be scored as specified for concrete sidewalks in Section 8-14 except that transverse and
5 longitudinal scoring must be modified as necessary to result in uniform size of squares in each landing. Where gutters are
6 along the side of the stairways, the gutter portion of stairway landing must be smooth finished without markings to conform
7 with the stairway gutter.

8 **8-18.3(6) GUTTER**

9 Where Type 440 stairway is called for in the Contract, or where a stairway gutter is called for in the Contract, the
10 concrete gutter must be constructed as specified in the detail on Standard Plan 440b. The gutter must be constructed along
11 and outside the stairway, adjacent to the concrete walk or landing that joins flights of stairs connecting the stairway gutters,
12 and must be sloped for continuous flow.

13 **8-18.3(7) STEPS**

14 Steps must be constructed as shown on Standard Plan 441.

15 Treads must range from a maximum 12 inches to a minimum 11 inches. Risers must range from a maximum 7 inches to
16 a minimum 5 inches. Within any single flight of stairs, the difference in the largest and shortest tread run, and the difference in
17 the highest and lowest riser height, must not exceed 3/8 inch respectively.

18 **8-18.3(8) BIKE RUNNELS**

19 Where Type 440 stairway with bike runnels is called for in the Contract, the concrete bike runnels must be constructed as
20 shown on Standard Plan 440c or 440d, and as shown on the Drawings. The runnel must be constructed along and outside the
21 stairway, adjacent to the concrete walk or landing that joins flights of stairs connecting the runnel path, and must be sloped for
22 continuous flow to drain surface runoff.

23 **8-18.4 MEASUREMENT**

24 Excavation for stairways, landings, gutters, and bike runnels will be measured by the cubic yard of common excavation
25 as specified in Section 2-04.

26 Measurement of "Steps, Cement Concrete" and "Stairway, Cement Concrete, Special" will be by the square foot of tread
27 surface installed.

28 Measurement for "Stairway, Cement Concrete, Type 440" will be by the linear foot for the horizontal distance from a point
29 2'-2" from the back of the top tread to a point 2'-2" from the face of the bottom riser for the width specified in the Contract.

30 Measurement for "Stairway, Cement Concrete, Type 440 w/25% Pozzolans" will be measured by the linear foot for the
31 horizontal distance from a point 2'-2" from the back of the top tread to a point 2'-2" from the face of the bottom riser for the
32 width specified in the Contract.

33 Measurement for "Steps, Cement Concrete w/25% Pozzolans" and "Stairway, Cement Concrete, Special w/25%
34 Pozzolans," will be by the square foot of tread surface installed.

35 Handrail of the type specified will be measured by the linear foot of actual handrail installed measured along the top of
36 the top rail from end post to end post including the posts.

37 Concrete landings or walkways outside the stairway measurement limits will be measured as "Sidewalk, Cement
38 Concrete" by the square yard as specified in Section 8-14.4.

39 Asphalt walks will be measured as specified in Section 5-04.4.

40 Gutter will be measured by the linear foot along the gutter end to end including stairway slope, landing, and concrete
41 walk.

42 Measurement for "Bike Runnel, Cement Concrete" will be by the linear foot for the horizontal distance from end to end of
43 the runnel, including the stairway slope, landings, and concrete walk to the edge of the runnel lip or "walk bike" stamp.

44 Measurement for "Bike Runnel, Cement Concrete w/25% Pozzolans" will be by the linear foot for the horizontal distance
45 from end to end of the runnel, including the stairway slope, landings, and concrete walk to the edge of the runnel lip or "walk
46 bike" stamp.

47 **8-18.5 PAYMENT**

48 1. "Stairway, Cement Concrete, Type 440", per linear foot

49 The Bid Item price for "Stairway, Cement Concrete, Type 440" must include all costs for the work required to construct
50 the concrete stairway to the width described in the Standard Plans.

51 2. "Stairway, Cement Concrete, Special", per square foot

52 The Bid Item price for "Stairway, Cement Concrete, Special" must include all costs for the work required to construct a
53 stairway as shown on Standard Plans for Type 440 Stairway for a width other than described in the Standard Plans.

54 3. "Handrail, (Type)", per linear foot

1 The Bid Item price for “Handrail, (Type)” of the type specified must include the costs for the work required to furnish,
2 fabricate and install the handrail along the stairway or sidewalk.

3 4. “**Steps, Cement Concrete**”, per square foot

4 The Bid Item price for “Steps, Cement Concrete” must include all costs for the work required to construct concrete steps.

5 5. “**Gutter, Cement Concrete, Type 440**”, per linear foot

6 The Bid Item price for “Gutter, Cement Concrete, Type 440” must include all costs for the work required to construct a
7 gutter section along the edge of stairways and landings.

8 6. “**Stairway, Cement Concrete, Type 440 w/25% Pozzolans**”, per linear foot

9 The Bid Item price for “Stairway, Cement Concrete, Type 440 w/25% Pozzolans” must include all costs for the work
10 required to construct the concrete stairway to the width indicated.

11 7. “**Stairway, Cement Concrete, Special w/25% Pozzolans**”, per square foot

12 The Bid Item price for “Stairway, Cement Concrete, Special w/25% Pozzolans” must include all costs for the work
13 required to construct a stairway as shown on Standard Plans for Type 440 Stairway for a width other than indicated.

14 8. “**Steps, Cement Concrete w/25% Pozzolans**,” per square foot

15 The Bid Item price for “Steps, Cement Concrete” must include all costs for the work required to construct concrete steps.

16 9. “**Bike Runnel, Cement Concrete**”, per linear foot.

17 The Bid item price for “Bike Runnel, Cement Concrete” must include all costs for the work required to construct the
18 concrete bike runnel, including “walk bike” stamp or painted text and anti-skate devices, as applicable.

19 10. “**Bike Runnel, Cement Concrete w/25% Pozzolans**”, per linear foot.

20 The Bid item price for “Bike Runnel, Cement Concrete w/25% Pozzolans” must include all costs for the work required to
21 construct the concrete bike runnel, including “walk bike” stamp or painted text and anti-skate devices, as applicable.

22 **11. Other payment information**

23 Payment for excavation required for stairways, landings, gutter, and bike runnel sections will be paid as “Common
24 Excavation” as specified in Section 2-04.

25 Payment for concrete landings and walkways will be made as “Sidewalk, Cement Concrete” as specified in Section 8-14.

26 Reinforcing steel is considered as incidental to the Bid Item price for the appropriate Bid Item.

27 **SECTION 8-19 CEMENT CONCRETE DRIVEWAY AND ALLEY**

28 **8-19.1 DESCRIPTION**

29 This Work consists of constructing cement concrete driveway and alley as shown on the Drawings and on Standard
30 Plans 403, 430 and 431.

31 Driveways and alleys for commercial access must be 8-inch minimum depth.

32 **8-19.2 MATERIALS**

33 Materials must comply with the requirements of the following Sections:

| Materials | Section |
|--|-------------------|
| Non-Roadway Cement Concrete, HES, High Strength | Section 5-05 |
| Non-Roadway Cement Concrete, High Strength | Section 5-05 |
| Non-Roadway Cement Concrete, High Strength W/25% pozzolans | Section 5-05 |
| Premolded Joint Filler | Section 9-04.1(1) |

35 The cement concrete mix class must be:

- 36 1. Non-Roadway Cement Concrete, High Strength for “Driveway, Cement Concrete, (Thickness)”
- 37 2. Non-Roadway Cement Concrete, HES, High Strength for “Driveway, Cement Concrete, HES, (Thickness)”
- 38 3. Non-Roadway Cement Concrete, High Strength W/25% pozzolans for “Driveway, Cement Concrete, or (Thickness)
- 39 w/25% Pozzolans”.

40 **8-19.3 CONSTRUCTION REQUIREMENTS**

41 **8-19.3(1) EXCAVATION AND SUBGRADE**

42 Subgrade preparation for driveways and the required compaction must conform to the applicable requirements in Section
43 2-09 to provide a firm, unyielding subgrade, acceptable to the Engineer. Where driveway construction is in an area with
44 exposed tree roots 2 inches or greater in diameter, the Contractor must comply with Section 1-07.16(2). Driveways for
45 accessing alleys and for commercial traffic must be excavated to accommodate an 8-inch minimum thickness concrete
46

1 driveway. Driveways for residential access must be excavated to accommodate a 6-inch minimum thickness concrete
2 driveway.

3 Subgrade must be compacted to 95 percent relative density per Section 2-11 for a 12-inch minimum depth.

4 **8-19.3(2) FORMS AND FINE GRADING**

5 Forms must have a height of not less than the specified depth of concrete to be placed and must be of ample strength to
6 resist deformation. All forms must be securely staked and braced plumb and true to line and grade.

7 A template must be set on the forms, and the subgrade must be fine graded and compacted to conform to the required
8 Section. Before the placement of concrete, the subgrade must be thoroughly dampened.

9 **8-19.3(3) PLACING AND FINISHING CEMENT CONCRETE DRIVEWAY AND ALLEY**

10 The concrete must be spread uniformly and consolidated between the forms, see Section 5-05. Through joints and
11 contraction joints must be located as shown on Standard Plans 403, 430 and 431. The concrete driveway and alley must be
12 brush finished. The sidewalk portion of the driveway must be scored as shown on the Standard Plans and as specified in
13 Section 8-14, cement concrete sidewalks.

14 Through joints as shown on the Standard Plans must be 1/2-inch thick premolded joint filler. The joint filler width must be
15 cut to a width equal to the full depth of the concrete sidewalk plus 1/2 inch. When installed, the premolded joint filler must be
16 placed with top edge 1/8 inch below the finished surface of the concrete in a plane perpendicular to the surface and with the
17 bottom edge embedded in the subgrade. All joints must be in straight alignment

18 In the construction of through joints, the premolded joint filler must be adequately supported until the concrete is placed
19 on both sides of the joint.

20 Contraction joints must be formed with a tee bar by first cutting a groove in the concrete to a depth equal to, but not
21 greater than the premolded joint filler. The premolded joint filler must then be worked into the groove. Premolded joint filler for
22 both through joints and dummy joints must be positioned in true alignment and at right angles to the center line of the driveway
23 or alley crossings.

24 After the concrete has been thoroughly compacted and leveled, it must be floated with wood floats and finished at the
25 proper time with a metal float. Joints must be edged with 1/4-inch radius edger and the driveway or alley return edges must be
26 tooled with 1/2-inch radius edger. Curbs must be tooled with a 1-inch radius edger.

27 The surface must be brushed in a transverse direction in relation to the center line of the driveway or alley return with a
28 fiber hair brush of approved type.

29 Unless otherwise approved, driveways and alley crossings must not be constructed at the same time the pavement is
30 placed.

31 **8-19.3(4) CURING AND PROTECTION**

32 The curing Materials and procedures must be as specified in Section 5-05; however Liquid membrane curing compound
33 must be type 1D per Section 9-23.2 unless otherwise approved by the Engineer. Curing compound must be applied to all
34 exposed surfaces immediately after brushing and must be maintained for a period of 5 Days

35 **8-19.4 MEASUREMENT**

36 Measurement for cement concrete driveway will be by the square yard for the class and thickness of driveway actually
37 placed, measured from the back of the sidewalk to the back of the curb and gutter, or to the face of the curb if poured
38 monolithically.

39 Measurement for alley will be by the square yard for the class and thickness of concrete actually placed per Standard
40 Plan 403 and will be measured as "cement concrete driveway". If curb wall or support wall are needed per Standard Plan 403,
41 these items will be measured per Section 8-17.4.

42 There will be no measurement for the edge wall shown on Standard Plan 403 if it is less than 1 foot high, otherwise, it will
43 be measured as Support Wall per Section 8-17.4 and constructed as shown on Standard Plan 800. Curb shown on Standard
44 Plan 403 must be measured per Section 8-04.4.

45 **8-19.5 PAYMENT**

- 46 1. "Driveway, Cement Concrete, (Thickness)", per square yard
- 47 2. "Driveway, Cement Concrete, HES (time), (Thickness)", per square yard
- 48 3. "Driveway, Cement Concrete (Thickness) w/25% Pozzolans" per square yard

49 The Bid Item prices for "Driveway, Cement Concrete..." must include all costs for the work required to construct the
50 driveway including excavation and subgrade preparation and the curb if monolithic.

51 Payment for the removal of existing concrete walk, concrete driveway, curb, or curb and gutter must be made separately
52 as specified in Section 2-02.

53 4. Alley payment information

54 Payment for alley will be made as "Driveway, Cement Concrete..." as shown on the Drawings. If the edge wall shown on
55 Standard Plan 403 is less than 1 foot high, it will be considered incidental to the various concrete Bid Items and no separate

1 payment will be made. If the edge wall is greater than 1 foot in height, the edge wall will be paid as support wall as specified in
2 Section 8-17.5

3 Payment for the curb and curb wall shown on Standard Plan 403 will be per Sections 8-04.5 and 8-17.5.

4 5. Other payment information

5 Payment for excavation below the prepared subgrade and additional selected Materials will be made as "Common
6 Excavation" per Section 2-04.5 and as "Mineral Aggregate, (Type)" per Section 4-01.5.

7 No separate or additional payment will be made for common excavation associated with the work described in this
8 Section.

9 No separate or additional payment will be made for driveway or alley concrete thickness greater than the thickness
10 specified in the Contract.

11 SECTION 8-20 RESERVED

12 SECTION 8-21 PERMANENT SIGNING AND POSTS

13 8-21.1 DESCRIPTION

14 Section 8-21 describes transporting, furnishing, installing and relocating signs, posts, and hardware specified in the
15 Contract, as shown on the Drawings, these Specifications, and Standard Plans 601b through 630.

16 8-21.2 MATERIALS

17 Materials must comply with the requirements of the following Sections:
18

| Materials | Section |
|--|-------------------|
| Non-Shrink Cement Sand Grout | Section 9-04.3(2) |
| Signing & Post Materials, and Jet Set Cement | Section 9-28 |

19 Traffic sign post Material must be Qwik Punch Telespar or approved equal as shown on Standard Plan 625.

20 Unless otherwise specified, all hardware and Material must be commercial quality.
21

22 8-21.3 CONSTRUCTION REQUIREMENTS

23 8-21.3(1) GENERAL

24 For temporary signage associated with temporary traffic control, see Section 1-10.

25 The removal of signs must be as specified in Sections 2-02.3(3)F and 2-02.3(3)K.

26 Unless the Contract specifies otherwise, bus zone signs will be relocated by METROKOC, see Section 1-07.28 for
27 coordination information.

28 General guidance:

- 29 1. Where the Bid Item for signs includes "Owner furnished", the sign will be furnished by the Owner.
- 30 2. When indicated on the Drawings "by others", or when no Bid Items exist for relocation or installation, the Owner or
31 sign owner will install and relocate signs and posts.
- 32 3. The Contractor must install and relocate all traffic signs and posts, street designation signs and posts, and other
33 signs and posts as specified in the Contract.
- 34 4. The Contractor must install signs on new or existing posts, poles, span wires, or mass arms as specified in the
35 Contract, where indicated on the Drawings or where directed by the Engineer.

36 When indicated "Owner furnished" in the Bid Item, SDOT will provide and make available traffic signs, street name signs,
37 and street designation signs. To order these signs, see Section 1-07.28 for contact and notification requirements. Unless
38 otherwise specified, other signs must be Contractor provided. Signs must be fabricated as shown on the Drawings as specified
39 in Section 9-28.1.

40 All Sign locations must be verified by SDOT Traffic. The Contractor must coordinate sign locations with SDOT Traffic and
41 the Engineer. Advanced notification is required, see Section 1-07.28.

42 Signs must be located as not to obstruct pedestrian traffic flow or ADA accessible routes. Where practical, a pedestrian
43 traffic flow width of the greater of 5 feet or 80 percent of the sidewalk, walkway, or path flow must be maintained. Traffic flow is
44 the normal or least obstructed path. If Contract sign locations seem to obstruct pedestrian traffic flow, or if the signs locations
45 seem to obstruct other traffic signal or signs, or if the signs seem to not be visible, field adjustments may be necessary. The
46 Contractor must coordinate sign locations with SDOT Traffic and the Engineer for field adjustments or location direction
47 verification. All signs must be mounted level and face in the direction specified in the Contract or as designated by the
48 Engineer.

1 8-21.3(1)A SIGNS**2 8-21.3(1)A1 TRAFFIC SIGN**

3 Unless the Contract specifies otherwise, the Contractor must install and relocate all traffic signs and posts as specified in
4 the Contract.

5 8-21.3(1)A2 STREET DESIGNATION SIGNS

6 Unless the Contract specifies otherwise, the Contractor must install and relocate street designation signs as specified in
7 the Contract.

8 8-21.3(1)A3 STREET NAME SIGNS

9 When indicated on the Drawings "by others", or when no Bid Items exist for relocation or installation, SDOT will install
10 and relocate all street name signs and posts. If the Contract requires removal or relocation before scheduled work, the
11 Contractor must notify SDOT as specified in Section 1-07.28.

12 Otherwise, the Contractor must install and relocate all street name signs and posts.

**13 8-21.3(1)A4 BUS ZONE SIGNS, NUMBERED BASE PLATES AND SIGNS ASSOCIATED WITH PARKING PAY
14 STATIONS, AND OTHER SIGNS**

15 Unless the Contract specifies otherwise, the SDOT will install and relocate all parking pay station, D-22 signs (includes
16 Pay L, Pay R, Pay H, and Pay LR signs) and numbered base plates, and parking meters. If the Contract requires removal or
17 relocation before scheduled work, the Contractor must notify SDOT as specified in Section 1-07.28.

18 Unless the Contract specifies otherwise, METROKOC will install and relocate all bus zone signs and posts. If the Contract
19 requires removal or relocation before scheduled work, the Contractor must notify METROKOC as specified in Section 1-07.28.

20 Unless the Contract specifies otherwise, all other signs not addressed in this Section, will be installed and relocated by
21 the sign owner. Should the Contract require removal or relocation before scheduled work, the Contractor must notify the sign
22 owner as specified in the Contract.

23 8-21.3(1)B MOUNTING SIGNS**24 8-21.3(1)B1 GENERAL**

25 Unless the Contract specifies otherwise, the Contractor must provide all hardware required to mount signs as shown on
26 the Drawings, as specified in Section 9-28.1(8), and shown on Standard Plans 601a through 630, as applicable.

27 The Contractor must not weld on steel or aluminum poles. The Contractor must not drill or tap steel, aluminum, or
28 concrete poles, unless otherwise specified in the Contract. All traffic signs less than 2'-6" wide x 3'-6" in height must be
29 attached using Steel Straps; see Standard Plan 616 for details.

30 8-21.3(1)B2 MOUNTED TO WOOD POST

31 When mounting a sign on an existing wood post or an existing wood pole, use 5/16" x 3-1/4" galvanized or cadmium
32 plated lags screws with 1/8" thick by 1" O.D. nylon washers. For details, see Standard Plan 620.

33 8-21.3(1)B3 MOUNTED TO STEEL, ALUMINUM, OR CONCRETE POLE

34 Unless otherwise specified, when mounting a sign on existing steel, aluminum, or concrete pole, use hardware as shown
35 on Standard Plans. For details see Standard Plans 601c, 610, 615, and 616. All sign installations must be by brackets or
36 bands unless otherwise approved by the Engineer. The Contractor is solely responsible for field repair of galvanized surfaces
37 due to damage during installation or drill holes due to sign removal or relocation. Field repairs use must galvanized repair paint
38 per Federal Specification MIL-P-21035 (Ships) paint, high zinc dust content, galvanizing repair.

39 For steel pole mounted or mast arm mounted Street Designation Sign (SDS), use CAN-BRAC Universal Sign Bracket
40 Assembly from Traffic Hardware + Design, AS-0144 or AB-0635 Astro Sign-Brac cable mount from Pelco Inc., or approved
41 equal.

42 8-21.3(1)B4 MOUNTED TO PARKING METER POST

43 When mounting a 9" x 12" or larger sign on a parking meter post, use 1/4" x 3-1/2" galvanized bolts, galvanized nuts, and
44 1-inch O.D. nylon washers. Mount signs smaller than 9" x 12" on a parking meter post with 1/4" x 3/4" galvanized self-tapping
45 screws with 1-inch O.D. nylon washers. For details, see Standard Plan 628.

46 8-21.3(1)B5 MOUNTED TO SPAN WIRE OR MAST ARMS

47 Unless otherwise specified, signs mounted on span wire or mast arms must be mounted as indicated on the Drawings
48 and in the signing details shown on Standard Plans 601b, 601c and 612. Sag in the span must be maintained between 5
49 percent and 7 percent of the span length. Clearance between the bottom of the sign and the roadway centerline must be
50 maintained between a minimum 17 feet and a maximum 19 feet. Use standard signal mounting hardware & span wire
51 assemblies as specified in Section 8-31. All sign installations on mast arms must be by brackets or bands unless otherwise
52 approved by the Engineer.

1 8-21.3(1)B6 MOUNTED TO TELES PAR QWIK-PUNCH SIGN POST

2 Signs mounted to Qwik Punch Telespar posts must be attached by punching out the appropriate holes on the Telespar
3 post, then fastening the sign to the post using a 3/8-inch drive rivet as indicated on Standard Plan 621a.

4 8-21.3(1)B7 MOUNTING STREET NAME SIGN TO POST

5 When mounting a sign on street name sign post, use hardware as shown on Standard Plans. For details see Standard
6 Plans 622 and 623.

7 8-21.3(2) POST INSTALLATION**8 8-21.3(2)A SIGN POST INSTALLATION****9 8-21.3(2)A1 GENERAL**

10 The area disturbed during sign post installation must be surfaced to match the surrounding surfaces. Where a sign post
11 is to be installed in an existing paved concrete area, a neat 12" x 12" cut out must be provided by saw cutting, or an 8-inch
12 diameter hole must be provided by core drilling.

13 Where the Drawings or the Engineer directs a street name or traffic sign post to be located within the area of new
14 sidewalk, the Contractor must provide a 12-inch square or a 12-inch diameter blockout, with depth to match the thickness of
15 the proposed paving.

16 After a post is installed, and backfilled and compacted with selected Material, the cutout or blockout must be filled with
17 Material matching surrounding Material and capped with additional Material from 3/4 inch above surrounding finished grade to
18 finished grade, to shed water away from the post. Where concrete is the surrounding Material, a 3/4-inch preformed joint
19 Material must be placed in the joint. See Standard Plan 624 for details.

20 All posts must be plumb.

21 Post must be as specified in Section 9-28.2 and Standard Plans 620 through 630.

22 8-21.3(2)A2 STREET NAME, AND STEEL PIPE SIGN POST INSTALLATION

23 Street name sign posts must be installed in an 8-inch diameter post hole, and must be backfilled with dry-pack concrete
24 as described in Standard Plans 622 and 630. Dry-pack concrete must be bagged premix concrete containing well graded
25 aggregate, sand, and cement, mixed with approximately 1 quart of water per 60 pound bag, or any concrete as specified in
26 Section 5-05 may be substituted with the Engineer's approval.

27 8-21.3(2)A3 TELES PAR QWIK-PUNCH AND WOOD SIGN POST INSTALLATION

28 Excavations for Qwik Punch Telespar and wood post installation must be of sufficient size to allow placement of backfill
29 Material completely around the posts; for details see Standard Plans 620 and 621b. Suitable backfill Material must be placed
30 and compacted as specified in Section 2-10 and Section 2-11.

31 Qwik punch Telespar posts must be mounted and fastened to anchor posts as indicated on Standard Plan 621b.

32 8-21.3(3) SIGN COVERING

33 As specified in the Contract, the Contractor is required to provide a temporary covering to hide or remove from view
34 select signs for public convenience until such time they are applicable. Existing signs covering is incidental and included in the
35 Bid Items related to traffic control. The covering must consist of 4 mil minimum thickness black polyethylene sheeting or other
36 approved Material, of sufficient size to cover the entire face or both faces of the sign as applicable, must extend over the
37 edges of the sign, and must be securely fastened to the sign and post. The Contractor must not use any type of Supply which
38 may permanently adhere to or damage the face of the sign and post. The covering Material, and method of fastening the
39 covering to the sign, is subject to the acceptance of the Engineer.

40 8-21.3(4) SIGN RELOCATION

41 Existing traffic signs, street name signs, street designation signs, and other signs as specified in the Contract; and their
42 posts, must be relocated to new locations shown on the Drawings or when designated by the Engineer. Temporarily stockpiled
43 signs and posts must be protected against loss or damage. Removal of signs and posts required for "sign relocation" must
44 conform to Section 2-02.3(3)K.

45 Reinstalling posts must comply with Section 8-21.3(2).

46 8-21.3(5) SIGN CLEANING

47 Signs must be thoroughly cleaned after relocation or installation, and before Physical Completion when directed by the
48 Engineer. The Contractor must not use cleaning solvents that harm the sign finish.

49 8-21.4 MEASUREMENT

50 Measurement for: "Install Sign, (type), Owner Furnished, (mounting)", "Sign, (type), (mounting)", "Post, (type)", and
51 "Relocate Sign, (type)", will be per each. "Sign, (type), (mounting)", per square feet (SF) will be measure by the square feet
52 (SF) of the face of the sign.

8-21.5 PAYMENT

1. **“Install Sign, (type), Owner Furnished, (mounting)”**, per each

The Bid Item prices for “Install Sign, (type), Owner Furnished”, must include all costs for the work required to pick up the sign, and furnish the mounting hardware, and install the sign.

2. **“Sign, (type), (mounting)”**, per each

The Bid Item prices for “Sign, (type)”, must include all costs for the work required to furnish the sign and mounting hardware, and install the sign.

3. **“Sign, (type), (mounting)”**, per square foot

The Bid Item prices for “Sign, (type)”, must include all costs for the work required to furnish the sign and mounting hardware, and install the sign.

4. **“Post, (type)”**, per each

The Bid Item prices for “Post (type)” must include all costs for the work required to furnish and install the specified post including foundation, selected backfill and surface restoration. Telespar may be abbreviated as “TS” followed by a length, for example “-12”. If length unit is not provided, the length is in feet. If length is not provided, it is determined per city and WSDOT adopted MUTCD standards.

5. **“Relocate Sign, (type)”**, per each

The Bid Item prices for “Relocate Sign, (type)” must include all costs for the work required to remove and relocate the sign, including posts, foundations, disposal, and cleaning as specified. If a new post is installed on the new location, the post will be paid for separately. New post will be shown on the Drawing or when directed by the Engineer.

Payment for the removal and replacement of surrounding improvement is per the Bid Items in the Bid Form. If this work is not specified in the Bid Form, replacement of improvement is incidental and included, and to applicable Specifications or in-kind to the satisfaction of the Engineer.

If no location is specified in the Bid Item, the sign must be mounted to post, pole, mast arm, or span wires at the location specified in the Contract.

Sign covering and cleaning is considered incidental to other Bid Items.

6. **Other payment information**

Payment for signing work related to the maintenance and protection of traffic control will be as specified in Section 1-10.5.

SECTION 8-22 PAVEMENT MARKING

8-22.1 DESCRIPTION

8-22.1(1) GENERAL

This Work must consist of furnishing and installing pavement markings on the roadway surface at locations shown on the Drawings, or where designated by the Engineer, as specified and shown on Standard Plans 700 through 724. Pavement markings must be for channelization, warnings, instructions, or curb usages.

8-22.1(2) PAVEMENT MARKING DESIGNATIONS

Pavement markings using methyl methacrylate (MMA) material will be denoted with a suffix of “M”. Pavement markings are defined as follows:

Paint or Type D - Liquid Cold Applied Methyl Methacrylate

| Item Designation | Description | Usage |
|------------------|--|--------------------------------------|
| L-1 | Two parallel solid 4-inch yellow stripes with 4-inch space between stripes | Double center line (Major Arterials) |
| L-2 | Solid 4-inch yellow stripe | Median line |
| L-3 | Dashed 4-inch yellow stripe (10 feet paint with 20 feet skip) | Centerline (Minor Arterials) |
| L-4 | Solid 4-inch yellow stripe with parallel dashed 4-inch yellow strips (10 feet paint with 20 feet skip) with 4-inch space between the two paint stripes | One side of two way left turn lane |
| L-5A | Dashed 4-inch white stripe (10 feet paint with 20 feet skip) | Lane line |

| Item Designation | Description | Usage |
|------------------|--|---|
| L-5B | Dashed 6-inch white stripe (2 feet paint with 4 feet skip) | Bus/HOV lane line, Bike Lane line |
| L-5C | Dashed 4-inch white stripe (2 feet paint with 4 feet skip) | Intersection guideline. |
| L-5D | Dashed 4-inch yellow stripe (2 feet paint with 4 feet skip) | Intersection median guideline. |
| L-6A | 4-inch solid white stripe | Approach line, edge line, guide line |
| L-6B | 6-inch solid white stripe | Bus/HOV lane line, Bike Lane Line, Buffered Bike Line |
| L-7 | 4-inch solid white stripe | Parking lane line |
| L-8 | 8-inch solid white stripe | Barrier line, crosswalk and crosshatch |
| L-8A | 16-inch white stripe | Stop bar |
| L-8B | 24-inch white stripe | Stop bar |
| L-9 | Triangles in a single line (H = 1.5B) with blank space between triangles | Yield line |
| L-10 | 6-inch white curb stripe | Various zones |
| L-11 | 6-inch red curb stripe | Tow away zone |
| L-12 | 6-inch yellow curb stripe | Various zones |
| L-13 | 6-inch combination curb stripe (3 feet red - 4 feet yellow - 3 feet red) | Bus zone |
| L-17 | Left and right arrow combination | |
| L-18 | Oblique left arrow | |
| L-19 | Oblique right arrow | |
| L-20 | Left arrow | |
| L-21 | Right arrow | |
| L-22 | Through arrow | |
| L-23 | Left and through arrow combination | |
| L-24 | Right and through arrow combination | |
| L-25 | "ONLY" legend | |
| L-26 | "OK" legend | |
| L-27 | Not applicable | |
| L-28 | Not applicable | |
| L-29 | Disabled person symbol | |
| L-30 | "Bus" legend | |
| L-31 | "Lane" legend | |
| L-32 | "Carpool" legend | |
| L-33 | Diamond symbol | |
| L-35 | "School" legend | |

1
2**Thermoplastic (Denoted by "T" Suffix)**

| Item Designation | Description | Usage |
|------------------|--|------------|
| L-8T | 8-inch solid white stripe | Crosswalk |
| L-8AT | 16-inch solid white stripe | Stop bar |
| L-8BT | 24-inch solid white stripe | Stop bar |
| L-9T | Triangles in a single line (H = 1.5B) with blank space between triangles | Yield line |
| L-17T | Left and right arrow combination | |

| Item Designation | Description | Usage |
|------------------|-------------------------------------|-------------------------------------|
| L-18T | Oblique left arrow | |
| L-19T | Oblique right arrow | |
| L-20T | Left arrow | |
| L-21T | Right arrow | |
| L-22T | Through arrow | |
| L-23T | Left and through arrow combination | |
| L-24T | Right and through arrow combination | |
| L-25T | "ONLY" legend | |
| L-26T | "OK" legend | |
| L-27T | Pedestrian symbol | |
| L-28T | Bicyclist symbol | In striped bike lane |
| L-28AT | Bicyclist symbol with arrow | In striped bike lane |
| L-28BT | Sharrow | In shared travel lane |
| L-29T | Disabled person symbol | |
| L-30T | "Bus" legend | |
| L-31T | "Lane" legend | |
| L-32T | "Carpool" legend | |
| L-33T | Diamond symbol | |
| L-35T | "School" legend | |
| L-36T | Bicycle detector loop symbol | Locate in hot spot of detector loop |

Pressure Sensitive Tape (Denoted by "S" Suffix)

| Item Designation | Description | Usage |
|------------------|---|--|
| L 10S | 4-inch white curb tape | Various zones |
| L 11S | 4-inch red curb tape | Tow away zone |
| L 12S | 4-inch yellow curb tape | Various zones |
| L 13S | 4-inch combination curb tape (3 feet red – 4 feet yellow 3 feet red) | Bus zone |
| L 14S | 4-inch white tape | Parking meter stall, motor cycle stall, barrier area |

8-22.2 MATERIALS

Materials must comply with the requirements of the following Sections:

| Materials | Section |
|----------------------------|--------------|
| Pavement Marking Materials | Section 9-29 |

Material for pavement marking must be specified in the Contract.

8-22.3 CONSTRUCTION REQUIREMENTS

8-22.3(1) PRELIMINARY SPOTTING

The Engineer will provide the preliminary layout as indicated on the Drawings for permanent pavement marking alignment following paving operations by the Contractor. Preliminary layout will consist of providing the Contractor with necessary control points at intervals agreed on with the Contractor to enable the Contractor to complete the preliminary spotting of the pavement marking alignment before marking begins. Control points for crosswalks will be marked near or adjacent to the curb. Control points for stop lines will be marked near or adjacent to the curb and at the center line. The Contractor is responsible for control points for legend and symbols. Legend and symbols must be placed per the 700 series Standard Plans at locations shown on the Drawings. At least 2 Working Days before applying permanent pavement marking,

1 the Contractor must arrange with the Engineer for a review of proposed marking locations. Approval by the Engineer must be
2 obtained before applying permanent marking. Preliminary spotting to guide the striping machine is required for all longitudinal
3 lines except where a clearly visible separation is present.

4 Permanent pavement markings such as crosswalks, stop lines, center lines, legends and lane stripes must be installed
5 by the Contractor within 5 Working days, weather permitting, after preliminary layout of the control points has been completed
6 by the Engineer. Temporary pavement marking, for centerline and lane lines and other pavement markings, must be installed
7 as specified in Sections 1-07.23(1) and 1-10.3(2)B. Temporary pavement marking tape must be as specified in Section 9-29.4.

8 **8-22.3(2) PREPARATION OF SURFACES**

9 Surface dirt and all contaminants within the areas to receive pavement markings must be removed. Large areas of tar,
10 grease or foreign Materials may require sandblasting, steam cleaning, power brooming, or chemical stripping to accomplish
11 complete removal. Grass obstructing curb painting must be trimmed to the back edge of the curb and the curbs cleaned of
12 foreign Material before painting.

13 Existing pavement markings must be completely removed. Cleaning and removal methods used must not damage the
14 pavement surface to a depth or width greater than that required to provide adequate bond between the pavement and the
15 pavement marking Material. The pavement surface must be approved by the Engineer before application of the markings.

16 Apply Materials to new HMA that is sufficiently cured according to the manufacturer's recommendations. Typically, Type
17 D Material applied to new HMA pavement requires a pavement cure period of 21 days. This cure period may be reduced if the
18 manufacturer performs a successful bond test and approves the reduction of the pavement cure period.

19 For new Portland cement concrete surfaces, remove curing compounds and laitance by an approved mechanical means.
20 Air blast the pavement with a high-pressure system to remove extraneous or loose material. Apply Materials to concrete that
21 has reached a minimum compressive strength of 2,500 psi and that is sufficiently cured according to the manufacturer's
22 recommendations. Typically, Type D Material applied to Portland cement concrete pavement requires a pavement cure period
23 of 28 days. This cure period may be reduced if the manufacturer performs a successful bond test and approves the reduction
24 of the pavement cure period.

25 After the pavement surface is clean and dry, apply primer as recommended by the manufacturer to the area receiving the
26 pavement markings. Apply the primer in a continuous, solid film according to the recommendations of the primer manufacturer
27 and the pavement markings manufacturer.

28 **8-22.3(3) MARKING APPLICATION**

29 **8-22.3(3)A MARKING COLORS**

30 Lane line and right edge line must be white in color. Centerline and left edge line must be yellow in color. Transverse
31 markings must be white, except as otherwise noted in the Standard Plans.

32 **8-22.3(3)B LINE PATTERNS**

33 Solid Line: A continuous line without gaps.

34 Broken Line: A line consisting of solid line segments separated by gaps.

35 Dotted Line: A broken line with noticeably shorter line segments separated by noticeably shorter gaps.

36 **8-22.3(3)C LINE SURFACES**

37 Flat Lines: Pavement marking lines with a flat surface.

38 Profiled Marking: A profiled pavement marking is a marking that consists of a base line thickness and a profiled
39 thickness, which is a portion of the pavement marking line that is applied at a greater thickness than the base line thickness.
40 Profiles must be applied using the extruded method in the same application as the base line. The profiles may be slightly
41 rounded provided the minimum profile thickness is the same throughout the length of the profile. See the Drawings for the
42 construction details.

43 Embossed Plastic Line: Embossed plastic lines consist of a flat line with transverse grooves. An embossed plastic line
44 may also have profiles. See the Drawings for the construction details.

45 **8-22.3(3)D LINE APPLICATIONS**

46 Surface Line: A line constructed by applying pavement marking Material directly to the pavement surface or existing
47 pavement marking.

48 Grooved Line: A line constructed by grinding or saw cutting a groove into the pavement surface and spraying, extruding,
49 or gluing pavement marking Material into the groove. Groove depth is measured vertically from the bottom of a 2-foot or longer
50 straight edge placed on the roadway surface to the ground surface. The groove depth is dependent on the material used, the
51 pavement surface, and the location. Do not construct grooved line pavement marking on bridge decks or on bridge approach
52 slabs.

53 **8-22.3(3)E INSTALLATION**

54 Apply pavement marking Materials to clean, dry pavement surfaces and according to the following:

- 1 1. Place Material according to the manufacture’s recommendations.
- 2 2. Place parallel double lines in 1 pass.
- 3 3. The top of pavement marking must be smooth and uniform.
- 4 4. Line ends must be square and clean.
- 5 5. Place pavement marking lines parallel and true to line.
- 6 6. Place markings in proper alignment with existing markings.

7 When applying paint, Type A or Type C Material, ensure that both the pavement surface and the air temperature during
 8 application are not less than 50°F and rising. When applying Type B or Type D Material, ensure that both the pavement
 9 surface and the air temperature during application are not less than 40°F and rising.

10 Ensure that the Type A thermoplastic Material meets the manufacturer’s temperature specifications when it contacts the
 11 pavement surface.

12 Two applications of paint will be required to complete all paint markings. The second application of paint must be
 13 squarely on top of the first pass. The time period between paint applications will vary depending on the type of pavement and
 14 paint (low VOC waterborne or low VOC solvent) as follows:

| Pavement Type | Paint Type | Time Period |
|------------------------------|--------------------|---------------------------------|
| Bituminous Surface Treatment | Low VOC Waterborne | 4 hrs minimum, 48 hrs maximum |
| Hot Mix Asphalt Pavement | Low VOC Waterborne | 4 hrs minimum, 30 days maximum |
| Cement Concrete Pavement | Low VOC Waterborne | 4 hrs minimum, 30 days maximum |
| Bituminous Surface Treatment | Low VOC Solvent | 40 min minimum, 48 hrs maximum |
| Hot Mix Asphalt Pavement | Low VOC Solvent | 40 min minimum, 30 days maximum |
| Cement Concrete Pavement | Low VOC Solvent | 40 min minimum, 30 days maximum |

16
 17 Centerlines on two-lane Highways with broken line patterns, paint, or plastic must be applied in the increasing milepost
 18 direction so they are in cycle with existing broken line patterns at the beginning of the project. Broken line patterns applied to
 19 multilane or divided Roadways must be applied in cycle in the direction of travel.

20 Where paint is applied on centerline on two-way roads with bituminous surface treatment or centerline rumble strips, the
 21 second paint application must be applied in the opposite (decreasing milepost) direction as the first application (increasing
 22 milepost) direction. This will require minor broken line pattern corrections for curves on the second application.

23 On painted ladder type crosswalks, pedestrian and bicyclist symbols (including arrows), white sharp sand must be
 24 spread over fresh paint at a rate of approximately 1 pound per 20 square feet.

25 Type B thermoplastic Material may be supplied complete with a precoated, factory applied adhesive, or may be furnished
 26 with separate adhesive, as recommended by the manufacturer. Whether precoated or supplied separately, the adhesive must
 27 be such as to allow the thermoplastic Material to be repositioned on the pavement surface before permanently fixing it in its
 28 final position with a downward pressure.

29 If the required pavement marking width is 12 inches or more, it may be fabricated from 12-inch or 6-inch wide Material.
 30 Longitudinal splices will be permitted, provided the gap at any splice does not exceed 1/16 inch.

31 Excess thermoplastic Material left on the pavement must be removed before continuation of the operation.

32 When thermoplastic sharrows are required to be installed, the Owner will furnish the Materials for the installation. The
 33 Contractor must contact SDOT’s Signs and Markings Traffic Shop at (206) 233-7101, 24 hours in advance to arrange for pick
 34 up. The sharrows must be picked up at 4200 Airport Way South, Seattle.

35 **8-22.3(3)F APPLICATION THICKNESS**

36 Pavement markings must be applied at the following base line thickness measured above the pavement surface or
 37 above the groove bottom for grooved markings in thousandths of an inch (mils):

| Marking Material Application | | HMA | PCC | BST | Groove Depth |
|------------------------------------|----------|-----|-----|-----|--------------|
| Paint – first coat | spray | 10 | 10 | 10 | |
| Paint – second coat | spray | 15 | 15 | 15 | |
| Type A – flat/transverse & symbols | extruded | 125 | 125 | 125 | |
| Type A – flat/long line & symbols | spray | 90 | 90 | 120 | |
| Type A – with profiles | extruded | 90 | 90 | 120 | |
| Type A – embossed | extruded | 160 | 160 | 160 | |
| Type A – embossed with profiles | extruded | 160 | 160 | 160 | |

| Marking Material Application | | HMA | PCC | BST | Groove Depth |
|--------------------------------------|------------|-----|-----|-----|--------------|
| Type A – grooved/flat/long line | extruded | 230 | 230 | 230 | 250 |
| Type B – flat/transverse & symbols | heat fused | 125 | 125 | 125 | |
| Type C-2 – flat/transverse & symbols | adhesive | 90 | 90 | NA | |
| Type C-1 & 2 – flat/long line | adhesive | 60 | 60 | NA | |
| Type C-1 – grooved/flat/long line | adhesive | 60 | 60 | NA | 100 |
| Type D – flat/transverse & symbols | spray | 120 | 120 | 120 | |
| Type D – flat/transverse & symbols | extruded | 120 | 120 | 120 | |
| Type D – flat/long line | spray | 90 | 90 | 120 | |
| Type D – flat/long line | extruded | 90 | 90 | 120 | |
| Type D – profiled/long line | extruded | 90 | 90 | 120 | |
| Type D – grooved/flat/long line | extruded | 230 | 230 | 230 | 250 |

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Liquid pavement marking Material yield per gallon depending on thickness must not exceed the following:

| Mm thickness | Feet of 4" line/gallon | Square feet/gallon |
|-------------------|------------------------|--------------------|
| 10 | 483 | 161 |
| 15 | 322 | 108 |
| 18 | 268 | 89 |
| 20 | 242 | 80 |
| 22 | 220 | 73 |
| 24 | 202 | 67 |
| 30 | 161 | 54 |
| 40 | 122 | 41 |
| 45 | 107 | 36 |
| 60 | 81 | 27 |
| 90 | 54 | 18 |
| 90 with profiles | 30 | 10 |
| 120 | 40 | 13 |
| 120 with profiles | 26 | 9 |
| 230 | 21 | 7 |

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Solid pavement marking Material (Type A) yield per 50-pound bag must not exceed the following:

| Mm thickness | Feet of 4" line/50 lb bag | Square feet/50 lb bag |
|------------------------------|---------------------------|-----------------------|
| 30 – flat | 358 | 120 |
| 45 – flat | 240 | 80 |
| 60 – flat | 179 | 60 |
| 90 – flat | 120 | 40 |
| 90 – flat with profiles | 67 | 23 |
| 120 – flat | 90 | 30 |
| 120 – flat with profiles | 58 | 20 |
| 125 – embossed | 86 | 29 |
| 125 – embossed with profiles | 58 | 20 |
| 230 – flat grooved | 47 | 15 |

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All grooved lines must be applied into a groove cut or ground into the pavement. For Type A or Type D Material, the groove must be cut or ground with equipment to produce a smooth square groove 4 inches wide. For Type C-1 Material, the

1 groove must be cut with equipment to produce a smooth bottom square groove with a width per the material manufacturer's
 2 recommendation. After grinding, clean the groove by shot-blasting or a method approved by Engineer. Immediately before
 3 placing the marking Material, clean the groove with high-pressure air.

4 **8-22.3(3)G GLASS BEADS**

5 Top dress glass beads must be applied to all spray and extruded pavement marking Material. Glass beads must be
 6 applied by a bead dispenser immediately following the pavement marking Material application. Glass bead dispensers must
 7 apply the glass beads as such that the beads appear uniform on the entire pavement marking surface with 50 to 60 percent
 8 embedment. Hand casting of beads will not be allowed.

9 Glass beads must be applied to 10 or 15 mil thick paint at a minimum application rate of 7 pounds per gallon of paint. For
 10 plastic pavement markings, glass bead type and application rate must be as recommended by the marking Material
 11 manufacturer.

12 When 2 or more spray applications are required to comply with thickness requirements for Type A and Type D Materials,
 13 top dressing with glass beads is only allowed on the last application. The cure period between successive applications must
 14 be per the manufacturer's recommendations. Any loose beads, dirt or other debris must be swept or blown off the line before
 15 application of each successive application. Successive applications must be applied squarely on top of the preceding
 16 application.

17 **8-22.3(4) TOLERANCES FOR LINES**

18 Allowable tolerances for lines are as follows:

- 19 1. Length of Line: The longitudinal accumulative error within a 40-foot length of broken line must not exceed ± 1 inch.
 20 The broken line segment must be at least 10 feet.
- 21 2. Width of Line: The width of the line must not be less than the specified line width or greater than the specified line
 22 width plus 1/4 inch.
- 23 3. Lane Width: The lane width, which is defined as the lateral width from the edge of pavement to the center of the lane
 24 line or between the centers of successive lane lines, must not vary from the widths shown on the Contract by more
 25 than ± 4 inches.
- 26 4. Thickness: A thickness tolerance not exceeding plus 10 percent will be allowed for thickness or yield in paint and
 27 plastic material application.
- 28 5. Parallel Lines: The gap tolerance between parallel lines is $\pm 1/2$ inch.

29 **8-22.3(5) INSTALLATION INSTRUCTIONS**

30 **8-22.3(5)A PLASTIC MARKINGS**

31 Installation instructions for plastic markings must be provided for the Engineer. The instructions must include equipment
 32 requirements, approved work methods and procedures, material application temperature range, air and pavement surface
 33 temperature requirements, weather limitations, precautions, and all other requirements for successful application and material
 34 performance. Do not use materials with incomplete or missing instructions. All materials including glass beads must be
 35 installed according to the manufacturer's recommendations. A manufacturer's technical representative must be present at the
 36 initial installation of plastic material to approve the installation procedure or the material manufacturer must certify that the
 37 Contractor will install the plastic material per their recommended procedure.

38 **8-22.3(5)B PRESSURE SENSITIVE TAPE PAVEMENT MARKING**

39 Application procedures for pressure sensitive tape must be as recommended by the tape manufacturer. The Contractor
 40 must submit these recommendations to the Engineer at least 2 Working Days in advance of usage.

41 **8-22.3(6) REMOVAL OF PAVEMENT MARKING**

42 Removal of pavement marking must be as specified in Section 2-02.3(3)J.

43 Grinding to remove painted markings is not allowed. Grinding to remove plastic marking is allowed to a depth just above
 44 the pavement surface, then water blasting or shot blasting is required to remove the remaining markings.

45 **8-22.3(7) TEMPORARY PAVEMENT MARKING**

46 See Sections 1-07.23(1) and 1-10.3(4)C.

47 **8-22.3(8) LOCATING BICYCLE DETECTOR LOOP SYMBOL**

48 Contractor must record the exact location of loop wire according to Section 1-05.3(13). Contractor must refer to both the
 49 Drawings and Standard Plan 725 for placement of the bike loop detector symbol.

50 **8-22.4 MEASUREMENT**

51 Measurement for "Pavement Marking, Paint, (Width) Stripe" will be by the linear foot of stripe, except dashed center lines
 52 and dashed lane lines will be measured as continuous lines with no deduction for the unpainted area caused by the skip
 53 pattern specified.

1 Measurement for "Pavement Marking, Paint, Legend/Symbol" will be per each legend or symbol.

2 Measurement for "Pavement Marking, Thermoplastic, 8-inch stripe" will be by the linear foot of 8-inch stripe actually
3 placed and will not include unmarked space.

4 Measurement for "Pavement Marking, Thermoplastic, Legend/Symbol" will be per each legend or symbol.

5 Measurement for "Pavement Marking, MMA (Width) Stripe" will be by the linear foot of stripe. No deduction will be made
6 for the unmarked area when the marking includes a broken or skip pattern specified.

7 Measurement for "Pavement Marking, MMA, Legend/Symbol" will be per each legend or symbol.

8 The legends "ONLY" and "OK" will be measured as 1 unit each.

9 The symbol "Bicyclist" with "Arrows" will be measured as 1 unit each.

10 Stop lines, 16 or 24 inches wide and comprised of multiple 8-inch wide stripes, will be measured by the linear foot of 8-
11 inch width stripe.

12 Measurement for "Pavement Marking, Pressure Sensitive Tape" will be by the linear foot of tape actually placed and will
13 not include unmarked space.

14 Measurement for "Sharrow, install Owner furnished" will be per each.

15 **8-22.5 PAYMENT**

16 1. "Pavement Marking, Paint, (Width) Stripe", per linear foot

17 2. "Pavement Marking, Paint, Legend/Symbol", per each

18 3. "Pavement Marking, Thermoplastic, 8 inch Stripe", per linear foot

19 4. "Pavement Marking, Thermoplastic, Legend/Symbol", per each

20 5. "Pavement Marking, MMA, (Width) Stripe", per linear foot.

21 6. "Pavement Marking, MMA, Legend/Symbol", per each.

22 7. "Pavement Marking, Pressure Sensitive Tape", per linear foot

23 The Bid Item prices for the above listed Bid Items must include all costs for the work required to furnish and install the
24 specified types of pavement marking.

25 No additional payment will be made for the required second application of paint. No additional payment will be made for
26 additional applications required to meet thickness requirements for plastic markings.

27 8. "Sharrow, install Owner furnished", per each

28 The Bid Item price for "Sharrow, install Owner furnished" must include all costs for the work required to schedule the
29 sharrow pick up, pick up the sharrow and install the sharrow at the location specified in the Contract, or as directed by the
30 Engineer.

31 **SECTION 8-23 RESERVED**

32 **SECTION 8-24 RESERVED**

33 **SECTION 8-25 GLARE SCREEN**

34 **8-25.1 DESCRIPTION**

35 This Work must consist of furnishing and constructing glare screen of the types specified, as shown on the Drawings, as
36 specified, and per WSDOT Standard Plans L 40.

37 Glare screen consists of diamond woven wire mesh fence of aluminum, galvanized iron or aluminum coated steel wire
38 fabricated and placed to reduce glare from headlights of opposing traffic or other adjacent light sources.

39 **8-25.2 MATERIALS**

40 Materials must be as specified in Section 9-16.6.

41 **8-25.3 CONSTRUCTION REQUIREMENTS**

42 **8-25.3(1) GLARE SCREEN FABRIC**

43 Glare screen fabric must be placed on the face of the posts designated by the Engineer. On curves the fabric must be
44 placed on the face of the post which is on the outside of the curve.

45 The fabric must be stretched taut and securely fastened to the posts. Fastening to end, brace, and pull posts must be
46 with stretcher bars and fabric bands spaced at 1 foot intervals. The fabric must be cut and each span attached independently
47 at all pull and corner posts. Fabric must be securely fastened to line posts with tie wires, metal bands, or other approved
48 methods at 14-inch intervals. The top and bottom of the fabric must be fastened to the tension cable and tension wire with hog
49 rings spaced at 24-inch intervals.

50 Rolls of wire fabric must be joined by weaving a single strand into the end of the rolls to form a continuous mesh.

1 **8-25.3(2) SLATS**

2 The slats must be fastened into the weave by using staples, screws, or other methods as approved by the Engineer.
3 Allowing the tension of the mesh to hold the slats in place will not be permitted.

4 Slats broken or split during construction must be removed and replaced by the Contractor at no expense to the Owner.

5 **8-25.3(3) POSTS**

6 Posts, except for Type 1 Design A, must be constructed per the WSDOT Standard Plans and applicable provisions of
7 Section 8-12.3(2)A.

8 Posts for Type 1 Design A must be bolted to the beam guardrail posts as detailed in WSDOT Standard Plan L-5. Drilling
9 of the guardrail posts must be done in such a manner to ensure that the glare screen posts are set plumb and centered over
10 the guardrail posts.

11 All round posts for Type 1 Design B, and Type 2 glare screen must be fitted with a water tight top securely fastened to
12 the post. Line posts must have tops designed to carry the top cable.

13 **8-25.3(4) TENSION WIRE**

14 Tension wires must be attached to the posts as detailed in the WSDOT Standard Plans.

15 **8-25.3(5) TENSION CABLES**

16 The tension cable must pass through the top of the line post. One continuous length of cable must be used between pull
17 posts. Apply sufficient tension to the cable to allow a maximum sag of 1/4 inch between posts after the chain link mesh has
18 been attached to the cable. Provide temporary bracing on pull posts when applying tension to one length of cable at a time to
19 prevent undue stresses on the pull post.

20 The cable must be fastened to the top of the pull post with an eye bolt through the post and a turnbuckle connecting the
21 eye bolt to the cable. Pull posts must be braced to the bottom of the end or anchor posts with a short length of cable or tension
22 wire as shown on the WSDOT Standard Plans. All turnbuckles must have a minimum of 1-inch takeup clearance after
23 tensioning.

24 The ends of all cables must be seized with annealed iron wire for a distance of at least 1 inch.

25 **8-25.3(6) FITTINGS, ATTACHMENTS, AND HARDWARE**

26 A lead washer must be placed against the shoulder of the eye nut, eye bolt, or backup nut, and a lead washer backed by
27 the steel washer must be placed between the pipe and lock washer, and the nut tightened sufficiently to seal the hole in the
28 pipe.

29 A galvanized iron strap 1/4 inch in thickness by 12 inches in width, formed as shown on the WSDOT Standard Plans,
30 must be provided for the attachment of eye bolts to the base of the H column post to take the strain of the cable tension off the
31 web of the H column.

32 **8-25.4 MEASUREMENT**

33 Measurement of glare screens will be by the linear foot of completed glare screen for the particular type and design
34 specified.

35 **8-25.5 PAYMENT**

- 36 1. "Glare Screen Type 1 Design _____", per linear foot
- 37 2. "Glare Screen Type 2", per linear foot

38 The Bid Item price for glare screen of the type and design specified must include all costs for the work required to furnish
39 and assemble in place the completed installation including excavation, backfilling, tamping, concrete footings, miscellaneous
40 hardware, smoothing the irregularities of the ground at the site, clearing the line for the glare screen, and disposing of all
41 debris.

42 **SECTION 8-26 RESERVED**

43 **SECTION 8-27 PROJECT IDENTIFICATION SIGN**

44 **8-27.1 DESCRIPTION**

45 Section 8-27 describes furnishing and installing project identification signs at the Project Site as specified in the Contract,
46 or installing Owner furnished project identification signs.

47 The quality of Contractor provided signs and supports must be such that they present a workmanlike appearance with
48 the paint remaining in good condition for the duration of the project.

49 The Work also includes removing and disposing of the signs and supports after construction is completed or when
50 directed by the Engineer.

1 8-27.2 MATERIALS AND FABRICATION**2 8-27.2(1) GENERAL**

3 Project identification signs must be constructed with Medium Density Overlay plywood, or will be Owner provided.
4 Descriptions of Owner furnished signs will be specified in the Contract.

5 8-27.2(2) PLYWOOD

6 Plywood signs must be made of Medium Density Overlay plywood meeting the requirements of "Products Standard PS
7 1-83 for Softwood Plywood, Construction and Industrial" grade, published by the Products Standards Section of the U.S.
8 Department of Commerce. The plywood must be free of contaminants which would adversely affect the application and life of
9 the paint. Face veneers must be Grade B or better.

10 Core and crossband veneers must be solid. Core veneers must be jointed. Core gaps must not exceed 1/8 inch in width.
11 The entire area of each contacting veneer surface must be bonded with a waterproof adhesive that meets the requirements of
12 the U.S. Department of Commerce for exterior type plywood.

13 The overlay must be high density type. It must have a minimum weight of 60 pounds per thousand square feet and must
14 be at least 0.012 inches thick before pressing. The overlay must have a sufficient resin content to bond itself to the plywood, a
15 content equal to 45 percent of the dry weight of the impregnated fiber.

16 The sign dimensions must be as shown on the Drawings. The thickness of the single panel plywood sign must be 1/2
17 inch.

18 8-27.2(3) SIGN BORDERS

19 Every project identification sign must have a border frame of 2" x 4" as shown on the Contract.

20 8-27.2(4) LETTERING AND SPACING FORMULA

21 Letters and symbols must be of the type, size, and color specified in the Contract.

22 Letters and symbols must be of Material compatible with the sign surface Material recommended by the sign surface
23 manufacturer.

24 The Contractor must submit 1 sample of a finished project identification sign for the Engineer's approval before
25 fabricating the remaining signs required under this Contract.

26 8-27.2(5) SIGN SUPPORTS

27 Posts and wood supports must be 4" x 4" as specified in Section 9-09.2 Preservative treatment for posts and wood
28 supports must be as required in Section 9-09.3. Project identification signs must be securely mounted either to the posts, or to
29 the wood supports and supporting framework. Posts must be of a length capable of installing in the ground to a minimum
30 depth of 3 feet below grade. The signs must be mounted to be level and in a vertical plane. Backfill around the posts must be
31 reasonably compacted to provide adequate lateral support to prevent movement caused by moderate wind conditions. The
32 wood supports and framework must be sturdy and must be installed to provide the needed stability to prevent movement
33 caused by moderate wind conditions.

34 8-27.3 CONSTRUCTION REQUIREMENTS**35 8-27.3(1) LOCATION OF SIGNS**

36 The Contractor must install project identification signs at locations shown on the Drawings or at locations directed by the
37 Engineer. Signs facing in each direction of traffic must be placed at all Project Sites before construction. Signs must be placed
38 so as to convey their message effectively without restricting lateral clearances or sight distance. When the Engineer requires
39 the Contractor to relocate signs, sign support must be as specified in Section 8-27.2(5).

40 8-27.3(2) SIGN REMOVAL

41 The Contractor must remove all project identification signs, posts, and supports from the Project Site when Work is
42 completed at that location or when required by the Engineer. When the Engineer directs a sign to be relocated, removal of the
43 sign, posts, and wood supports and supporting frame must be done in such a manner as to prevent disturbance or damage to
44 the sign, wood support and supporting frame. If the sign, post, or wood support is disturbed or damaged, the Contractor must
45 restore the sign to an acceptable condition, or provide an identical sign or post or support, as necessary, at no cost to the
46 Owner. The Engineer will determine if new posts, or new wood supports and framework, are required to accommodate a
47 reasonably different Job Site terrain where signs are to be relocated.

48 All removed Materials become the property of the Contractor and must be removed from the Project Site.

49 The area must be restored to pre-existing or better condition immediately after removal.

50 8-27.4 MEASUREMENT

51 Measurement for "Sign, Project Identification" and for "Sign, Project Identification, Owner Furnished" will be per each sign
52 actually used on the Project Site.

53 Measurement for "Relocate Project Sign" will be per each.

1 Measurement for posts, and for wood supports and supporting framework, will be per each sign.

2 **8-27.5 PAYMENT**

3 1. "Sign, Project Identification", per each

4 The Bid Item price for "Sign, Project Identification" must include all costs for the work required to fabricate, paint, install,
5 remove and dispose of signs, and restore all areas after project completion.

6 2. "Sign, Project Identification, Owner Furnished", per each

7 The Bid Item price for "Sign, Project Identification, Owner Furnished" must include all costs for the work required to pick
8 up and deliver, install, remove and dispose of signs, and restore the areas after project completion.

9 3. "Posts, Project Sign", per each sign

10 The Bid Item price for "Posts, Project Sign" must include all costs for the work required to furnish, fabricate, install,
11 maintain, relocate, and remove the posts, or wood supports and supporting frame, for each project sign.

12 4. "Relocate Project Sign", per each

13 The Bid Item price for "Relocate Project Sign" must include all costs for the work required to relocate a project sign and
14 posts or wood supports and support frame as specified.

15 **5. Other payment information**

16 No additional payment will be made for signs requiring restoration or replacement if disturbed or damaged by Contractor
17 operations.

18 No additional payment will be made for posts or wood supports and support frames if disturbed or damaged by
19 Contractor operations.

20 Relocation of a project sign to a different site where a significant change in the original post, or wood support and
21 supporting frame, is necessary to accommodate different terrain or other conditions, will be paid as "Posts, Project Sign".

22 **SECTION 8-28 RESERVED**

23 **SECTION 8-29 WIRE MESH SLOPE PROTECTION**

24 **8-29.1 DESCRIPTION**

25 Section 8-29 describes constructing wire mesh slope protection as shown on the Drawings.

26 **8-29.2 MATERIALS**

27 Materials must comply with the requirements of the following Sections:
28

| Materials | Section |
|----------------------------|---------|
| Wire Mesh Slope Protection | 9-16.4 |

29

30 **8-29.3 CONSTRUCTION REQUIREMENTS**

31 **8-29.3(1) ANCHORS**

32 The Contractor must install anchors of the type shown on conformance to the layout shown on the Drawings. The
33 spacing and number of the anchors and cables as shown on the Drawings are approximate only, and the Engineer will arrange
34 the spacing in such a manner as to hold the wire mesh against the slope. Backfill Material must be thoroughly compacted.

35 **8-29.3(2) CABLE ASSEMBLY**

36 The cable assembly must be in place before the wire mesh is attached. Do not tension the bottom cable. No cable
37 splicing is allowed.

38 **8-29.3(3) WIRE MESH**

39 The wire mesh must be fastened to the completed cable assembly as shown on the WSDOT Standard Plans D-7 and D-
40 7a. Hog rings on the vertical lap splices must be placed in a single row centered on the splice. Horizontal splices joining 2 rolls
41 of mesh must be made by removing a horizontal end wire and reweaving through the ends of the fabric to form a continuous
42 mesh. All top and bottom laps must be made by folding the mesh to the outside, away from the slope, to avoid the possibility of
43 falling material hanging up in the folds. The bottom of the mesh must be located so that material dislodged under the mesh
44 can drain freely from the bottom, yet does not flow or bounce onto the roadway. The ends of all tie wires must be secured to
45 the mesh with a minimum of 1-1/2 turns.

46 The wire mesh must not be tensioned in any direction but must remain loose so as to increase its dampening effect on
47 rolling rocks. The Contractor must not damage the wire mesh and cable during handling and installation. Any mesh or cable
48 damaged due to the Contractor's operations must be replaced by the Contractor at no additional cost to the Owner.

8-29.4 MEASUREMENT

- Measurement of anchors will be per each for the completed anchor. Anchor types will not be differentiated.
Galvanized wire mesh will be measured by the square foot of the completed area.
Galvanized wire rope will be measured by the linear foot of wire rope actually used for the slope protection work.

8-29.5 PAYMENT

1. **"Wire Mesh Slope Protection Anchor"**, per each

The Bid Item price for "Wire Mesh Slope Protection Anchor" must include all costs for the work required to furnish and install the anchors of the type required including removing obstructions, excavating, drilling, backfilling and grouting.

2. **"Galvanized Wire Mesh"**, per square foot
3. **"Galvanized Wire Cable"**, per linear foot

The Bid Item price for "Galvanized Wire Mesh" and for "Galvanized Wire Cable" must include all costs for the work required to furnish and install the wire mesh and the cable, including all rings, U bolts, thimbles, wire rope, clips, hog rings, and tie wire necessary to complete the wire mesh slope protection.

SECTION 8-30 ILLUMINATION AND ELECTRICAL SYSTEMS**8-30.1 DESCRIPTION****8-30.1(1) GENERAL**

Section 8-30 describes furnishing and installing a complete and functional illumination and electrical system as specified in the Contract and as shown on the Standard Plans.

All existing service disconnections, temporary and final service connections and energizing of illumination and electrical street lighting systems to overhead secondary or to secondaries in vaults or handholes will be made by Seattle City Light. The Contractor must provide the Engineer at least 10 Working Days advance notice unless otherwise arranged with the Engineer.

Do not use illumination and electrical street lighting systems to serve other electrical services.

Required permits for electrical work except street lighting and signals, and except irrigation, see Sections 8-03.1 and 8-03.3(1), must be obtained as specified in Section 1-07.6.

The Contractor must become thoroughly familiar with the electrical environment within the Project Site and with the relevant Work.

8-30.1(2) APPLICABLE ELECTRICAL CODES AND STANDARDS

In addition to the safety rules and standards specified in Section 1-07.1(2), electrical work must be performed per the current applicable provisions of the following codes:

1. SCL Material Standards, SCL Construction Standards, and Requirements for Electrical Service Connection
2. State of Washington Electrical Workers Safety Rules, Chapter 296-45 WAC
3. National Electrical Safety Codes
4. National Electrical Code
5. City of Seattle Electrical Code Supplement
6. Edison Electric Institute (EEI)

8-30.1(3) ELECTRICAL SHOP DRAWINGS

The Contractor must submit Shop Drawings to the Engineer of the following items as specified in Section 1-05.3:

1. Luminaires (include photometrics and socket position)
 - a. Housing
 - b. Photoelectric Cells
2. Wiring
 - a. Wire
 - b. Wire Connectors
 - c. Fuseholders
 - d. Fuses
 - e. Splice Kits
3. Grounding
 - a. Ground Rods
 - b. Ground Clamps
4. Receptacle (Festoon Outlet)

1 **8-30.1(4) ELECTRICAL AND ELECTRONIC WORDS AND PHRASES**

2 See Section 1-01.3.

3 **8-30.2 MATERIALS**

4 Materials must comply with the requirements of the following Sections:

| Materials | Section |
|---|--------------|
| Illumination and Electrical Materials, Luminaires, Ground Rods & Clamps | Section 9-31 |

6
7 All welds on tubular steel must comply with ANSI/AWS D1.1 Section 10 Tubular Structures.

8 **8-30.3 CONSTRUCTION REQUIREMENTS**

9 **8-30.3(1) GENERAL**

10 To maintain safe traffic conditions, existing luminaires must remain in service until cut over to new luminaires can be
11 accomplished. roadways must not be opened to traffic before all of the required lighting system is operating properly.

12 Temporary lighting plans must be required unless provided in the Drawings. Temporary lighting must be provided at the
13 cost of the Contractor unless plans are provided in the Drawings. When temporary lighting plans are provided in the Drawings
14 a Bid Item for Temporary Lighting must be provided.

15 **8-30.3(2) LUMINAIRES**

16 The luminaire glassware, reflector and lamp must be thoroughly cleaned before installation on the tenon on the bracket
17 arm. For LED luminaires, the LED array must be cleaned with a soft cloth. The luminaire must be secured and adjusted
18 according to the manufacturer’s recommendations. The luminaire refractor or LED array must be level in the transverse
19 roadway axis and parallel to the roadway grade in the longitudinal roadway axis after the pole has been plumbed with all loads
20 added, according to SCL Construction Guidelines D12 9/NSL 30.

21 Date of installation must be marked on the bottom of the photoelectric cell with an indelible ink. The luminaire must have
22 the installation date marked inside the metal base adjacent to the photo cell.

23 The photoelectric cell receptacle must be adjusted such that the photoelectric cell faces north.

24 **8-30.3(3) HANDHOLE, MAINTENANCE HOLE AND VAULT ACCESS REQUIREMENTS**

25 Access to handholes, maintenance holes, and vaults must be provided at all times. Temporary storage of any material on
26 top of or within 2 feet of any handhole, maintenance hole and vault will not be allowed.

27 **8-30.3(4) RELOCATING EQUIPMENT**

28 When equipment and associated Material is to be relocated, the Contractor must furnish and install all equipment and
29 material, including additional new material as necessary, required to complete the installation. All material and equipment must
30 comply with these Specifications.

31 **8-30.3(5) WIRING, FUSING, AND SPLICING**

32 Luminaire fusing must be sized appropriately per SCL Construction Standard 1730.00. Individual luminaire fuses for
33 roadway and pedestrian luminaires must be located in the adjacent handhole.

34 Festoon outlets must be fused at 15 amps.

35 The Contractor must provide wiring from luminaire terminal boards to in line fuseholders and to the source of secondary
36 service.

37 The Contractor must coil a minimum 8 feet of wire at the source of secondary service to allow for connections by Seattle
38 City Light. The Contractor must coil 3 feet of excess conductor in each type handhole.

39 Each “hot” conductor must have an in line fuseholder and insulating boots located as indicated on the Drawings.

40 Multiple connectors must also be used as required by the Drawings. Grounding and bonding for all streetlights must
41 conform to requirements outlined in SCL Construction Standard 1710.50 and 1810.05.

42 Ground wire attached to the face of a wood pole, not enclosed in conduit, must be covered with plastic molding meeting
43 SCL Material Standards 5820.50.

44 Caution must be exercised in working near and within Seattle City Light Vaults and the electrical distribution system.
45 Voltages present can be 26,000 volts or higher. Vault wiring will not be de energized while the qualified Contractor is working.
46 The Contractor must arrange for scheduling a Seattle City Light Electrical Safety Observer when work is required in a Seattle
47 City Light vault or near an electrical distribution facility as specified in Section 1-05.2(2).

48 When cables or single conductors are being installed, use care to not exceed tension limitations recommended by the
49 manufacturer. Conductors may be pulled directly by hand; however, conductors pulled by mechanical means must use a
50 dynamometer with drop needle hand on every pull. On mechanical pulls, either the insulation must be stripped off each

1 conductor and conductors formed into a pulling eye and firmly taped before pulling, or a cable grip must be used. Apply the
2 pulling force must directly to the conductor.

3 Secondary insulator racks required for new construction must be per SCL Material Standards and installed per SCL
4 Construction Guidelines.

5 Where new cable will be installed in occupied existing conduits, the Contractor must protect existing wiring from damage.
6 Use a cable pulling compound to minimize cable pulling tensions and adverse effects on existing wire insulation, jacket, and
7 shield. Use care in pulling cable into poles and pedestals, as sharp metal edges may be present.

8 Aluminum wire and connectors must be prepared and coated with an oxide inhibiting compound.

9 Where triplex wire is installed overhead to feed only 1 street light, the 2 hot conductors must be tied together at each
10 pole.

11 Wire insulation must be removed by a method that does not "ring" or nick the wire. "Ringing" will be cause for rejection of
12 the splice.

13 Wire splices must be made mechanically and electrically secure. Each individual splice or termination of extra leads must
14 be insulated and made waterproof.

15 All cables must be marked with a permanent stainless steel tag in handholes or access points with feed point circuit
16 number per SCL Construction Standard 1714.10. Racking of cables must be required.

17 For above ground splices, the connector must be torqued to the manufacturer's recommended level. The splice and
18 termination of extra leads must be covered with rubber base insulating and waterproofing tape as specified in SCL Material
19 Standards. This tape must be worked around the wire insulation to insure a water tight assembly. The splice assembly must
20 be protected with 2 layers of electrician tape.

21 For below ground splices, connectors must be tightened or crimped per the manufacturer's specifications. Use only
22 manufacturer's approved crimping tools to compress crimp splices. Center the metal splice in the enclosure. The encapsulant
23 must be mixed and installed per manufacturer's recommendation. The encapsulant must completely fill the enclosure and be
24 free of voids and impurities.

25 Where festoon outlets are installed on poles a separate circuit must be provided.

26 **8-30.3(6) LUMINAIRES RELAMPING**

27 Relamping must be completed without power disconnection. The Contractor personnel servicing streetlights must be
28 Washington State certified electricians licensed to work on electrical low voltage up to 600 Volts AC.

29 Before starting work on conductive structures, the Contractor must perform touch potential testing. Conductive structures
30 must be understood as, but not limited to, any structure capable of carrying current. The Contractor must test structures using
31 an electric voltage detector to test touch potential voltage. Electric voltage detector must detect voltages 5 V or greater. If a
32 voltage above 5 V is not detected, the test is complete and Contractor must proceed with luminaire replacement.

33 If a voltage above 5 V is detected, the Contractor must test structures using a voltmeter equipped with a 3000-ohm
34 shunt. Use adequate ground points to reference all measurements. All ground points must first be checked for voltage. Fire
35 hydrants, Storm Drains or other grounded structures must be sought for ground points.

36 If touch potential is detected, all conductive structures within a 40-foot radius must be tested for voltage. If less than 30
37 volts has been detected, the area must be taped and coned off to prevent incidental contact and reported to the Engineer.

38 If a structure is found to be energized at 30 volts or more, the immediate area must be secured and the Engineer must be
39 notified immediately.

40 Removal of the existing luminaire must be done per Section 2-02.3(3)L. Installation of new luminaire must be done per
41 Section 8-30.3(2).

42 After completing work on conductive structures, Contractor must perform touch potential testing to confirm Contractor's
43 activities have not created touch potential on the structures as identified above.

44 **8-30.3(7) GROUNDING AND BONDING**

45 Grounding and bonding for all streetlights must conform to requirements outlined in SCL Construction Standard 1710.50.

46 All conductive appurtenances containing electrical conductors, including cabinets, metallic conduit, metal poles,
47 pedestals, and junction boxes, must be made mechanically and electrically secure to form a continuous system which must be
48 effectively grounded. Each streetlight or traffic management system circuit must only have 1 Service Bond.

49 Where conduit (including steel conduit) systems are used, all metallic appurtenances must be electrically bonded by a
50 separate insulated ground conductor. Conduit risers must be bonded to the grounding conductor.

51 Where parallel electrical circuits exist in an electrical conduit, the equipment grounding conductor must be sized as
52 determined by the rating of the largest overcurrent device serving any circuit contained in the conduit. The minimum size for
53 the grounding conductor must be #6 copper. Only 1 equipment grounding conductor is required in any conduit, raceway,
54 junction box, handhole, or pole.

55 All conduit runs with phase conductors (with the exception of the run from the riser to the first handhole) must have the
56 grounding conductor installed in the conduit unless noted otherwise on the Drawings.

1 The grounding conductor must connect all ground rods in each circuit. The grounding conductor must be installed in one
2 continuous length without a splice or joint. If necessary, splices or connections must be made by irreversible compression-type
3 connector listed for direct-buried use. Exothermic weld is acceptable.

4 Metal conduit, grounding conductor and the service neutral must be bonded and grounded at the service entrance point
5 as required in SCL Construction Standard 1710.50, under the NEC and the City of Seattle Electrical Code.

6 Only 1 wire must be installed under any ground clamp.

7 Ground rods must be installed in firm undisturbed earth. In areas with loose or soft soil conditions, extensions must be
8 coupled until the rod cannot be removed by hand. Minimum spacing between ground rods must be 8 feet per Seattle Electrical
9 Code.

10 Grounding performance must be based on both the NESC and NEC. If installed system does not measure below 25
11 ohms resistance to Earth, the Engineer must make the determination if the overcurrent protection is adequate for acceptance
12 or if additional grounding is required.

13 **8-30.3(8) REMOVAL AND SALVAGE OF EXISTING EQUIPMENT**

14 Refer to Sections 2-02.3(3)G and 2-02.3(7)C.

15 **8-30.3(9) FIELD TESTING**

16 Before completion of the Work, the Contractor must provide the Engineer 3 Working Days advance notice. The Engineer
17 must coordinate with the Contractor to determine a hold-open timeframe. Parties must make the following tests on all electrical
18 circuits:

- 19 1. During open trench, test for grounds in each circuit by physically examining the installation to ensure that all required
20 ground jumpers, devices and appurtenances are in place, that they are mechanically and electrically firm, and that
21 they comply with Seattle City Light requirements.
- 22 2. The insulation test must be performed after all field connections have been made. All readings must be recorded and
23 made available when requested by the Engineer.
- 24 3. A functional test in which it is demonstrated that each and every part of the system functions as specified or intended
25 here. The functional test must be performed after all field connections are completed. If applicable, streetlight
26 contactor function must be tested as part of the complete functional test as follows:
 - 27 a. No current on the load side of contactor when in the OFF position or in the AUTO position when the PE cell is
28 open: and
 - 29 b. Correct current to the load side of the contactor when in the ON position or in the AUTO position when the PE cell
30 is closed.

31 **8-30.3(10) AS-BUILT DRAWINGS**

32 See Section 1-05.11.

33 Before service connection, the Contractor must submit to the Engineer for approval, as built wiring drawings indicating
34 field wiring, conduit route and sizes, handhole location and sizes, and pole locations.

35 **8-30.3(11) FINAL INSPECTION**

36 See Section 1-07.28(8)D.

37 The Contractor must coordinate with the Engineer for all inspections. The Contractor must provide 10 Days notice before
38 inspection.

39 **8-30.3(12) COMMISSIONING**

40 All projects are subject to commissioning to ensure proper operations and installation of the system. The Contractor must
41 coordinate with the Engineer to ensure completion of all commissioning requirements.

42 Components in this process must include controls operation verification and adjustments, system stress testing
43 (operation under full load), light level verification, power quality, and consumption verification.

44 Findings in this process that do not comply with Construction, Material, and Design Standards must be flagged and
45 remedied during this process.

46 **8-30.3(13) ACCEPTANCE**

47 Upon completion of punch list and remedy of flagged items, an acceptance document must be signed by the Contractor,
48 Engineer, and SCL, and then the system is accepted by SCL.

49 Upon acceptance, final connection of the lighting must occur after a service application is made to Seattle City Light and
50 the as-built drawings are received, confirmed, and approved.

51 The illuminations system will not be approved and wiring Bid Items not be paid until the Contractor meets all
52 requirements made in Sections 8-30.3(11), 8-30.3(12), and 8-30.3(13).

8-30.4 MEASUREMENT

Bid Items of Work completed under the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs in this Section.

8-30.5 PAYMENT1. **“Luminaire, (Light Source Type), (Description)”**, per each

The Bid Item price for “Luminaire, (Light Source Type), (Wattage or Number of LEDs), (Description)” must include all costs for the work required to furnish and install a complete luminaire including the fuse, hardware, photoelectric control and wiring to the fuseholder at the secondary source or at the base of the pole.

2. **“Relocate (Item)”**, per each

The Bid Item price for “Relocate (Item)” must include all costs for the work required to remove the item and reinstall the item complete at the new location, including furnishing new hardware if necessary, and cleaning and relamping (which includes a new lamp and photoelectric cell) relocated luminaires.

3. **“Wiring, Street Lighting”**, per lump sum

The Bid Item price for “Wiring, Street Lighting” must include all costs for the work required to furnish and install wiring for the street light system from the service point to the luminaire fuseholder, including taps, splices, tape, fuseholder, excess wire for connections, and any other Material necessary for a complete illumination and electrical system.

4. **“Relamp Luminaire, (Light Source Type), (Description)”**, per each

The Bid Item price for “Relamp Luminaire, (Light Source Type), (Description)” must include all costs for the work required to completely remove and salvage the existing luminaire and furnish and install a complete luminaire including hardware and photoelectric control.

5. **“Bond Existing Handhole”**, per each6. **“Bond Existing Pole”**, per each

The Bid Item price for “Ground Existing Handhole” and “Ground Existing Pole” must include all costs for the work required to bond handholes or poles to grounding electrode conductor and ground rods including furnishing and installing wire, taps, splices, tape, clamps, lugs and any other Material necessary for a complete ground system.

7. **“Install Ground Rod”**, per each

The Bid Item price for “Install Ground Rod” must include all costs for the work required to furnish and install ground rods including wire, taps, splices, tape, clamps, lugs, couplers, locating underground utilities and Structures, and any other Material necessary to complete a grounded system.

8. **“Inspect Grounding and Bonding”**, per each

The Bid Item price for “Inspect Grounding and Bonding” must include all costs for the work required to inspect the grounding and bonding system for each existing service point location from the furthest downstream metal appurtenance to the service point.

9. **“Remove (Item)”**, per each

The Bid Item price for “Remove (Item)” must include all costs for the work required to remove and salvage as required.

10. Other payment information

All existing service disconnections, temporary and final service connections of the illumination and electrical street lighting systems to overhead secondaries, or to secondaries in vaults or handholes will be made by Seattle City Light at the project's expense.

All costs for furnishing and installing hardware not specifically called out, but required to complete the constructions in Section 8-30 must be included in the applicable Bid Item prices and no separate or additional payment will be made.

Existing materials proposed to be relocated per approved drawings and documents and found to be in need of repair or replacement during the time of construction by the Engineer must be replaced by new material and will be addressed as extra work per Section 1-04.3.

Costs for Electrical Safety Observer must be as specified in Section 1-05.2(2).

SECTION 8-31 TRAFFIC SIGNAL SYSTEM**8-31.1 DESCRIPTION****8-31.1(1) GENERAL**

This Work must consist of furnishing and installing a complete and functional traffic control system consisting of controller assembly, signals, miscellaneous traffic devices, and appurtenances as specified in the Contract.

The Contractor must become thoroughly familiar with the electrical environment within the Project Site and with the relevant Work.

All final signal system service connections to secondary overhead / underground will be made by Seattle City Light.

1 If, for any reason, vehicular or pedestrian signals fail to function properly, the Contractor must immediately call for an off-
2 duty Uniformed Peace Officer to control the intersection. The Contractor must also immediately notify the Engineer and the
3 Owner's Signal Maintenance Office (206) 386-1206 of the nature of the malfunction. The Contractor must immediately
4 undertake the necessary repairs. The Engineer may require the work to be done by Owner forces.

5 **8-31.1(2) ELECTRICAL AND ELECTRONIC WORDS AND PHRASES**

6 See Section 1-01.3.

7 **8-31.1(3) APPLICABLE ELECTRICAL CODES**

8 See Section 8-30.1(2).

9 **8-31.1(4) SUBMITTALS AND REFERENCE MATERIALS**

10 **8-31.1(4)A SIGNAL SHOP DRAWINGS**

11 The Contractor must submit Shop Drawings including catalog cuts as specified in Section 1-05.3 for the following:

- 12 1. Signal Heads and Mounting Assemblies
- 13 2. Cable and Wire
 - 14 a. Wire Connections
 - 15 b. Fuse Kits
 - 16 c. Splice Kits
- 17 3. Pole Line Hardware
- 18 4. Interior Illuminated Signs and Blank Out Signs
- 19 5. ITS Equipment
 - 20 a. CCTV Cameras
 - 21 b. Detection Cameras
 - 22 c. License Plate Readers
 - 23 d. Wireless Detectors
 - 24 e. Dynamic Message Signs
 - 25 f. Communication Devices
- 26 6. Miscellaneous
 - 27 a. Aerial Terminal Compartments
 - 28 b. Pedestrian Push Button
 - 29 c. Ground Rods
 - 30 d. Emergency Vehicle Preemption Detector
- 31 7. Detector Loops
 - 32 a. Loop Sealant
 - 33 b. Wire

34 The Contractor must submit redline as-built wiring diagrams to the Engineer for each signalized intersection at least 3
35 Working Days before requesting the Engineer's approval for turn on or cut over.

36 **8-31.1(4)B SAMPLES**

37 The Contractor must submit a sample to the Engineer for approval of the type of electronic component to be used.
38 Approved samples will be retained for future comparison for the remaining equipment to be installed.

39 **8-31.1(5) CONTROLLER ASSEMBLY TESTING REQUIREMENTS**

40 **8-31.1(5)A FIELD TESTING**

41 The Contractor must make the following tests on all new electrical circuits. Test equipment must be calibrated as
42 recommended by the test equipment manufacturer.

- 43 1. Test for continuity of each circuit.
- 44 2. Test for grounds in each circuit which consists of the physical examination of the installation to ensure that all
45 required ground jumpers, devices and appurtenances do exist and are mechanically firm, meeting the requirements
46 of Article 250 of the National Electrical Code.
- 47 3. A megger test on each circuit between the conductor and ground with all switchboards, panel boards, fuse holders,
48 switches, receptacles and over current devices in place and all readings recorded. The megger test must be
49 performed with all wiring installed but connections not made to controller, conflict monitor, load switches, or other plug
50 connected accessories. The Contractor must submit 3 copies of the test results identifying observed readings with

1 their respective circuits at least 3 Working Days before any checkout of the installation is turned on or cut over. 1
2 copy must be filed in the controller cabinet.

3 The insulation resistance on all electrical circuits whose nominal voltage is between 115 volts and 600 volts, except
4 direct burial cable, must not be less than 6 megohms between the conductor and ground on circuits with total single
5 conductor lengths of more than 2,500 feet, nor less than 8 megohms between the conductor and ground for circuits
6 with single conductor length 2,500 feet or less.

7 For circuits below 115 volts nominal and all direct burial circuits, the insulation resistance must not be less than 2
8 megohms to ground, and for loop wire not less than 10 megohms.

9 Any change in the above stated minimum readings requires written approval by the Engineer. Only those factors
10 based on dielectric properties of items such as but not limited to conductor insulation, splicing insulations, and
11 terminal strips will be cause for consideration of variance.

- 12 4. A functional test (intersection check out) in which it is demonstrated that each and every part of the system functions
13 as specified here. The functional test will be performed after all field connections to the controller cabinet have been
14 made.

15 Any fault in any Material or in any part of the installation revealed by these tests requires Material replacement or repair
16 by the Contractor as approved by the Engineer, and the same test must be repeated until the system is approved by the
17 Engineer.

18 **8-31.1(6) GUARANTEE**

19 See Section .

20 **8-31.2 MATERIALS**

21 Materials must be as specified in Section 9-32.

22 All welds on tubular steel must comply with ANSI/AWS D1.1 Section 10 Tubular Structures.

23 **8-31.3 CONSTRUCTION REQUIREMENTS**

24 **8-31.3(1) CLEARANCE REQUIREMENTS AND INTERSECTION CHECK OUT AND TURN ON PROCEDURES**

25 **8-31.3(1)A TRAFFIC CONTROL**

26 The Contractor must provide an off-duty Uniformed Peace Officer at any time a signalized intersection is dark or
27 inoperative, such as during controller change out, cable installation, signal turn on or cut over, or similar circumstances. The
28 Contractor must have all traffic controls (i.e. pavement markings, channelization, and signage) in place before requesting
29 Engineer's approval for turn on or cut over.

30 To maintain safe traffic conditions, existing signals must remain in operation until a simultaneous cut over to new signals
31 can be accomplished.

32 At the time of turn on of new signals, temporary advanced warning signs must be installed on all approaches. These
33 signs must remain in place for not less than 7 Calendar Days nor more than 21 Calendar Days. All signs must be highly visible
34 and be placed in convenient and secure locations. Installation and removal of signs is the Contractor's responsibility and
35 incidental to sign work.

36 At the time of cut over of revised signals having phasing which is different from the old signal operation (including but not
37 limited to an added phase or split phase) temporary SIGNAL REVISION signs must be placed upstream on all approaches.
38 These signs must remain in place for not less than 7 nor more than 14 Calendar Day s. At a cut over of revised signals having
39 phasing which is the same as the old signal operation, no temporary signing is necessary. All signs must be highly visible and
40 placed in convenient and secure locations. See Sections 8-31.3(16), 1-07.23, and Section 1-10 for traffic safety and traffic
41 control. The Contractor is responsible for installation and removal of signs incidental to signal work.

42 **8-31.3(1)B TRAFFIC SIGNAL CONTROLLER CABINET AND HANDHOLE ACCESS REQUIREMENTS**

43 Access to traffic signal controller cabinets and handholes must be provided at all times. Storage of any item on, against,
44 or within 3 feet of any traffic signal controller cabinet will not be allowed. Traffic signal controller cabinets must always have at
45 least 3 feet clear on all sides. Clear and uncluttered access between the traffic signal controller cabinet and accompanying
46 handhole must be provided at all times with a minimum access width of 3 feet. Temporary storage of any material on top of or
47 within 2 feet of any handhole will not be allowed.

48 **8-31.3(1)C TRAFFIC SIGNAL CONTROLLER ASSEMBLY REPLACEMENT**

49 At each location which requires that an existing traffic signal controller assembly be replaced by a new one using the
50 existing foundation, the work must proceed as follows:

51 The Contractor must check and tag all field circuits, and must provide the Engineer at least 5 Working Days advance
52 notice for de-energizing.

53 After field circuits have been tagged, the Engineer will de energize the traffic signal controller assembly, and disconnect
54 and remove existing traffic signal controller and auxiliary equipment from the cabinet. The Contractor must then remove the

1 field wiring, remove the existing traffic signal controller cabinet, install the new traffic signal controller cabinet, and connect the
2 field wiring.

3 At each location selected for modification work that requires removal or rebuilding of the existing traffic signal controller
4 cabinet foundation, the Engineer will de energize the traffic signal controller cabinet and remove electronic equipment while
5 the Contractor temporarily relocates the existing cabinet as approved by the Engineer. The cabinet must be temporarily
6 relocated in such a manner that the intersection operates in its present mode during foundation reconstruction or modification.
7 The Contractor must protect the traffic signal controller assembly within the Work area, as approved by the Engineer.

8 Following foundation reconstruction, the new traffic signal controller assembly must be installed on the new or modified
9 foundation.

10 **8-31.3(2) TRAFFIC SIGNAL CONTROLLER ASSEMBLY**

11 **8-31.3(2)A GENERAL**

12 The Contractor must install the traffic signal controller cabinet. The Engineer will install the traffic signal controller and
13 associated electronic equipment. The Contractor must terminate all field wiring on the terminal strip in the traffic signal
14 controller cabinet.

15 Auxiliary equipment added to existing traffic signal controller cabinets must be installed as indicated on the Drawings and
16 as specified here.

17 Any field modification requires the Contractor to submit to the Engineer for approval a modification plan 3 weeks before
18 scheduling the Work. The submittal must include equipment layout and wiring diagrams detailing the work to be done, as well
19 as the portion of the critical path schedule to be followed. A description of how the Work affects traffic and signal operation
20 must also be submitted, along with information on measures to be taken to minimize adverse impacts on traffic.

21 The Engineer must be notified 2 Working Days in advance of energizing the unit.

22 The Contractor must coordinate with SDOT Signal Operations at the preconstruction meeting for traffic signal controller
23 cabinet pick up schedule. The Contractor must pick up the traffic signal controller cabinet at the Traffic Signal Shop for
24 installation. The Traffic Signal Shop is at 4200 Airport Way South, or (206) 386-1206.

25 For installation of the Type 2070 traffic signal controller cabinet, the Contractor is required to have power service at the
26 cabinet location and to be hooked up to keep the electronics warm and dry until energizing the traffic signal.

27 **8-31.3(2)B TEMPORARY CONTROLLER CABINET FRAMING APPARATUS**

28 Where relocation of the controller cabinet is required for locations where a new foundation is being poured in the same
29 location as the existing foundation, the Contractor must furnish a temporary controller cabinet framing apparatus to support the
30 controller cabinet over the control box handhole.

31 The framing apparatus must be sized to match the base of the controller cabinet and completely cover the control box
32 handhole. It must also have a means to securely tie the controller cabinet to the framing apparatus.

33 The framing apparatus must be constructed from wood and treated to withstand the rain while in the field.

34 The temporary controller cabinet framing apparatus must be installed at the same orientation as the existing traffic signal
35 cabinet, unless otherwise directed by the Engineer.

36 **8-31.3(2)C AUXILIARY CABINETS**

37 The Contractor must supply 336a cabinets installed in the location for Auxiliary Cabinets as shown on the Drawings and
38 as specified in this Section. The cabinet must not be supplied with a "police panel." All hardware in the 336a cabinet will be
39 furnished by the City of Seattle unless otherwise specified. The installation must consist of the following:

- 40 1. Inspect cabinet before installation to ensure that the cabinet is free of damage.
- 41 2. Install cabinet on concrete foundation per the Drawings.
- 42 3. Mount cabinet to foundation per manufacturer's instructions.
- 43 4. Seal cabinet at base and seal all conduits into cabinet with a waterproof sealant following installation.
- 44 5. Ground cabinet to comply with National Electric Code (NEC) standards.

45 The Contractor will store each cabinet in a secured location before installation. This storage area may be an outdoor
46 secure facility.

47 Any field modification requires the Contractor to submit to the Engineer for approval a modification plan 3 weeks before
48 scheduling the Work. The submittal must include equipment layout and wiring diagrams detailing the work to be done.

49 **8-31.3(2)D TERMINAL CABINET**

50 Terminal cabinets must be field installed on all signal poles as shown on the Drawings. All terminal cabinets must have 3
51 to 12 position terminal strips. Use terminal cabinets for all vehicular and pedestrian signal heads attached to or spanned from
52 signal poles. Install terminal cabinets at a minimum of 12 feet from the sidewalk grade and above pedestrian signal heads.
53 Terminal cabinets must be locked. The Contractor must supply construction cores with 2 master keys. The keys must be
54 delivered to the Engineer. Terminal cabinets must be wired per the field termination diagram shown on the Drawings. If no field

1 termination diagram is provided in the Drawings, the Contractor must submit a proposed termination diagram for review by the
2 Engineer before installation.

3 **8-31.3(3) SIGNAL HEADS, VEHICLE AND PEDESTRIAN**

4 **8-31.3(3)A GENERAL**

5 Do not install signal heads at any intersection earlier than 10 Working Days before turn on or cut over.

6 Mounting must be bracket, mast arm, post top, span wire, or clamshell as indicated on the Drawings. Signals mounted on
7 post tops must use standard 4-inch slipfitters. Bracket mounted signal heads must use the signal bracket assembly and type of
8 mounting indicated on the Drawings. The bracket assembly must be installed in line with the pole center line.

9 Attachments such as visors, backplates or adapters must conform and readily fasten to existing mounting surfaces
10 without affecting the weatherproofing and light integrity of the signal.

11 Electrical service must be neatly formed to the supporting structure with only sufficient slack for wind effect when span
12 wire mounted.

13 All new vehicular and pedestrian signals must be temporarily, securely, and completely covered with a 6 mil minimum
14 thickness black, or blue, polyethylene sheeting until the time of turn on or cut over.

15 Alignment of vehicular and pedestrian signal heads and the overall readiness of other traffic control devices and
16 channelization will be approved by the Engineer before activating signal locations.

17 **8-31.3(3)B VEHICLE SIGNAL HEADS**

18 The bottom of vehicle signals mounted over roadways, excluding backplates, must have a range of clearance between
19 17 feet to 19 feet above roadway grade at the crown of the roadway. On designated truck and overhead trolley routes, the
20 range of clearance must be 18 feet to 19 feet. Under no circumstances must the bottom of the vehicle green section be more
21 than 19 feet above roadway grade at the crown of the roadway. Vehicle signals mounted on poles or pedestals must be 12 to
22 15 feet above sidewalk grade. Only steel pedestals must have vehicular signal heads mounted to them. Pole plates used for
23 bracket mounted installations must be of the type that must fit flush against the pole surface without altering the pole or pole
24 plate.

25 The signal must be mounted with standard 1-1/2 inch fittings as a single section or as a multiple section head. The signal
26 section must be provided with an adjustable connection that permits incremental tilting from zero to at least 10 degrees above
27 or below the horizontal while maintaining a common vertical axis through couplers and mounting. Terminal connection must
28 allow external adjustment about the mounting axis in 5 degree increments. The signal must be mountable with ordinary tools
29 and capable of being lamped without tools.

30 Signal heads located over the roadway must not be in physical or visual conflict with trolley wires, span wires, electrical
31 wires, or any other hardware existing or proposed for the location. Maintain a 4-foot edge-to-edge clearance between signal
32 heads and trolley wires. Span wires and tether lines within 4 feet of trolley lines must be properly insulated. If it becomes
33 evident that a conflict exists, the Contractor must immediately notify the Engineer and allow 5 Working Days to resolve the
34 problem.

35 Do not install balance adjusters when the approach grade is less than 10 percent.

36 When balance adjusters are required, the vehicular heads must be adjusted in the field such that persons standing on
37 the pavement, 4 times the speed limit in feet back from the stop bar, must see the brightest image of the red section. Heads
38 must be plumbed as viewed from the direction in which they face.

39 Optically programmed type traffic signal heads must be programmed before traffic signal system turn on. Programming
40 must be performed in the presence of the Engineer by giving 2 Working Days advance notice.

41 Vehicle signal heads must be attached to the mast arm with a signal coupling unit as detailed on Standard Plan 510A
42 and 510B. Mounts must include elevator straight plumbizer units between the red and yellow signal sections, or 90 degree
43 plumbizers.

44 Vehicle signal heads must be attached to the span wire by a hanger clamp, balance adjuster, and suspension fittings as
45 shown on the Standard Plans. The sag in the span wire after loading must be within the range of 5 percent to 7 percent of the
46 total span. Span wires must be attached to the poles such that the signal head mounted at the lowest point on the span does
47 not require a signal height adjuster. The top (red) section of all heads hanging on the same span must be approximately level
48 when viewed from the approach direction.

49 For optically programmed signals which are span wire mounted, use a tether cable with connections and hardware as
50 recommended by the signal head manufacturer to provide and maintain proper optical visibility of all indications. The tether
51 cable clamps used must be designed to release under severe wind loads and impact. The tether cable must be insulated,
52 bright yellow, and must be installed a minimum 18 feet above roadway grade.

53 **8-31.3(3)C PEDESTRIAN SIGNAL HEADS**

54 Pedestrian signal heads must be aligned to focus on the center of the far end of the crosswalk which it is associated with
55 and at a point 5 feet above the opposing sidewalk.

1 Multiple pedestrian signal heads mounted on a pedestal must be stagger mounted so that the distance to the bottom of
 2 the lower housing is 8 feet above the sidewalk, and the distance to the bottom of the upper housing is 9'-6" above the
 3 sidewalk.

4 The Contractor must use a "Clamshell" type mounting assembly for pedestrian signals.

5 Pedestrian signal heads mounted on the same pole (not pedestal) must be installed so that the bottom of the housing of
 6 each head is a minimum 8 feet to a maximum 9'-6" above sidewalk grade. On poles where the signal housings interfere with
 7 each other, stagger mounting must be required as indicated on the Standard Plans.

8 **8-31.3(4) PEDESTRIAN PUSHBUTTON ASSEMBLY**

9 The complete Accessible Pedestrian Signal (APS) system must be furnished and installed by the Contractor and must be
 10 designed as shown on the Drawings. The mounting height of the pushbutton must be 3'-6" above the sidewalk as indicated on
 11 Standard Plans 521 and 522. The APS system must consist of audible tones/message capabilities from the pushbutton
 12 housing, pedestrian pushbutton (with a raised tactile directional arrow and latching mode as described in Standard
 13 Specification 9-32.3), MUTCD sign, frame which provides an integral pushbutton mount and sign platform (with sign mounted
 14 above the pedestrian pushbutton), central control unit in the traffic control unit, and all associated cables and mounting
 15 hardware. The Contractor must use the cable type and mounting assembly as recommended by the pushbutton manufacturer.

16 The pushbutton assembly must be located on the side of the pole as shown on the Drawings.

17 **8-31.3(5) VEHICLE DETECTION**

18 **8-31.3(5)A INDUCTIVE DETECTOR LOOPS**

19 Vehicle loop detectors indicated on the Drawings are located schematically and actual loop detector locations will be
 20 verified by the Engineer before sawcut or installation. The Contractor must mark out proposed detector loops on the roadway
 21 at least 3 Working Days before any sawcut or installation occurs. The location of stop bar pavement marking must be obtained
 22 by the Contractor before sawcut or loop detector installation. In general, locate loop locations behind existing or proposed stop
 23 bar pavement marking, and do not locate where pavement dowel or tie bars or metal supports within the pavement are
 24 located. Loops located within or beyond the stop bar pavement marking are allowed. Do not start sawcutting pavement until
 25 loop locations have been approved by the Engineer. When parallel to a pavement joint or edge, the sawcut must be at least 1
 26 foot away from the edge or joint. All saw cuts must be cleaned of all debris.

27 Traffic loops must be sawcut into the concrete base or HMA sublayer after planning and before placement of final
 28 wearing course. The Contractor must sawcut the existing base to a depth that provides a minimum of 1 inch of cover between
 29 the top of the loop wire and the top of the existing pavement base.

30 Use one single continuous length of loop wire to form a loop with 4 turns. The wire must be placed by tamping it into the
 31 saw cut with a blunt wooden stick, taking care not to damage the insulation. To reduce abrasion of the insulation, the
 32 Contractor must sawcut all corners at least once to reduce the corner angle. This corner angle must then be filed or smoothed
 33 acceptably free of sharp edges.

34 The sawcut in concrete must be filled with a quick drying high strength highway concrete patching Material. The
 35 Contractor must submit to the Engineer at least 3 Working Days in advance, a catalog cut describing the patch Material
 36 properties including strength and time to develop strength characteristics.

37 In asphalt installations, the loop wire must be sealed with an asphaltic sealant approved by the Engineer. Do not seal
 38 when the pavement is damp.

39 When placing loops across joints or cracks in pavement, the portion of wires across the joint or crack must be protected
 40 by placing it in tubing as indicated on the Standard Plans. The tubing must be sliced open to insert the wire in the tubing and
 41 then placed across the joint or crack extending a minimum 6 inches each side of the joint or crack.

42 Loop wire, from the loop to the lead in splice, must be twisted a minimum of 3 turns per foot. Care must be taken so that
 43 the twists are uniform.

44 A minimum of 60 inches of loop wire must be brought into the handhole and spliced to the lead in cable with a crimped
 45 soldered, waterproof splice.

46 Before Turn-on/Cut-over, the Contractor must provide the Engineer as-built drawings diagramming the complete loop
 47 detector system. After Turn-on/Cut-over has been accepted by the Engineer, a dated as-built drawing, provided by the
 48 Contractor, of the complete loop system indicating their size, direction, lane location, inductance reading and identifying
 49 number assigned must be installed in the controller cabinet. Also see Sections 1-05.3(11), 8-31.3(5)C, 8-31.3(5)E, and 8-
 50 31.3(16).

51 Before splicing the loop wire to the loop lead in cable, an inductance test must be performed by the Engineer to ensure
 52 the inductance is within the acceptable range of ± 15 percent of the calculated inductance. If the inductance does not fall within
 53 the acceptable range, the Contractor must take necessary corrective measures until the desired readings are obtained or as
 54 approved by the Engineer. Before cut-in/turn-over, the completed loop and lead in configuration after splicing must be checked
 55 for continuity by the Contractor, using a tester that does not exceed the voltage rating of the lead in and loop wires.

56 The Contractor must also perform a Megger test on the loop and lead in configuration to make certain that the resistance
 57 to ground is 10 megohms or greater. If resistance to ground before placing the sealant is less than 10 megohms, all splices
 58 and wires must be checked for insulation damage. Corrective measures must be taken until an acceptable resistance is

1 obtained. After the slot has been sealed, the Contractor must perform the resistance and continuity tests again. If the
2 continuity and resistance tests do not comply with the above mentioned requirements, the Contractor must take corrective
3 measures until readings acceptable to the Engineer are obtained.

4 After loop wire and lead in cable splices have been made, and the continuity test has been completed, the Engineer must
5 test the inductance of the loop and loop lead in cable at the controller cabinet. The inductance must be within the acceptable
6 range of ± 15 percent of the calculated inductance. If the inductance does not fall within the acceptable range, the Contractor
7 must take corrective measures until acceptable readings are obtained.

8 **8-31.3(5)B PREFORMED DETECTOR LOOP**

9 The Specifications of Section 8-31.3(5), except Section 8-31.3(5)A, apply to preformed detector loops except as follows:

10 Catalog cuts must be submitted as specified in Section 8-31.1(4)A. No more than 4 different lengths of lead-in can be
11 submitted.

12 The Contractor must mark out proposed loop detector locations for the Engineer's approval at least 3 Working Days
13 before the concrete placement. Follow the loop detector location coordination specifications in Section 8-31.3(5)A.

14 Preformed loop detectors must be placed per plan above the concrete reinforcing steel, when present, and just above the
15 neutral axis of the panel. Detectors located in panels without rebar must be secured onto poly insert tees as shown on details
16 at 2-foot spacing to hold the preformed loop with a minimum of 3-inch clearance from the top and bottom surface of the
17 concrete. A minimum of 6-foot of lead-in slack must be placed in a neat coil in the handhole. If the loop is not to be spliced as
18 part of this contract, the ends must be taped and the wire marked with the loop number per the plan using permanent
19 waterproof tags.

20 Preformed loop detectors must be installed and tested before the pavement being placed. Before the paving operation
21 begins, the Engineer will conduct an inductance test per Section 8-31.3(5)C. The test will be performed again after the
22 pavement has been placed, and before turn-on or cut-over. The Contractor must perform the test as specified in Section 8-
23 31.3(5)D, in the presence of the Engineer, if the preformed detector loop is connected to the controller cabinet. The pavement
24 must be poured making certain not to disturb the loop cable. The lead-in cable must be protected during construction. If the
25 preformed loop or lead-in cable is not functional during the final test or is damaged during construction the Contractor must
26 provide a fully functional equivalent wireless detector system, equal to the Contract plans, with 1 wireless detector replacing
27 each upstream preformed detector and 2 wireless detectors at the stop bar as approved by the Engineer and at the
28 Contractor's sole expense.

29 Before Turn-on/Cut-over, the Contractor must provide the Engineer as-built drawings diagramming the complete loop
30 detector system. After Turn-on/Cut-over has been accepted by the Engineer, a dated as-built drawing, provided by the
31 Contractor, of the complete loop system indicating their size, direction, lane location, inductance reading and identifying
32 number assigned must be installed in the controller cabinet. Also see Sections 1-05.3(11), 8-31.3(5)C, 8-31.3(5)E, and 8-
33 31.3(16). Before splicing the loop wire to the loop lead in cable, the Engineer will perform an inductance test to ensure the
34 inductance is within the acceptable range of ± 15 percent of the calculated inductance. If the inductance does not fall within the
35 acceptable range, the Contractor must take necessary corrective measures until the desired readings are obtained or as
36 approved by the Engineer. Before cut-in/turn-over, the Contractor must check the completed loop and lead in configuration
37 after splicing for continuity, using a tester that does not exceed the voltage rating of the lead in and loop wires.

38 The Contractor must also perform a Megger test on the loop and lead in configuration to make certain that the resistance
39 to ground is 10 megohms or greater. If resistance to ground before placing the sealant is less than 10 megohms, all splices
40 and wires must be checked for insulation damage. Corrective measures must be taken until an acceptable resistance is
41 obtained. After the slot has been sealed, the Contractor must perform the resistance and continuity tests again. If the
42 continuity and resistance tests do not comply with the above mentioned requirements, the Contractor must take corrective
43 measures until readings acceptable to the Engineer are obtained.

44 After loop wire and lead in cable splices have been made, and the continuity test has been completed, the Engineer will
45 test the inductance of the loop and loop lead in cable at the controller cabinet. The inductance must be within the acceptable
46 range of ± 15 percent of the calculated inductance. If the inductance does not fall within the acceptable range, the Contractor
47 must take corrective measures until acceptable readings are obtained.

48 **8-31.3(5)C VIDEO DETECTION CAMERA**

49 Video cameras must be installed for vehicle detection in locations shown on Drawings. The Contractor is responsible for
50 installation and fine-tuning the position of the cameras. The Contractor must provide all materials necessary for a complete
51 system including the controller interface. The Owner will configure the detection processors installed in the controller cabinet.
52 The Contractor must notify the Engineer 10 Working Days before installing the cameras. The Contractor must test all video
53 detection equipment before installation. The testing must include verifying that all components of the camera and lens are
54 operational and that the video image processor unit can power up and receive a signal from the camera. After installation, the
55 Contractor must perform the same verification in the field before scheduling configuration. The Owner is responsible for
56 configuration of the detection zones. The Contractor and the Engineer must be present during the configuration of the
57 detection zones. The Contractor must keep the video detection equipment fully operational until the end of the project. Within
58 10 Working Days of Substantial Completion, the Contractor must upgrade the video detection processor software and the PC
59 based management software to the most current version.

8-31.3(5)D WIRELESS SENSOR DETECTION

Each Wireless Sensor Detection System must contain one or more Wireless Sensors buried in the roadway for vehicle detection, and 1 or 2 SPP radios per Job Site mounted along the roadway shoulder to receive and process information from the data collected by the sensors and Wireless Repeaters. These must also be mounted along the roadway shoulder for providing two-way relay between out-of-range wireless sensors.

An in-pavement Wireless Sensor must be provided for each Wireless Sensor location shown on the Drawings. The Wireless Sensor is designed for permanent deployment in all traffic conditions, including freeways, arterials and parking lots, for detecting the presence or absence of a vehicle at the Wireless Sensor.

Access Point Contact Closure Cards in conjunction with up to 2 digital radios (Serial Port Protocol – SPP) must be provided at each Wireless Sensor Detection System location for communicating to the wireless sensors in the roadway and other wireless repeaters on the roadside. The SPP are identified to be mounted on roadside poles in the Drawings. An SPP maintains two-way wireless data reception with the in-pavement sensors and/or with the repeaters in case of out-of-range sensors. It also communicates to the roadside traffic signal controller via the Contact Closure Card, and to/from the central network management centers. The Isolator is used between each SPP radio and APCC to extend the communication range between the devices and provides both electrical isolation and surge protection.

Wireless Repeaters must be provided at the locations designated on the Drawings for two-way relay communications between out-of-range wireless sensors. At the identified locations in the design Drawings Wireless Repeaters will be pole mounted. The Wireless Repeater provides a two-way relay between the out-of-range sensors and the SPP radio.

Use the pole mounting brackets for mounting the SPP and repeaters. See Drawings for installation requirements.

Use the proper RJ45 connector crimping tool to attach connectors directly to the outdoor rated CAT5-E cable.

The Contractor must follow these steps to complete the installation of the Wireless Sensor Detection system:

1. Mark all sensor locations in the field before installation.
2. Coordinate with the Engineer for approval of all wireless sensors locations before installation. The Contractor must mark 5 intersections before requesting Engineer’s approval. 2 Days notice is required before the requested field review date.
3. Install the wireless sensors as outlined in Section 8-31.3(18).
4. Mount the SPP radio on the pole shown on the Drawings.
5. Coordinate with the Engineer to connect the SPP radio into the Isolator in the controller cabinet. The Contractor must have 5 locations ready for connection before contacting the Engineer and provide 2 Days notice before the requested day for final connection.
6. Turn on the SPP radio without any of the Repeaters installed and see if all Wireless Sensors are reliably communicating back to the SPP radio.
7. Install Repeaters at locations shown on the Drawings only for the Wireless Sensors that are not communicating with the SPP radio. All spare Repeaters must be delivered to the City.
8. SPP radios and repeaters must be mounted 25’ above the roadway where possible unless otherwise indicated on the Drawings. The minimum height is 20 feet.

The Contractor must install each sensor according to the manufacturer’s installation recommendations and as shown on the Drawings. After installation, the Contractor must ensure successful operation of the devices using the vendor supplied software utilities.

- a. Identify and locate the Wireless Sensor on Job Site to ensure that the sensor is installed at the location as identified on the Drawings. The Engineer will approve the final sensor locations.
- b. Record distances between each Wireless Sensor in a lane.
- c. Use a 4-inch coring bit and drill rig to make a hole not more than 3 inches deep at the identified wireless sensor location. Dry coring is recommended with a vacuum to remove the dust.
- d. Clean the surface of each hole with a brush. Make sure the surface is completely dry before applying the epoxy.
- e. Use a fast drying epoxy as a sealant to backfill the hole for proper installation of the sensor inside the hole.
- f. Apply the epoxy in each hole. Place the sensor in the hole on top of the epoxy, with the orientation indicator on the top of the sensor pointing in the direction of the traffic flow. Apply enough pressure to the sensor so that epoxy squeezes out around the edges of the sensor and that the sensor is flush with (or slightly below) the roadway surface. Make sure that the sensor installs level in the cored hole and is not tilted.

The Contractor must install each sensor according to the manufacturer’s recommendations and as shown on the Drawings. After installation, the Contractor must ensure successful operation of the devices using the vendor supplied utilities.

The SPP radios and repeaters must be pole or davit arm mounted using a clamp band at the designated location identified on the Drawings using the specified mounting brackets/kits.

The Contractor must provide a limited two-year warranty on the detection system transferred to the City of Seattle. During the warranty period, technical support must be available from the Supplier via telephone within 24 hours of the time a call is made by a user, and this support must be available from factory-authorized personnel or factory-authorized installers. During the warranty period, standard updates to the software must be available from the Supplier without charge. On-site

1 installation and/training support must be provided by a factory authorized representative before the Contractor begins any
2 installation work. All documentation must be provided in the English language.

3 **8-31.3(5E) DETECTOR LOOP LEAD-IN CABLE**

4 The Contractor must sawcut pavement to a depth which provides a minimum 1-inch cover between the top of loop wire
5 and pavement surface.

6 Lead in cable must be one continuous length from the splice at the handhole to the termination point in the controller
7 cabinet.

8 The cable shield and drain wire must be grounded at the system ground only at the controller cabinet and must be
9 continuous and insulated.

10 Each loop lead in wire must have a permanent cloth or plastic tag with the label number shown on the loop detector
11 wiring chart specified on the Drawings. These tags must be placed at handhole splice and controller cabinet terminations.

12 **8-31.3(6) OVERHEAD ILLUMINATED SIGN**

13 Interior illuminated signs must be temporarily covered completely with a 6 mil minimum thickness opaque polyethylene
14 sheeting until the sign is ready to be energized and the Engineer authorizes the Contractor to remove the sheeting.

15 The sign must be mounted as indicated on the Standard Plans unless indicated otherwise in Contract. The sign must be
16 mountable and capable of being serviced with common tools. The clearance distance to the bottom of the sign at the lowest
17 point on the span to the roadway must be a minimum of 16-1/2 feet and a maximum of 19 feet. On designated truck routes,
18 this clearance must be a minimum 18 feet.

19 Signs must be plumb.

20 **8-31.3(7) PREEMPTION DETECTORS AND CAMERAS**

21 **8-31.3(7)A EMERGENCY VEHICLE PREEMPTION DETECTORS**

22 Opticom emergency vehicle preemption detectors must be installed per the manufacturer's instructions and other
23 requirements of this Contract. No substitution will be allowed.

24 The detector cable must be brought back to the controller as shown on the wiring schedule on the Drawings. No splicing
25 is allowed between the detector and the controller cabinet. When called for on the Drawings, the detector cable must be
26 attached to a #9 galvanized iron wire messenger with black nylon tie wraps at 18-inch intervals.

27 **8-31.3(8) SIGNAL INTERCONNECT**

28 **8-31.3(8)A GENERAL**

29 The Contractor must match the sag as closely as possible with wires already on poles to ensure minimal movement in
30 windstorms and adjacent wire conflict.

31 All cable pulled through underground ducts must be lubricated with an approved cable pulling compound.

32 The Contractor must use grip or "come along" to hold on to the jacketed messenger when pulling and tensioning. Pulling
33 and tensioning must be done in such manner as to not damage the jacket. When separating the messenger from the jacketed
34 conductor assembly for dead ending or splicing, the web must be split in the middle. Cable with damaged jackets will be
35 rejected and promptly replaced by the Contractor at no expense to the Owner.

36 At corners and run ends, the messenger strand must be dead ended with either automatic strand vises or preformed guy
37 grip dead end. When dead ending with strand vises, the Contractor must cut the strand and remove the jacket from the steel
38 strand, exposing enough strand so that the ends of the strand coming through the chuck of both strand vises can be
39 overlapped and bonded together to form a continuous ground. Use a one bolt guy clamp to bond the strand ends together.

40 Do not splice interconnect cable. The cable must be a continuous run between the terminal strip of one controller to the
41 terminal strip of the next controller. The messenger wire must be removed from aerial figure 8 cable in pole risers and conduit.

42 The shield of all cables entering an aerial terminal compartment must terminate on a common terminal. The shield must
43 be connected to the terminal strip of the controller at the start of a system and then connected only at alternate controls along
44 the route of the system.

45 The installation of controllers and the connection to the energized interconnect cable must be done starting at the master
46 control point and going to the end of the system. When controllers are to be connected into new or existing systems, take care
47 not to disrupt the integrity of the entire system. A plan of order for converting from an old to a new system must be submitted
48 for approval by the Engineer at least 10 Working Days in advance.

49 An extra 6 feet of interconnect cable must be coiled in the nearest handhole to the controller cabinet. After the cable has
50 been pulled into the controller cabinet, the outside jacket must be stripped back 3 feet. All exposed wiring must have the gel
51 removed from each wire individually. The Jacket end must be sealed to prevent the gel from leaking out of the cable. Sealing
52 must be done by applying a small portion of duct seal, well pressed between the wires and jacket and then firmly taped with 4
53 to 6 wraps of friction type extending 2 inches from each side of the jacket end to hold the seal in place. After cleaning and
54 sealing, the exposed length of wiring must be re-twisted as a pair with the original mate. Use an approved shield grounding
55 connector to ground the shielding.

1 Interconnect cable in conduit must be installed as specified in Section 8-30.3(5).

2 **8-31.3(9) SIGNAL WIRING**

3 **8-31.3(9)A CONDUCTOR INSTALLATION**

4 The Contractor is responsible for making all circuits fully functional after pulling in new cables.

5 Cable and wire which is damaged in pulling must be promptly replaced with new cable at the sole expense of the
6 Contractor.

7 When conductors and cables are being installed, use care to not exceed tension limitations recommended by the
8 manufacturer. Conductors may be pulled directly by hand. However, if conductors are pulled by any mechanical means, use a
9 dynamometer with drop needle hand on every mechanical pull.

10 On mechanical pulls, sufficient insulation must be stripped off the conductor to form a pulling eye and then firmly taped
11 before pulling; or a cable grip must be used. When pulling eyes are used or when the conductor is formed into a loop, limit the
12 pulling force applied directly to the conductor to 0.008 pound per circular Mil area of copper conductor, but must not exceed
13 the recommended limits of the conductor's manufacturer. When a cable grip is applied over nonmetallic sheathed cables, limit
14 the maximum pulling force to 1,000 pounds, provided this is not in excess of the force as calculated above.

15 To limit the side wall pressure at bends in duct and conduit runs, the pulling force in pounds must not exceed 100 times
16 the radius of the bend in feet or the manufacturer's recommendation, whichever is less. Adequate lubrication of the proper
17 type to reduce friction in conduit and duct pulls must be used. Lubricant must be of a non-hardening type approved by the
18 Engineer.

19 In existing conduits where new cable will be installed which contain existing traffic and street light wiring as noted on the
20 Drawings, the Contractor must protect existing wiring from damage due to pulling new cable. Use a cable pulling compound to
21 minimize cable pulling tensions and adverse effects on existing insulation, jackets and shields.

22 Enough cable must be pulled into controller cabinets to allow approximately 4 feet of cable to be stripped and coiled
23 around the bottom of the cabinet before connections are made. The Contractor must terminate all cables on the terminal strip
24 in the controller cabinet.

25 Cable routings on span wire must be securely attached to the span wire by 4 to 6 wraps of friction tape spaced no more
26 than 18 inches apart. Drip loops must be left at the point of entrance to span mounted signal heads and steel pole conduit
27 entrance fittings to allow moisture to drip from the cable rather than run down the cable into entrances. Where the drip loop
28 from the pole outlet to the span wire exceeds 18 inches, the cable must be secured to the pole to give a neat appearance.

29 All electrical cable for traffic signal facilities passing through handholes, junction boxes, conduit bodies, vaults and
30 maintenance holes must be properly identified.

31 Each cable must be identified with the appropriate colored tape within 6 inches of a splice. Cable in handholes, junction
32 boxes and conduit bodies must be appropriately marked near the center of the enclosed section of cable. Cable passing
33 through Seattle City Light handholes, maintenance holes and vaults must be identified with a permanent waterproof marker
34 secured to the cable. The cable marker must indicate SDOT SERVICE for traffic signal service cable, SL SERVICE for street
35 lighting cable, or SDOT SIGNAL for all other traffic signal cable usage.

36 Work in maintenance holes and vaults must be per the National Electric Safety Code and SCL Standards. Cable being
37 installed in maintenance holes and vaults with existing power cable must be racked on the wall opposite the power cable. If
38 cable must be racked on the same wall with power cable, it must be mounted above the power cable, maintaining a 6-inch
39 minimum separation. Every effort must be made to minimize any negative impact of power cable noise and transients on the
40 new communications cable, while adhering to all safety regulations. See Section 1-07.28 item 6 regarding notifications
41 required for work in or near SCL Structures. In handholes, all cables and conductors must be orderly to provide easy
42 recognition and quick access. Racking of cables must be required by the Engineer.

43 Care must be exercised in working near and within any SCL vaults. Voltages present are as high as 26,000 volts, and the
44 vault wiring will not be de-energized while the Contractor is working. The Contractor must adhere to all SCL safety and
45 Electrical Safety Observer standards while working in vaults or in the vicinity of the electrical distribution system. Also see
46 Sections 1-05.2(2), 1-07.1(2), and 1-07.28 item 8.

47 **8-31.3(9)B SPLICES**

48 Signal cable must be spliced only in poles, pedestal bases, or overhead within 2 feet of the poles. Aerial splices must be
49 covered by reverse wrapping of the first layer with electrician insulating tape, then a built up rounded end of electrical tape,
50 then a minimum of 2 layers forward with electrician tape.

51 At locations where existing signal cables are being used, the traffic signal cables must be spliced in pole or pedestal
52 bases and each individual conductor must be insulated and the entire splice must be waterproofed.

53 Each individual splice or termination of extra leads must be insulated, taped and made waterproof.

54 Do not splice loop wire except with the loop lead in wire within the handhole.

55 Do not splice service cable or master cable except as shown on the Drawings.

1 8-31.3(9)C TERMINATIONS

2 Except at a splice, conductors must terminate on a terminal strip or push on connectors at the signal equipment which it
3 is serving. Use only terminal strips with screw type pressure binding posts. Stranded conductors must use compression type
4 pressure fittings at the terminal strip. Compression-type pressure fitting must be applied using an irreversible crimping tool.
5 Single solid conductors must attach directly to the screw post; otherwise use compression type pressure fittings when more
6 than 1 conductor is attached.

7 All electrical terminations must be tightened to their prescribed torque value.

8 All terminals must be marked with field wiring termination numbers printed on back or front-mounted marking strips.

9 8-31.3(9)D PEDESTRIAN PUSHBUTTON CABLE

10 Do not splice pedestrian pushbutton cable. The cable must be one continuous length from the pedestrian pushbutton to
11 the termination point in the controller cabinet. The cable shield must be grounded to the system ground only at the controller
12 end. The cable shield between cabinet and pedestrian pushbutton must be continuous throughout intermediate junction boxes,
13 must completely cover the wires, and must be insulated to prevent grounding in any junction box or in any conduit.

14 8-31.3(9)E CAT5-E CABLE

15 The Contractor must use an outdoor, 600V rated jacketed CAT5-E cable. The Contractor must use the proper RJ45
16 connector crimping tool to attach connectors directly to the outdoor rated CAT5-E cable. Do not splice CAT5-E. Underground
17 installation of CAT5-E cable must be accomplished without damaging the cable. Damaged cable must be replaced by the
18 Contractor at no cost to the Owner. Follow manufacturer recommendations for cable installation. Use shield cable as specified
19 in Division 9.

20 8-31.3(9)F ELECTRICAL SERVICE CONNECTIONS

21 The Contractor must furnish and install equipment and wiring for a single 2 phase 120/240 volt, 60 Hz AC electrical
22 services. The electrical service cable must be installed as indicated on the Drawings.

23 A service cabinet must be provided at each traffic management service point. Meter enclosures must be required per the
24 Drawings. Service cabinet must be wired per the Standard Plans. Service bond must occur in the service cabinet.

25 All final service connections of signal system to overhead secondaries or to secondaries in vaults or handholes will be
26 made by Seattle City Light at the project's expense. The Contractor must arrange a schedule with the Engineer for service
27 connections at the preconstruction conference.

28 8-31.3(9)G SERVICE CABINETS

29 Power sources shown on the Drawings are approximate only; exact location will be determined in the field.

30 8-31.3(10) GROUNDING AND BONDING

31 All grounding and bonding must comply with the National Electrical Code and Seattle Electrical Code.

32 All conductive appurtenances containing electrical or communication conductors including but not limited to cabinets,
33 metallic conduit, metal poles, pedestals, and junction boxes, must be made mechanically and electrically secure to form a
34 continuous system which must be effectively grounded. This continuous system must include any related traffic management
35 system and must only have on Service Bond.

36 Where conduit (including steel conduit) systems are used, all metallic appurtenances must be electrically bonded by the
37 equipment ground conductor. Conduit risers must be bonded to equipment grounding conductor not SCL distribution ground.
38 The grounding electrode conductor must be fed through the riser and bonded at the top of the riser.

39 The minimum size for the grounding electrode conductor must be #6 copper. Only 1 grounding electrode conductor is
40 required in any conduit, raceway, junction box, handhole, or pole.

41 All conduit runs with branch circuit conductors or feeder conductors must have the equipment grounding conductor
42 installed in the conduit unless noted otherwise on the Drawings.

43 The equipment grounding conductor must interconnect all ground rods in each circuit. The grounding electrode conductor
44 must be installed in one continuous length without a splice or joint. If necessary, splices or connections must be made by
45 irreversible compression-type connectors listed as grounding and bonding equipment.

46 Metal conduit, grounding electrode conductors and the service neutral must only be bonded and grounded at the service
47 entrance point as required under the NEC and the City of Seattle Electrical Code.

48 Only 1 conductor must be installed under any ground clamp.

49 Ground rods must be installed in firm undisturbed earth. Minimum spacing between ground rods must be 8 feet.

50 Grounding performance must be based on both the NEC and NESC. If installed system does not measure below 25
51 ohms resistance to Earth, the Engineer will make the determination if the overcurrent protection is adequate for acceptance or
52 if additional grounding is required.

53 Keep the equipment grounding conductor and neutral isolated from the logic ground circuits in the controller cabinet.

1 **8-31.3(11) POLE LINE HARDWARE INSTALLATION**

2 Span wire portions that are directly above METRO trolley wires must be insulated spanwire and covered with plastic
3 cable guard. The cable guard must extend a minimum of 4 feet beyond each side of the trolley wire track. See Section 1-07.28
4 item 2 regarding notifications required for coordination of work with METRO trolley lines.

5 Span wire must be secured to steel strain poles by pole bands, and to timber poles by single strand guy eye bolts. Span
6 wire sag must be 5 to 7 percent of the total span. Pole bands and eye bolts must be installed as detailed on the Standard
7 Plans.

8 Span wire must be secured to eye bolts or strain clamps at poles by use of self-locking cable clamp type dead ending
9 devices. Span wire must be secured to bull rings and anchors by the use of cable guy wrap and guy thimbles. Span wire must
10 be secured to strain insulators by the use of cable guy wraps.

11 Strain insulators must only be installed when the traffic signal spans over METRO trolley, streetcar, or light rail overhead
12 wires. Strain insulators must be installed on all spans and down guys at a distance of 9 feet from the face of wood poles, and 3
13 feet from the face of steel poles.

14 Tether wire must be mounted a minimum of 18 feet above the roadway.

15 On steel poles, do not use lag or through bolts.

16 **8-31.3(12) RELOCATING EQUIPMENT**

17 When existing equipment is to be relocated, the Contractor must furnish and install all necessary new Materials and
18 equipment (including all hardware) required to install the salvaged equipment in the new installation. Any new hardware
19 required to complete the installation must be of the same quality and type as hardware required in these Specifications for all
20 other new Work.

21 All traffic signals, flashing beacons, and illuminated signs to be relocated must be cleaned and relamped.

22 **8-31.3(13) REMOVAL AND SALVAGE OF EXISTING ELECTRICAL EQUIPMENT**

23 Refer to Section 2-02.3(3)G and 2-02.3(7)C.

24 **8-31.3(14) OWNER FURNISHED EQUIPMENT AND MATERIALS**

25 The Contractor must pick up equipment and Material, as specified and at pickup locations specified in the Contract, and
26 install such as indicated on the Drawings.

27 **8-31.3(15) CHECK OUT PROCEDURE**

28 The Contractor must arrange a schedule with the Engineer at least 2 Working Days in advance for a complete
29 intersection check out after having completed the installation of the controller cabinet, all signal and illuminated sign
30 equipment, pedestrian signal activators, vehicle detection, interconnect cable system and all associated wiring and
31 connections as called for on the Drawings. The Contractor must be present and assist with the check out by energizing each
32 field circuit and assisting as necessary to verify completeness of the installation except for the controller unit and auxiliary units
33 of the controller assembly. If the intersection is found to be incomplete or inadequate, the Contractor will be notified of the
34 deficiencies to be corrected.

35 **8-31.3(16) TURN ON/CUT OVER PROCEDURE**

36 See Section 8-31.3(1)A. Upon acceptable check out of an intersection, the Contractor, after conferring with the Engineer,
37 must arrange a schedule for cut over from the old signals or a turn on of a new installation. A request for "turn on" of a new
38 signalized intersection or "cut over" modifications to existing signalized intersection must be submitted in writing to the
39 Engineer at least 5 Working Days before the proposed date of an existing signal cut over, and 5 Working Days before the
40 proposed date of a new signal turn on. The Engineer will respond to the Contractor within 5 Working Days of receipt of request
41 for cut over or turn over.

42 As-built drawings: The Contractor must submit "redline" as-built wiring diagram to the Engineer at checkout. Also see
43 Sections 1-05.3(11), 8-31.3(5)B, 8-31.3(5)C, and 8-31.3(5)E. See Section 8-31.3(17) for final as-built drawing requirements.

44 Turn ons or cut overs must be scheduled and completed between the hours of 9:00 a.m. and 2:30 p.m.

45 The Owner will deliver to the Project Site and plug into the controller cabinet, the controller unit and the auxiliary units.
46 The signal timing for the controller unit will be done by the Owner. The Contractor must not energize the signals until the
47 Engineer is on the Job Site and has authorized the Contractor to proceed. To maintain safe traffic conditions, existing signals
48 must remain in operation until a simultaneous cut over to the signal can be accomplished, unless an alternate procedure is
49 approved in writing by the Engineer. New signals must not obscure existing traffic controls.

50 The Contractor must be present and must be prepared at such turn on time, with Materials and tools necessary to correct
51 any malfunctions which may occur. Turn on must not take place if any subsequent work requires turning off the signal system.

52 All new vehicular and pedestrian signals and illuminated signs must be temporarily covered completely with a 6 mil
53 opaque polyethylene sheeting, or approved equal until the new signals are ready to be energized. A 1-inch diameter hole must
54 be cut into the opaque plastic cover in front of each vehicular signal lens and a 1" x 3" slot in front of each pedestrian signal
55 lens to allow for a visual check of indications during performance testing.

1 Immediately after turn on or cut over, all existing vehicular and pedestrian signals that have been deactivated must be
2 covered or removed. The old signal heads must not obscure the new traffic controls at any time.

3 **8-31.3(17) FINAL INSPECTION AND AS-BUILT DRAWINGS**

4 See Section 1-05.11.

5 As soon as practicable after completion of all signal and related Work, the Contractor must submit to the Engineer for
6 approval, as built wiring drawings indicating revised field wiring and revised controller assembly wiring. Final "redline" as-built
7 wiring diagrams to be placed in controller cabinets must be in-place 1 Working Day after acceptance of Turn-on/Cut-over. See
8 Sections 8-31.3(5)B, 8-31.3(5)C, 8-31.3(5)E, 8-31.3(16), and 1-05.3(4).

9 **8-31.3(18) LICENSE PLATE READER (LPR)**

10 The LPR system consists of the cameras, interface boxes, mounts, and cables. The installation of the cameras must
11 include all cabling connectors required to make the connections complete. The LPR Box may be mounted on poles or within a
12 cabinet as specified on the Drawings. The installation must also include all cabling connectors to make the installation
13 complete. Note that 1 LPR interface box can support up to 2 LPR cameras provided both cameras are within 100 feet of the
14 interface box.

15 The Contractor must furnish 1 composite cable as between each LPR camera and LPR interface box. The Contractor
16 must provide power conductors to the interface box as specified on the Drawings.

17 The Contractor must have the LPR manufacturer's representative on the Job Site during installation of a minimum of the
18 first two LPR installations to assist in setting up the camera, interface box and controller to ensure proper set-up procedures
19 are followed to maximize the number of license plates being read by the system. The representative must provide a capture
20 rate to validate the system performance. The Contractor must notify the Engineer a minimum of 10 Working Days in advance
21 of the time the representative will be on-site.

22 The Contractor must comply with the steps outlined below to complete the installation of the LPR System:

- 23 1. Mark the locations of all cameras in the field before drilling access holes in poles. Once camera locations are
24 approved by the Engineer, start installation of all cameras and the associated cabling.
- 25 2. Work with the City Signal Technician to verify the cameras are adjusted properly.
- 26 3. In the presence of the Engineer or City Signal Technician, confirm all cameras are properly detecting license plates.

27 The Contractor must provide a limited two-year warranty on the LPR system transferred to the Owner. During the
28 warranty period, technical support must be available from the Supplier via telephone within 24 hours of the time a call is made
29 by a user, and this support must be available from factory-authorized personnel or factory-authorized installers.

30 **8-31.3(19) CCTV CAMERA**

31 All CCTV cameras must be installed at the locations shown on the Drawings. All cameras must be securely mounted per
32 manufacturer's specifications. The Contractor must submit Shop Drawings for all attachments to existing signal strain poles
33 and utility poles. All mounting hardware must be adjustable. The Contractor must adjust the mounting hardware as necessary
34 for each camera installation to ensure that the camera is mounted level. The Contractor must verify that the mounting plate
35 supporting the camera equipment at each location is level before installing the camera equipment. Contractor must use a
36 plumb-level placed across the mounting plate in two directions (90 degree offset) to ensure that the mounting plate is level.

37 For each camera location, the camera control cable must be installed per manufacturer specifications between the
38 camera and the signal cabinet. The camera control cable must be coiled in the handhole adjacent to the controller cabinet.
39 The Contractor must notify the Engineer 10 Working Days before final connection. Final termination will be conducted by the
40 Owner.

41 All un-terminated/un-connected cables must have sufficient slack coiled in each signal cabinet or handhole to allow
42 proper connections to all communications equipment within the camera or signal cabinet.

43 Cameras must be 4 feet clear of trolley lines.

44 The Contractor must test the CCTV system using a Contractor-supplied NTSC-compatible video monitor and a
45 Contractor-supplied camera control device. The control device may be laptop computer with a suitable EIA-422 converter
46 running Contractor-supplied software. The control device and monitor must remain the property of the Contractor. The
47 Contractor is responsible for all test cables and connections.

48 At each signal controller cabinet, the Contractor must connect the video monitor to the coaxial video cable and connect
49 the camera control device to the camera control cable. The Contractor must provide the camera controller interface to be
50 placed in the signal controller cabinet. The Contractor must conduct Proof of Performance Testing and demonstrate to the
51 Engineer the following features of the camera installation:

- 52 1. Display camera video on the Contractor-provided monitor.
- 53 2. Program the I.D. generator to display the location on line 1 and the cardinal direction the camera is pointing on line 2.
- 54 3. Pan and tilt the camera (For PTZ cameras).
- 55 4. Zoom and focus the camera in both fast and slow modes.
- 56 5. Turn the camera off and on.

6. Change the iris to auto and manual.

Each of these features must be demonstrated successfully for the camera installation to be accepted.

8-31.3(20) DYNAMIC MESSAGE SIGN (DMS)

The Contractor must furnish and install the DMS as shown on the Drawings. The Contractor must furnish and install the auxiliary equipment cabinet as shown on the Drawings, Standard Plans and as specified in Section 8-31.

The Contractor must install fully equipped DMS sign units and related cables as shown on the Drawings and as recommended by the manufacturer. The Contractor must furnish and install the sign controller in the auxiliary equipment cabinet and terminate the cables.

The Contractor must store the sign in a secured location before installation. This storage area may be an outdoor secure facility. Any material arriving in a cardboard box must be stored indoors. If the sign is stored for more than 3 days, it must be stored indoors or energized so that the environmental enclosure is operable.

The equipment covered by this specification must be tested by the Contractor, and witnessed by the Engineer.

Final system acceptance must be defined as when all work and Materials provided for in this item have been furnished and completely installed, and all parts of the Work have been approved and accepted by the Engineer and the Dynamic Message Sign (DMS) System has been operated continuously and successfully for 90 Calendar Days with no more than 5 Working Days downtime due to mechanical, electrical and/or other malfunctions.

8-31.4 MEASUREMENT

Measurement for "Signal Wiring, (Location)" will be by lump sum for each intersection.

Measurement for "Detector Loop, (Size)" and for "Detector Loop, Encapsulated, (Size)" will be by each complete installation.

Measurement for "Boom Truck and Operator For Inspector" will be by the hour.

Measurement for "Emergency Vehicle Preemption Detector, Opticom (model number)" will be per each complete installation.

8-31.5 PAYMENT

Payment for the cost necessary to complete the Work described in Section 8-31 will be at the Bid Item prices Bid only for the Bid Items listed or referenced as follows:

1. "Install Owner Furnished Traffic Signal Controller Cabinet, (Type)", per each

The Bid Item price for "Install Owner Furnished Traffic Signal Controller Cabinet, (Type)" must include all costs for the work required to install the Owner furnished cabinet complete on the foundation and to make all field terminal connections with the cabinet.

2. "Signal Head, (Type) (Description)", per each

The Bid Item price for "Signal Head, (Type) (Description)" must include all costs for the work required to furnish and install the signal head complete, including all mounting hardware for the mounting specified, installation, alignment, testing; and when specified, bimodal fiber optic arrow lens, louvers, backplates, and programming as may be required.

3. "Pedestrian Pushbutton Assembly", per each

4. "APS Pedestrian Pushbutton Assembly", per each

The Bid Item price for "Pedestrian Pushbutton Assembly" and for "APS Pedestrian Pushbutton Assembly" must include all costs for the work required to furnish and install the pedestrian pushbutton assembly complete, including the button and housing, hardware, controller interface, and signs.

5. "Detector Loop, (Size)", per each

6. "Detector Loop, Preformed, (Size)", per each

The Bid Item price for "Detector Loop, (Size)" and "Detector Loop, Preformed, (Size)" must include all costs for the work required to install the preformed loop cable and suspension system and conduit complete to the first handhole from the loop, including pavement fillers, splices, hardware, and restoration of pavement surface.

7. "Video Detection Camera", per each

The Bid Item price for "Video Detection Camera" must include all costs for the work required to furnish and install a functional video detection camera including but not limited to, video camera, mounting bracket, lens, housing, cables, processing unit, surge suppresser/lighting protection, splices, taps, and hardware,.

8. "Wireless Sensor", per each

The Bid Item price for "Wireless Sensors" must include the cost of all work to furnish, install, and test each sensor, sensor unit including epoxy.

9. "Wireless Sensor Access Point", per each

The Bid Item price for "Wireless Sensor Access Point" must include the cost of all work to furnish and install the Wireless Sensor Access Point with pole mount bracket and for the configuration, contact closure cards, expansion cards, access box, hardware, splices, and taps and testing each Access Point

1 10. **“Wireless Sensor Repeater”**, per each

2 “Wireless Sensor Repeater” must include the cost of all work to furnish and install the “Wireless Sensor Repeaters” with
3 pole mount bracket, hardware, and for the testing of each device.

4 11. **“Sign, Illuminated, (Size)”** per each

5 The Bid Item price for “Sign, Illuminated (Size)” must include all costs for the work required to furnish and install the
6 illuminated sign complete, including all mounting hardware, sign wiring and photoelectric cell.

7 12. **“Emergency Vehicle Preemption Detector, Opticom (model number)”** per each.

8 The Bid Item price for “Emergency Vehicle Preemption Detector” must include all costs for the work required to furnish
9 and install the emergency vehicle preemption detector, including all mounting hardware for the mounting specified, cabling to
10 the controller cabinet, installation, alignment, and testing

11 13. **“Signal Wiring (Location)”**, per lump sum

12 The Bid Item price for “Signal Wiring (Location)” must include all costs for the work required to furnish and install
13 complete signal wiring at the location including terminal cabinets, signal lead wiring, pushbutton wiring, sign (attached to
14 signal) wiring, service wiring, and loop lead in cable.

15 14. **“Terminal Cabinet”**, per each

16 The Bid Item price for “Terminal Cabinet” must include all costs for the work required to furnish and install the complete
17 cabinet including mounting hardware, terminal strips, splices, taps, and sealing.

18 15. **“Span Wire”**, per linear foot

19 16. **“Span Wire, Catenary”**, per linear foot

20 The Bid Item price for “Span Wire” and for “Span Wire, Catenary”, must include all costs for the work required to furnish
21 and install the spanwire complete, including wire, clamps, insulators and all hardware.

22 17. **“Relocate (Item)”**, per each

23 18. **“Relocate (Item)”**, per linear foot

24 19. **“Relocate (Item)”**, per lump sum

25 The Bid Item price for “Relocate (Item)” must include all costs for the work required to remove and reinstall the item
26 complete, including hardware and rehabilitating signals and signs as required.

27 20. **“Boom Truck and Operator For Inspector”**, per hour

28 The Bid Item price for “Boom Truck and Operator for Inspector” must include all costs for the work required to provide a
29 boom truck and operator for the field inspector as requested by the Engineer.

30 21. **“CCTV Camera, (Type)”**, per each

31 The Bid Item price for “CCTV Camera, (Type)” must include all costs for the work required to furnish and install cameras,
32 including but not limited to, camera, cabling, mounting hardware, controller interface, testing, equipment, labor and any other
33 accessories required to provide an operational system.

34 22. **“LPR System”**, per each

35 The Bid Item price for “LPR System” must include all costs for the work required to furnish and install the license plate
36 reader system, including but not limited to, 2 cameras, interface boxes, cabling, mounting hardware, testing, equipment, and
37 any other accessories required to provide an operational system.

38 23. **“Dynamic Message Sign”**, per each

39 The Bid Item price for “Dynamic Message Sign” must include all costs for the work required to furnish and install dynamic
40 message signs, including but not limited to the sign, sign controller, cabling, sign mounting brackets and hardware, testing,
41 equipment, wiring, and other accessories required to provide an operational system.

42 24. **“Auxiliary Cabinet”**, per each

43 The Bid Item price for “Auxiliary Cabinet” must include all costs for the work required to furnish and install the cabinet
44 complete on the foundation and to make all field terminal connections with the cabinet.

45 25. **“Service Cabinet”**, per each

46 The Bid Item price for “Service Cabinet” must include all costs for the work required to furnish and install the cabinet,
47 wiring, and breakers complete on the foundation and to make all field terminal connections with the cabinet.

48 26. **Other payment information**

49 Existing Materials required to be relocated and found to be unacceptable by the Engineer must be replaced by new
50 Material and will be addressed as extra work per Section 1-04.3.

51 Payment for providing an off-duty Uniformed Peace Officer will be as specified in Section 1-10.5.

52 All final service connections of electrical signal systems to overhead secondaries or to secondary in vaults or handholes
53 will be made by Seattle City Light at the project’s expense.

54 All costs for furnishing and installing hardware not specifically called out, but required to complete the Work and
55 approved by the Engineer must be included in the Bid Item prices for the applicable Bid Items.

1 See Section 1-05.2(2) regarding payment for Electrical Safety Observer

2 **SECTION 8-32 POLES, PEDESTALS, AND FOUNDATIONS**

3 **8-32.1 DESCRIPTION**

4 **8-32.1(1) GENERAL**

5 This Work consists of furnishing and installing poles, bracket arms, pedestals, posts, mast arms, concrete foundations
6 and back guy assemblies as shown on the Standard Plans and as specified in this Section. The Contractor must become
7 thoroughly familiar with the electrical and civil environment within the Project Site and with the relevant Work.

8 **8-32.1(2) APPLICABLE ELECTRICAL CODES**

9 See Section 8-30.1(2).

10 **8-32.1(3) POLE AND PEDESTAL SHOP DRAWINGS**

11 The Contractor must submit Shop Drawings and catalog cuts as specified in Section 1-05.3 for the following:

- 12 1. Metal poles and appurtenances
- 13 2. Anchor bolt extenders
- 14 3. Mast Arms
- 15 4. Anchor bolts, nuts, washers
- 16 5. Bracket Arms
- 17 6. Pedestals

18 All poles which deviate from the Drawings will be considered an alternate proposal and requires a submittal to the
19 Engineer for review and approval at least 10 Working Days in advance of ordering the poles. The alternate pole must comply
20 with Section 9-33 and the requirements specified in the Contract. The Contractor accepts all responsibility for any impact the
21 Engineer's decision may have on the Contractor's critical path schedule and accepts any necessary adjustment to the critical
22 path schedule to meet Contract Time at no additional or separate cost to the Owner. This submittal must be as specified in
23 Section 1-05.3.

24 **8-32.1(4) ELECTRICAL AND ELECTRONIC WORDS AND PHRASES**

25 See Section 1-01.3.

26 **8-32.2 MATERIALS**

27 Materials must comply with the requirements of the following Sections:

28

| Materials | Section |
|---|-------------------|
| Concrete for foundations | Section 6-02 |
| Non-Shrink Cement Sand Grout | Section 9-04.3(2) |
| Poles, Mast Arms, Pedestals, Foundations, and Back Guy Assemblies | Section 9-33 |

29

30 All welds on tubular steel must comply with ANSI/AWS D1.1 Section 10 Tubular Structures.

31 **8-32.3 CONSTRUCTION REQUIREMENTS**

32 **8-32.3(1) POLES**

33 **8-32.3(1)A GENERAL**

34 See Section 8-32.3(2)A for foundation concrete mix design requirements.

35 The Contractor must lay out pole locations and grades as indicated on the Drawings. Poles must be located to provide a
36 minimum of 3 feet clearance measured from the face of the curb to the face of pole unless otherwise indicated on the
37 Drawings or Standard Plans.

38 Poles must be handled during loading, unloading, and erecting in such a manner that they are not damaged.

39 Field repair of galvanized surfaces must be accomplished by coating with a heated zinc alloy solder to a minimum
40 thickness of 3 mils per ASTM A 780.

41 The Contractor must repair or replace all rejected poles at no expense to the Owner. If the Contractor elects to repair the
42 rejected pole, a repair plan must be submitted at least 5 Working Days in advance.

43

1 City_Standards_Engineer@seattle.gov

8-32.3(1)B METAL POLES AND PEDESTALS

Do not erect street light poles and pedestals before concrete foundations have cured for a minimum 7 Days or have attained a minimum 70 percent of specified strength.

Do not load strain and mast arm poles before concrete foundations have cured for a minimum of 14 days or have reached specified strength.

Do not load strain poles type V, X, and Z with METROKC loading until the concrete has attained design strength or has been cured a minimum 28 Days.

The Contractor may request concrete test samples or provide an ASTM accredited testing Laboratory approved by the Engineer to sample and test the concrete.

Use leveling nuts on all metal poles. Place leveling nuts and washers on anchor bolts to allow between 2 and 4 inches of non-shrink grout under the base plate. Place poles on the bolts and the leveling nuts and washers. The leveling nuts and washers must then be adjusted to plumb the pole.

The pole must be raked before loading such that it is plumb after all loads have been applied. Plumb is defined as an imaginary vertical line from the center line of the pole top passes through the center line of the pole base at ground level. A tolerance of ± 0.17 inches per foot of pole height above the ground will be permitted with the exception that in no case must the pole lean toward the pavement. Nuts must be torqued to the manufacturer's recommendations.

After pole anchor bolts and rake have been inspected and approved by the Engineer with loads applied, tape must be placed around the periphery of the anchor bolts and leveling nuts, then non-shrink cement sand grout must be placed under the pole to completely fill the void under the base outside the anchor bolts by packing from the bolts and finishing towards the outside. The non-shrink grout must be sloped at approximately 60 degrees away from the base plate. There must be a 1/2-inch drain tube in the non-shrink grout on the lowest side of the base to provide drainage from within the pole or pedestal to the outside (see Standard Plans 524a, 524b, and 563a). Installation of pedestals must comply with the same requirements for installation of metal poles, except raking will not be required.

8-32.3(1)C WOOD POLES

Wood poles must be set at the depth specified in the following table:

Pole Setting Depth

| Length of Pole, ft. | Minimum Set Depth, ft. | Minimum Set Depth in Rock, ft. |
|---------------------|------------------------|--------------------------------|
| 20 | 5.0 | 3.0 |
| 25 | 5.0 | 3.0 |
| 30 | 5.5 | 3.5 |
| 35 | 6.0 | 4.0 |
| 40 | 6.0 | 4.0 |

After each wood pole is set in the ground to the specified depth as indicated on SCL Construction Guideline D3-3, the space around the pole must be backfilled with selected earth or sand, free of rocks and other deleterious material, placed in layers approximately 4 inches thick. Each layer must be moistened and thoroughly compacted.

When wood poles are used as strain poles, the poles must be raked to be plumb after loading as defined in Section 8-32.3(1)B.

8-32.3(2) FOUNDATIONS

8-32.3(2)A GENERAL

With the exceptions of strain poles types T, V, X, and Z, concrete mix for foundations must comply with the following requirements:

| Type Pole or Pedestal | Class Concrete |
|---------------------------|----------------|
| Strain and Mast Arm Poles | Class 4000 |
| Non Strain Metal Poles | Class 3000 |
| Chief Seattle Light Pole | Class 3000 |
| Metal Street Light Pole | Class 3000 |
| Pedestal | Class 3000 |
| Pedestrian Pushbutton | Class 3000 |

Strain pole foundations for pole types T, V, X, and Z must have air-entrained concrete Class 4000 per Section 6-02.

1 Foundations must be augered and constructed against undisturbed soil. Concrete must be placed against undisturbed
2 earth within a dry hole. If a dry hole is not maintained, the Contractor must select a method of concrete placement that does
3 not adversely impact the strength or durability of the concrete. In unstable ground, the Contractor must install sonotube or
4 other approved form material to provide undisturbed concrete placement. Backfill between form material and undisturbed earth
5 must be controlled density fill. Each foundation must be poured in one continuous pouring operation. Where new excavations
6 are near an existing foundation, the Contractor must provide temporary support for the existing Structure as appropriate.
7 Where foundations are installed on slopes, foundation depth is measured using the shortest bearing surface.

8 Anchor bolts must be set securely in place and held in a vertical position with the specified bolt projection and at the
9 specified bolt circle to match the exact hole pattern of the item to be installed. The tops of the bolts must all be at the same
10 elevation. Use a steel template at the lower end, and a wood or steel template at the upper end of the anchor bolts, to maintain
11 the correct bolt pattern and spacing until the concrete has set. Anchor bolts must not be altered in any way after fabrication.
12 Bending of anchor bolts is cause for rejection and removal of the entire foundation. The bolt circle must be measured by the
13 Engineer before pouring the concrete.

14 Before placing concrete, all projecting anchor bolts must be taped with a corrosion protection tape from a point 6 inches
15 below the top of the foundation to the top of the bolt. Tape must be per SCL Material Standard 7367.3 and must remain
16 permanently in place. Nuts and washers must be installed over the tape. Immediately after concrete is placed, the location of
17 the anchor bolts must be checked with a template conforming to the bolt pattern of the bases of the poles. After the concrete is
18 placed, anchor bolts and conduit must be cleaned and kept free of concrete splatter and mortar.

19 Concrete must be float finished, edged and brushed where necessary. Adjusting anchor bolts to make them fit the hole
20 pattern in the base plate will not be allowed after concrete has begun to set.

21 **8-32.3(2)B TRAFFIC SIGNAL CONTROLLER FOUNDATIONS**

22 Anchors, cinch anchors, nut couplers, square washer and bolts must be installed per Standard Plans, or by an alternate
23 method recommended by the manufacturer. Where the manufacturer recommends installation differing from the Standard
24 Plans, the Contractor must submit the manufacturer's recommendations to the Engineer for approval at least 5 Working Days
25 in advance of installation. The cinch anchors must be sized as recommended by the traffic signal controller manufacturer. A
26 bead of waterproof sealant must be installed under the lip of the traffic signal controller cabinet before installing the cabinet to
27 prevent moisture penetration.

28 Tops of the traffic signal controller foundations must be level, and must be 6 to 8 inches above adjacent finished grade.

29 A 3/4-inch PVC conduit drain must be installed in all concrete foundations for traffic signal controllers Type II and Type III
30 cabinet foundations to provide drainage from within the cabinet to the outside finished grade.

31 **8-32.3(2)C POLE, PEDESTAL AND PEDESTRIAN PUSHBUTTON POST FOUNDATIONS**

32 Anchor bolts must be supplied by the Contractor on foundation installations unless specified otherwise in the Contract.

33 Reinforcing steel must be kept 3 inches clear from surrounding earth within the concrete pole foundation, and must be
34 set securely in place.

35 Where the foundation is in or adjacent to, a proposed sidewalk/paved area, the top of the foundation must be at or just
36 below the bottom of the adjacent sidewalk or paving Material. The Contractor must first coat the foundation top with a bond
37 breaker, and then place sidewalk or paving Material over the top of the foundation. Install premolded joint Material in the
38 construction joint where new pavement or sidewalk is placed over and around the foundation.

39 Where the foundation is in an unpaved area, the top of the foundation must be 3 inches below the finished ground level.
40 The foundation must be poured to specified depth and a 3-inch deep, square finished pad must be provided above the
41 foundation.

42 Conduits must extend 1 inch above the pole base plate. Anchor bolts must be installed, or be cut off, with sufficient
43 projection above the foundation to allow 3 threads above the upper nut. Where inadequate projection is provided, bolt
44 extenders may, if approved by the Engineer, be used, or complete removal and replacement of the foundation will be required
45 at no expense to the Owner.

46 **8-32.3(2)D EXISTING POLE FOUNDATIONS**

47 Where grade changes decrease the standard bolt projection, bolt couplers may be used as approved by the Engineer.
48 Existing foundation concrete must be chipped to a depth approved by the Engineer. Existing bolts must not be damaged by
49 concrete chipping. Bolts must be cut. Use heavy-duty couplers with straight, all thread bolts. Bolt length is determined
50 according to the necessary bolt projection for the foundation type. Additional rebar may be required by the Engineer.

51 Where existing pole foundations require bolt pattern changes, epoxy anchors may be used as approved by the Engineer.
52 The Contractor must mark new anchor locations for approval by the Engineer before drilling holes. Anchors must be injection
53 epoxy type. Core drilling must occur only with the Engineer present. Holes must be drilled with ANSI B212.15 matched
54 tolerance carbide tipped drill bits with drill in roto-hammer mode or with a matched tolerance diamond core drill bit of the
55 diameter specified by the bolt manufacturer. Drilled hole specifications must match ICC ESR 1562 or ICC ESR-1967. Anchors
56 must be tightened with a calibrated torque wrench. Use of an impact wrench is not permitted. Anchors must be all-thread.
57 Holes must be completely cleaned with compressed air or blow out pump before epoxy is poured into the holes. The epoxy
58 must be set and cured per manufacturer recommendations.

1 **8-32.3(3) BACK GUY ASSEMBLIES**

2 Back guy assemblies for wood poles must be constructed as shown on the Standard Plans.

3 All through bolts must be properly trimmed and treated.

4 **8-32.3(4) RELOCATING EQUIPMENT**

5 When equipment is to be relocated, the Contractor must furnish and install all necessary materials and equipment
6 including all new hardware required to complete the new installation. Any new hardware required to complete the installation
7 must be of the same quality and type as hardware required in the Specifications for other new Work.

8 **8-32.3(5) BRACKET ARMS**

9 Mounting point of the bracket arm on wood poles must be located as necessary to provide the required mounting height
10 of the luminaire above the pavement. However, the Engineer may field determine the required mounting height to provide
11 required wire clearances. The Engineer requires a minimum 1 Working Day advance notice.

12 Wood pole bracket arms must be attached by 1 through bolt and 2 lag bolts. Through bolts on wood poles must be cut off
13 so no more than 4 threads nor less than 3 threads are left exposed beyond the captive nut. The exposed end must be treated
14 with galvanizing repair paint approved by the Engineer. Do not use this through bolt to mount any other hardware.

15 **8-32.4 MEASUREMENT**

16 Measurement for davit poles and the attached davit arm will be per each as a combined unit.

17 Measurement for "Install (Item), Owner Furnished" will be per each.

18 **8-32.5 PAYMENT**

19 1. "Pole, Steel Strain, (Type)", per each

20 2. "Pole, Steel Mast Arm", per each

21 The Bid Item price for "Pole, Steel Strain, (Type)" and for "Pole, Steel Mast Arm" must include all costs for the work
22 required to furnish and install the pole complete, including pole cap, handhole, handhole cover, nut covers, bracket arm flange
23 and bolts, base plate, all necessary hardware, raking, plumbing, and grouting.

24 3. "Pole Steel Strain Davit, (Type) w/(Length) Arm", per each

25 The Bid Item price for "Pole, Steel Strain Davit, (Type) with (Length) Arm" must include all costs for the work required to
26 furnish and install the complete pole, pole cap, the extension arm, including handhole, handhole cover, nut covers, steel pole
27 extension tenon, steel pole luminaire tenon, welding, base plate, all necessary hardware, raking, plumbing, and grouting.

28 4. "Pole, Steel Lighting (Length)", per each

29 5. "Pole, Aluminum Lighting (Length)", per each

30 The Bid Item price for "Pole, Steel Lighting (Length)" and for "Pole, Aluminum Lighting (Length)" must include all costs for
31 the work required to furnish and install the pole complete, including handhole, handhole cover, and all necessary hardware,
32 raking, plumbing, and grouting.

33 6. "Pole, Wood, (Length), (Type), (Class)", per each

34 The Bid Item price for "Pole, Wood (Length), (Type), (Class)" must include all costs for the work required to furnish and
35 install the wood pole complete, including excavation, backfill, and compaction.

36 7. "Mast Arm (Length)", per each

37 The Bid Item price for "Mast Arm, (Length)" must include all costs for the work required to furnish and install the mast arm
38 complete with all necessary hardware, fittings and end cap.

39 8. "Pedestal, (Material), (Length)", per each

40 The Bid Item price for "Pedestal, (Material), (Length)" must include all costs for the work required to furnish and install the
41 pedestal complete including pipe, cap, base, and all hardware.

42 9. "Pedestrian Pushbutton Post", per each

43 The Bid Item price for "Pedestrian Pushbutton Post" must include all costs for the work required to furnish and install the
44 post complete including all drilling and tapping, plumbing, steel pipe, pipe cap "meter collar", grout, pipe flange, and all
45 required hardware.

46 10. "Foundation, Traffic Signal Controller (Type)", per each

47 11. "Foundation, (Use)", per each

48 The Bid Item prices for "Foundation, Traffic Signal Controller (Type)" and for "Foundation, (Use)" must include all costs
49 for the work required to construct the foundation complete in place including, but not limited to, excavation, excavation support,
50 and furnishing and placing backfill, forming, concrete, reinforcing steel, anchor bolts, ground rods and/or systems, washers,
51 nuts, nut covers, grout, wire, conduit, ground rod, handhole and drainage hardware.

52 12. "Back Guy Assembly", per each

1 The Bid Item price for "Back Guy Assembly" must include all costs for the work required to furnish and install the back
2 guy assembly complete including installation of all guy cable, hardware, insulators, pipe, fittings, and anchor.

3 13. "Relocate (Item)", per each

4 The Bid Item price for "Relocate (Item)" must include all costs for the work required to remove and reinstall the item
5 complete including all new hardware and rehabilitation as required.

6 14. "Remove (Item)", per each

7 The Bid Item price for "Relocate (Item)" must include all costs for the work required to remove and salvage as required.

8 15. "Bracket Arm, (Length)", per each

9 The Bid Item price for "Bracket Arm, (Length)" must include all costs for the work required to furnish and install the
10 bracket arm complete including hardware.

11 16. "Install (Item), Owner Furnished", per each

12 The Bid Item price for "Install (Item), Owner Furnished" must include all costs for the work required to install the Owner
13 furnished item including transportation of the item from the supply yard to the Job Site.

14 **17. Other payment information**

15 When installation of a new pole, pedestal, or post disturbs existing surface improvement that remain, the cost of surface
16 restoration must be included in the Bid Item price of the pole, pedestal, or post as appropriate, see Section 1-07.16.

17 The installation of the pole number plate furnished by Seattle City Light will be considered as incidental to the cost of
18 installing the pole.

19 If the Contractor proposes an alternate pole which is approved by the Engineer, no change will be made to the Bid Item
20 price for the pole specified in the Bid Item.

21 See Section 1-05.2(2) regarding payment for Electrical Safety Observer.

22 **SECTION 8-33 ELECTRICAL CONDUIT AND TRENCHING**

23 **8-33.1 DESCRIPTION**

24 **8-33.1(1) GENERAL**

25 This Work must consist of trench excavation, furnishing and installing conduit, conduit, condulets, and handholes for
26 illumination and signal systems as specified in the Contract and shown on the Standard Plans.

27 The Contractor must become thoroughly familiar with the electrical environment within the Project Site and with the
28 relevant Work.

29 In areas where deteriorated conduits are encountered during trenching, the Contractor must promptly notify the Engineer
30 who will then determine if sleeving of conduits is required so as to keep backfill from entering the conduit. It is important to
31 preserve conduits whenever economically practical for future use.

32 **8-33.1(2) APPLICABLE ELECTRICAL CODES**

33 See Section 8-30.1(2).

34 **8-33.1(3) ELECTRICAL CONDUIT SHOP DRAWINGS**

35 The Contractor must submit Shop Drawings and catalog cuts as specified in Section 1-05.3 for the following items:
36

| Shop Drawing and Catalog Cuts Submittals | |
|--|------------------------------------|
| Conduit and Fittings | Condulets Junction Box |
| Stand-off Brackets | Expansion Fittings |
| Weatherhead | Seals and Sealing Compounds |
| Galvanizing Repair Material | PVC Coatings to be field installed |
| Handholes and handhole lids | Flexible Conduit |

37
38 **8-33.1(4) ELECTRICAL AND ELECTRONIC WORDS AND PHRASES**

39 See Section 1-01.3.

40 **8-33.2 MATERIAL**

41 Materials must comply with the requirements of the following Sections:
42

| Materials | Section |
|------------------------------|--------------|
| Non-Shrink Cement Sand Grout | 9-04.3(2) |
| Paint | Section 9-08 |
| Conduits and Handholes | Section 9-34 |

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8-33.3 CONSTRUCTION REQUIREMENTS

8-33.3(1) TRENCHING

Excavation required for the installation of conduit, foundations, and other Materials must be performed in such a manner as to cause the least possible damage to the streets, sidewalks, and other improvements. Do not excavate trenches any wider than necessary for the proper installation of the electrical appliances and foundations. Place excavated soils where they least interfere with traffic and surface drainage.

Trenching, conduit and other in-common installation, backfilling, and either temporary surfacing or final surfacing as necessary, must be scheduled on a daily basis and for minimum disturbance to traffic.

The Contractor must take all necessary steps to keep excavated native Material deemed suitable by the Engineer from becoming unsuitable. The requirements of Section 2-04 must apply.

Depth to top of conduit, or depth of cover, must be as follows unless specified otherwise in the Contract:

| Location of Conduit | Depth of Cover |
|--|---|
| Under Railroad (Refer to Railroad Company's requirements) | 48 inches below bottom of railroad ties |
| Under Asphalt & Concrete Pavement, Any Roadway or Driveway | 36 inches |
| All Other Locations (e.g. Planting strips, sidewalks) | 24 inches |

The bottom of the trench for all conduit must be free of abrupt change of grade or alignment, and be free of objects and materials that could cause damage to conduit, conduit coating, or excessive bending of the conduit. The first 6 inches of backfill must be free of rock, gravel, or other deleterious objects and materials 1 inch or larger. The Engineer must approve all conduit installations before backfilling the trench.

Trench backfill must be compacted to 95 percent as specified in Section 2-04. The first loose lift of backfill over the conduit must be 8 to 12 inches.

Excavations over 4 feet deep are subject to protective systems as specified in Section 7-17.3(1)A7a.

8-33.3(2) CONDUIT INSTALLATION

8-33.3(2)A GENERAL

Conduit must be installed as shown on the Drawings. Install conduit for streetlight systems per SCL Construction Standard 1716.07. When installing conduit under existing pavement or sidewalks, removal must comply with Section 2-02. Surface restorations must comply with the applicable Sections of the Standard Plans and Standard Specifications. Conduit and fittings within drainage and sanitary Structures and Sewer pump station wet wells are considered to be in a Class I environment and all construction must be in compliance with Article 501 of N.E.C.

Conduit must be installed in the number, type, size and location shown on the Drawings.

As-built drawings: For conduit runs that deviate from the location shown on the Drawings or on Shop Drawings reviewed by the Engineer, and are to be buried in concrete Structures such as floor slabs, retaining walls, abutments, or bridge superstructures, the Contractor must submit an as built drawing showing the actual locations of all roughed in conduit to the Engineer at least 5 Working Days before pouring the concrete. The as built drawing must show the conduit run, conduit size, and conduit Material type in red and must be dimensioned to the nearest 1 inch.

Conduit cable runs must be parallel to building lines and grouped together where possible.

Conduit runs parallel to curbs must be placed adjacent to back of curb unless detailed otherwise on the Drawings.

Changes of conduit direction must be made with manufactured or fabricated elbows of radius not less than that noted in the NEC.

Conduit installed totally within the metering and disconnect enclosure must be rigid metal and may be without PVC coating.

The Contractor may use larger size conduit when approved by the Engineer. Where larger size conduit is used, it must be for the entire length of the run from outlet to outlet.

1 Conduit terminating in enclosures (such as but not limited to poles, cabinets and pedestals) must extend vertically above
2 the foundation a minimum of 1 inch, unless indicated otherwise on the Drawings. Exceptions to the 1-inch minimum are
3 indicated on Standard Plans 500a, 521, 524, and 550a. Reducing couplings are not permitted. Conduit must not change size
4 between handholes, or conduit access point.

5 Conduit entering through the bottom of a handhole must be located near the end walls to leave the major portion of the
6 box clear and terminate 3 inches above the bottom of the handhole. Conduit entering through the sides of the handhole must
7 enter from the direction of the run, and terminate flush with the box wall.

8 All conduit must be thoroughly cleaned and a proper size mandrel pulled through it before installing wires or pull cord.
9 Mandreling must be done in the presence of the Engineer.

10 Existing conduit to be incorporated into a new system must be cleaned with a mandrel and a cylindrical wire brush and
11 blown out with compressed air and a pull cord installed extending at least 3 feet beyond the conduit at each end.

12 Conduit repairs: When small portions of damaged conduit repairs are necessary, repairs are permitted by using PVC in
13 its place. The PVC must be coupled to the local conduit by beveled edge couplings slipped into place and then sealed with
14 PVC cement. On repairs to steel conduit using PVC, a bonding #6 AWG jumper must be installed connecting the metal
15 sections together with bonding clamps approved by the Engineer.

16 Marker stakes or tacks must be set flush with the ground to locate the ends of stubbed out conduits which may be buried
17 so that they may be located in the future. All stubbed out conduits must be capped.

18 Conduit entrances into metal junction boxes (Except NEMA 1) must be drilled and tapped a minimum of 3 full threads for
19 the size conduit used. Bosses must be provided where the wall thickness is not sufficient for the minimum number of threads.

20 Entry to electrical vaults or other Structures must be made such that the physical integrity of the vault or Structure is not
21 impaired. Any hole for entry to vaults or Structures must be core drilled of a diameter no greater than 1-1/2 times the diameter
22 of the conduit entering the vault. See Section 1-05.2(2) for Electrical Safety Observer requirements.

23 Annular spaces around conduit, equipment grounding conductor, ducts, at wall penetrations of vault or other structural
24 walls must be filled with non-shrink cement sand grout see Section 9-04.3(2). Threaded inserts must be coated with an
25 approved rust preventative compound which is soluble in petroleum solvent.

26 At locations designated by the Engineer, fittings must be installed to provide a conduit channel that permits freedom for
27 installing the electrical control wires. When conduit fittings are indicated on the Drawings, or where their installation is required
28 by the Engineer, the Contractor must also furnish all necessary covers and gaskets. Expansion/deflection fittings per Standard
29 Plans must be installed at all Structure expansion joints.

30 Conduits must be attached to walls and other surfaces (except poles) using approved one hole malleable iron pipe
31 clamps and clamp backs.

32 Rigid steel conduit may be jacked or bored when approved by the Engineer.

33 New conduit that does not have wire installed (vacant) must have a pull cord installed extending at least 3 feet beyond
34 the conduit at each end and fastened down.

35 Conduit entrances into metal junction boxes must be drilled and tapped a minimum of 5 full threads for the size conduit
36 used. Bosses must be provided where the wall thickness is not sufficient for the minimum number of threads.

37 **8-33.3(2)B RIGID STEEL CONDUIT AND PVC COATED RIGID STEEL CONDUIT**

38 When rigid steel conduit is cut, the ends must be made square and true with conventional pipe cutting equipment.
39 Conduit must be threaded with a standard conduit cutting die. Burrs and sharp corners at the end of each conduit must be
40 removed with a tapered reamer. Threads must be cleaned of all metal, lubricants, red lead, and any other Material which
41 prevents joining with threaded counterparts. Conduit threads must be coated with a conduit thread compound designed to
42 ease assembly and disassembly, and to improve electrical conductivity. Conduit must be joined by the use of rigid steel
43 conduit couplings. Running threads are not permitted for coupling conduit. When a standard coupling cannot be used, use an
44 approved threaded union coupling. Tighten conduit securely to prevent the entrance of moisture, concrete, or other foreign
45 Material and to provide a good electrical connection throughout the entire length of the conduit run. The method of tightening
46 must not damage the conduit or coupling. Where the galvanizing on the conduit or the coupling has been damaged, it must be
47 thoroughly painted, per the manufacturer's recommendations, with galvanizing repair paint meeting Federal Spec. MIL P
48 21035. An Alternate repair method must consist of applying a heated zinc alloy solder coating to a minimum thickness of 2
49 mils per ASTM A 780.

50 Bushings must be of the insulated throat type. The entire conduit system must be properly bonded and grounded per
51 N.E.C.

52 Installation of the PVC coated system must be made under the following:

- 53 1. Coupling and Joining: All conduit connections must be made mechanically tight with strap wrenches to assure rigidity
54 and maximum electrical conductivity. Over tightening that results in gouging of the PVC coating will not be permitted.
55 After each connection is completed, any gouges, cuts or abrasions must be repaired. Solvent weld the sleeves to the
56 conduit at each connection by applying touch up compound to the PVC coating before screwing on the sleeve.
57 Cutting off plastic sleeves will be cause for rejection of that length of conduit.
- 58 2. Cutting: The conduit must be tightened securely in a vise or chuck. The cut must be made with a roll cutter or hack
59 saw. When using either a jaw vise or a chain vise, the use of vise adapters will be required. If vise adapters are

1 unavailable, use a jaw vise and wrap the portion of the coated conduit to be gripped in the vise with emery cloth with
2 the coarse side toward the conduit. The use of a chain vise without adapters is not permitted.

3 3. Threading: When using a hand threader, use a tool with an adjustable guide. If the threader does not have an
4 adjustable guide, ream the stationary guide 0.10 inch to accommodate the plastic coating. Whittling of the PVC
5 coating is not permitted. After threading, apply touch up compound to indentations made by the vise. Raw field cut
6 threads must be protected by the methods set forth above. For machine threading, use a threader designed for
7 coated conduit. must

8 4. Bending: PVC coated conduit may be bent with conventional bending equipment; however, the internal walls of the
9 shoes must be machined out approximately 0.050 inch. Bending must be accomplished by segmented bending rather
10 than a one shot bend. For sharp bends, saddles, or offsets, a PVC coated hickey is required. Any cuts, gouges, or
11 abrasions must be coated with touch up compound. Coating the exterior of the conduit with a slippery substance such
12 as wire pulling compound is permitted before bending.

13 5. Touch up: During the installation of the coated conduit, the Contractor must assure that no metal is left exposed or
14 uncoated. Metal exposed as the result of field cuts must be coated with touch up compound. If an uncoated
15 accessory must be used, it must also be coated.

16 6. One hole malleable iron pipe strap, pipe spacers (clamp backs), and mounting brackets must be PVC coated.

17 **8-33.3(2)C PVC CONDUIT**

18 PVC conduit must be assembled with solvent welded joints per the manufacturer's written instructions. Bends and fittings
19 must be factory produced.

20 **8-33.3(3) CONDUIT RISERS**

21 Conduit less than 2 inches in diameter mounted on wood poles must be mounted by use of 2 hole malleable conduit
22 clamps spaced per N.E.C./N.E.S.C. Use a minimum of 2 clamps per length of conduit.

23 Conduit sized 2 inches and larger, or more than 1 conduit installed on wood poles, must be installed using stand off type
24 brackets. Stand off brackets must be installed per N.E.C./N.E.S.C. with a 10-foot maximum spacing. Attachment must be near
25 the top of each 10 feet length of conduit.

26 All conduit risers must be grounded with a ground clamp installed 8 feet above finished grade. Where conduit risers are
27 connected to a ground rod, a ground rod handhole well must be provided.

28 The conduit must be wrapped with corrosion protection tape conforming to SCL Material Standard 7367.3, 8 inches
29 above and below finished grade.

30 Conduit risers must be the size indicated on the Drawings. The 90 degree bend and conduit up the pole to 10 feet above
31 the surface must be rigid steel. The riser above the 10 foot-level must be PVC, Schedule 80. The riser must be equipped with
32 a PVC weatherhead and must be grounded as indicated on Standard Plans.

33 **8-33.3(4) HANDHOLES**

34 Handholes must be installed per Standard Plans 550a and 550b. The frame (ring) and lid must be grounded with an
35 approved grounding clamp to the ground rod per SCL Construction Standard 0233.05 at the locations shown on the Drawings.
36 Unless dimensioned, handholes are located schematically, and must always be located outside the pedestrian travel way. The
37 Contractor must provide the Engineer a minimum 1 Working Day advance notice regarding the exact handhole location.

38 When required by the Contract or Engineer, handhole extensions must be provided by Contractor and installed.

39 Unused conduit openings in handholes must be capped to afford protection against debris from entering the conduits.

40 Cables and conductors must be racked. The Contractor must select a racking method to be approved by the Engineer.

41 See Section 8-31.3(1)B for Traffic Signal handhole access requirements and Section 8-30.3(3) for SCL handhole,
42 maintenance hole, and vault access requirements.

43 See Section 9-34.6 for additional handhole Material requirements.

44 **8-33.3(5) JACKING OR BORING OR TUNNELING, RIGID STEEL AND OTHER CONDUIT**

45 Rigid steel conduit may be jacked or bored when approved by the Engineer. Rigid nonmetallic type conduit may be
46 installed under existing pavement if a hole larger than the conduit is predrilled and the conduit installed by hand.

47 When tunneling under existing pavement or other surface improvement is required for conduit installation, the Contractor
48 must submit the proposed tunneling process including the Materials and methods for filling any voids created by the tunneling
49 process at least 10 Working Days in advance for the Engineer's approval. Directional drilling must be as specified in Section 2-
50 16.

51 **8-33.4 MEASUREMENT**

52 Measurement for "Conduit, (Material), (Size)" will be by the linear foot measured on the ground along the conduit to the
53 center line of pole, to the 90 degree bend of a conduit riser, to equipment, or to the inside face of a handhole or of a vault.

54 Measurement for "Conduit Riser, (Size)" will be by each from and including the weatherhead to and including the 90
55 degree rigid steel bend underground.

1 Measurement for "Relocate (Item)" will be per each.

2 No separate measurement will be made for jacked or augered conduit. No measurement will be made for removal or
3 restoration of surface improvements where the conduit is jacked or augered, but such measurement will be made at jacking
4 pits and access holes as specified in Section 2-02.4.

5 Measurement for pavement restoration will be as specified in Sections 5-04.4 and 5-05.4 as applicable.

6 **8-33.5 PAYMENT**

7 1. **"Conduit, (Material), (Size)"**, per linear foot

8 The Bid Item price for "Conduit, (Material), (Size)" must include all costs for the work required to furnish and install the
9 conduit complete including all bends, fittings, condulets and hardware.

10 2. **"Trenching, Conduit"**, per linear foot

11 The Bid Item price for "Trenching, Conduit" must include all costs for the work required to excavate, backfill with suitable
12 Material, and compact the trench section for both conduit and conduit riser trenching. Payment for replacement of native
13 material determined unsuitable by the Engineer will be as specified in Section 1-02.9(3). All costs for replacement of suitable
14 native Material which becomes unsuitable due to Contractor operations will be at the Contractor's sole expense.

15 3. **"Conduit Riser, (Size)"**, per each

16 The Bid Item price for "Conduit Riser, (Size)" must include all costs for the work required to furnish and install the
17 complete riser, including all conduit, fittings, clamps and hardware from and including the weatherhead to and including the 90
18 degree rigid steel bend underground.

19 4. **"Handhole, (Type)"**, per each

20 The Bid Item price for "Handhole, (Type)" must include all costs for the work required to furnish and install the handhole
21 complete including excavation, backfill and compaction, groundrod, and handhole extensions when required.

22 5. **"Handhole, (Type), Polymer"**, per each

23 The Bid Item price for "Handhole, (Type), Polymer" must include all costs for the work required to furnish and install the
24 handhole complete including excavation, backfill and compaction, groundrod, and handhole extensions when required.

25 6. **"Relocate (Item)"**, per each

26 The Bid Item price for "Relocate (Item)" must include all costs for the work required to relocate the specified item.

27 7. **"Remove (Item)"**, per each

28 The Bid Item price for "Remove (Item)" must include all costs for the work required to remove and salvage as required.

29 8. **Other payment information**

30 Payment for jacked or augered conduit will be made at the Bid Item price for "Trenching, Conduit".

31 All costs for ground rod wells must be included in the Bid Item prices of the applicable Bid Items.

32 See Section 1-05.2(2) regarding payment for Electrical Safety Observer.

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END OF DIVISION

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1 DIVISION 9 MATERIALS**2 SECTION 9-00 DEFINITIONS AND TESTS****3 9-00.1 FRACTURE**

4 Fractured aggregate is defined as aggregate particles which have one or more fractured faces. A face will be counted as
5 fractured whenever one half or more of the projected area of the particle is comprised of a fractured face when viewed normal
6 to the fractured face.

7 9-00.2 WOOD WASTE

8 Wood waste is defined as all material which, after drying to constant weight, has a specific gravity of less than 1.0.

9 9-00.3 TEST FOR WEIGHT OF GALVANIZING

10 At the option of the Engineer, the weight of zinc in ounce per square foot required by the various galvanizing
11 Specifications may be determined by an approved magnetic thickness gage calibrated within the last 6 months for accuracy
12 and demonstrated to the approval of the Engineer, in lieu of the other methods specified.

13 9-00.4 SIEVE ANALYSIS OF AGGREGATES

14 Sieve analysis for acceptance of aggregate gradation will comply with procedures specified in Section 9-03.13.

15 9-00.5 DUST RATIO

16 The dust ratio is defined as the percent of material passing the U.S. No. 200 sieve divided by the percent of material
17 passing the U.S. No. 40 sieve.

18 9-00.6 SAND/SILT RATIO

19 The sand/silt ratio is defined as the percent of material passing the U.S. No. 10 sieve divided by the percent of material
20 passing the U.S. No. 200 sieve.

21 9-00.7 GALVANIZED HARDWARE, AASHTO M 232

22 An acceptable alternate to hot dip galvanizing per AASHTO M 232 is zinc coatings mechanically deposited per AASHTO
23 M 298, providing the minimum thickness of zinc coating is not less than that specified in AASHTO M 232, and the process
24 does not produce hydrogen embrittlement in the base metal. Sampling and testing will be made by the Engineer in accordance
25 with commonly recognized national standards and methods used in the SPU Materials Laboratory.

26 SECTION 9-01 PORTLAND CEMENT AND BLENDED HYDRAULIC CEMENT**27 9-01.1 TYPES OF CEMENT**

28 Cement must be classified as Portland cement or blended hydraulic cement.

29 9-01.2 SPECIFICATIONS**30 9-01.2(1) PORTLAND CEMENT**

31 Portland cement must comply with AASHTO M 85 or ASTM C 150 Types I, II, or III Portland cement, except that the
32 cement must not contain more than 0.75 percent alkalis by weight calculated as Na₂O plus 0.658 K₂O and the content of
33 tricalcium aluminate (C₃A) must not exceed 8 percent by weight calculated as 2.650Al₂O₃ minus 1.692Fe₂O₃. Processing
34 additions must comply with ASTM C 465 and the total amount of processing additions used must not exceed 1 percent of the
35 weight of Portland cement clinker. Cement kiln dust may be used as a process addition above 1 percent but not exceed 4
36 percent of the weight of Portland cement clinker. When process additions greater than 1 percent are used, the type and
37 amount of processing additions used must be shown on mill test reports.

38 The time of setting must be determined by the Vicat Test method per AASHTO T 131 or ASTM C 191.

39 9-01.2(2) LOW ALKALI CEMENT

40 When the Engineer requires the use of low alkali cement, the percentage of alkalis in the cement must not exceed 0.60
41 percent by weight calculated as Na₂O plus 0.658 K₂O. This limitation applies to all types of Portland cement.

42 9-01.2(3) BLENDED HYDRAULIC CEMENT

43 Blended hydraulic cement must be either Type IP or Type IS cement conforming to AASHTO M 240 or ASTM C-595,
44 except that the blended hydraulic cement must not contain more than 0.75 percent alkalis by weight calculated as Na₂O plus
45 0.658 K₂O and the content of tricalcium aluminate (C₃A) must not exceed 8 percent by weight calculated as 2.650Al₂O₃
46 minus 1.692Fe₂O₃ and comply with the following additional requirements:

- 47 1. Type IP(X), Portland Pozzolan Cement, where (X) dictates pozzolan percentage. Type IP(X), Portland Pozzolan
48 Cement, must be Portland cement and pozzolan. Pozzolan must be limited to fly ash or microsilica fume. Fly ash is
49 limited to a maximum of 25 percent by weight of the cementitious material in air entrained concrete and 35 percent in

- 1 non-air entrained concrete. Microsilica fume is limited to a maximum of 15 percent by weight of the cementitious
- 2 material.
- 3 2. Type IS(X), Portland Blast Furnace Slag Cement, where (X) dictates slag percentage. Type IS(X), Portland Slag
- 4 Cement, must be Portland cement and ground granulated blast furnace slag. The addition of ground granulated blast
- 5 furnace slag must be limited to a maximum of 30-percent by weight of the cementitious material in air entrained
- 6 concrete and 50-percent in non-air entrained concrete.
- 7 3. Type IL(X), Portland Limestone Cement, where (X) dictates limestone percentage. Type IL(X), Portland Limestone
- 8 Cement, must be Portland cement and limestone where the percent of limestone in the blend must be greater than 5
- 9 percent, and no more than 15 percent, of the total weight of Portland cement and limestone.
- 10 4. Type IT(AX)(BY), Ternary Blended Cement, where A is either "S" for Slag cement, "P" for pozzolan, or "L" for
- 11 limestone; whichever is present in larger quantity by weight. And where B is either "S" for Slag cement, "P" for
- 12 pozzolan or "L" for limestone. "X" is the targeted percentage by weight of constituent A, and "Y" is the targeted
- 13 percentage by weight of constituent B. Portland cement that may be replaced by weight in the blend is limited to the
- 14 following maximums:

Portland Cement Replacement Maximums

| | <u>Air Entrained Concrete</u> | <u>Non-Air Entrained Concrete</u> |
|--------------------------|-------------------------------|-----------------------------------|
| Total Cement Replacement | 35% | 50% |
| Fly Ash | 25% | 35% |
| Microsilica Fume | 10% | 10% |
| GGBFS | 30% | 40% |
| Limestone | 15% | 15% |

17 The source and weight of the pozzolan, ground granulated blast furnace slag, or limestone must be certified on the

18 cement mill test certificate and must be reported as a percent by weight of the total cementitious material plus limestone, if

19 present. The pozzolan, ground granulated blast furnace slag, or limestone constituent content in the finished cement must not

20 vary more than ± 5 percent by weight of the finished cement from the certified value. Type IL and Type IP with limestone will

21 be considered to be low sulfate resistance cements.

22 Fly ash must be as specified in Section 9-23.6.

23 Ground granulated blast furnace slag must be as specified in Section 9-23.7.

24 Limestone must comply with the specifications of Section 9-23.10.

25 Microsilica fume must comply with the specifications of Section 9-23.8.

SECTION 9-02 BITUMINOUS MATERIALS

9-02.1 ASPHALT MATERIAL

9-02.1(1) RESERVED

9-02.1(2) MEDIUM CURING (MC) LIQUID ASPHALT

| Characteristics | | AASHTO Test Method | MC 70 | MC 250 | MC 800 | MC 3000 |
|---|--------|--------------------|--------|---------|----------|-----------|
| Kinematic Viscosity at 140 °F (cSt) | -- | T 201 | 70-140 | 250-500 | 800-1600 | 3000-6000 |
| Flash Point (Tag Open Cup) | Min °F | T 79 | 100 | 150 | 150 | 150 |
| Water Content | Min. % | T 55 | 0.2 | 0.2 | 0.2 | 0.2 |
| Distillation: volume % of total distillate | -- | T 78 | | | | |
| to 680 °F | -- | -- | 0-20 | 0-10 | -- | -- |
| to 437 °F | -- | -- | 20-60 | 15-55 | 0-35 | 0-15 |
| to 500 °F | -- | -- | 65-90 | 60-87 | 45-80 | 15-75 |
| to 600 °F | -- | -- | 55 | 67 | 75 | 80 |
| Residue of 680 °F distillation % volume by difference | Min. | | -- | | | |

| Characteristics | | AASHTO Test Method | MC 70 | MC 250 | MC 800 | MC 3000 |
|---|--------|--------------------|----------|----------|----------|----------|
| Properties of residue from distillation to 680 °F Absolute viscosity at 140°F (poise) | -- | T 202 | 300-1200 | 300-1200 | 300-1200 | 300-1200 |
| Ductility, 5 cm/min. at 77 °F ¹ | Min. | T 51 | 100 | 100 | 100 | 100 |
| Solubility in trichloroethylene | Min. % | T 44 | 99.0 | 99.0 | 99.0 | 99.0 |

NOTE:

1. If the ductility at 77 °F is less than 100, the Material will be acceptable if its ductility at 60 °F is more than 100.

The Material must not foam when heated to the application temperature recommended in 2010 edition WSDOT standard Specification Section 5-02.3(3).

9-02.1(3) RESERVED**9-02.1(4) ASPHALT CEMENT****9-02.1(4)A PAVING ASPHALT**

Asphalt cement binder must comply with AASHTO M 320 and must be of the grade specified in the Contract.

9-02.1(4)B PERFORMANCE GRADE (PG) ASPHALT CEMENT

| Binder Grade | PG 58- | | | PG 64- | | | PG 70- | | | PG 76- | | | | | | | | | | | |
|---|---|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|--|-----|--|-----|--|-----|--|-----|--|-----|
| | -22 | -28 | -34 | -22 | -28 | -34 | -22 | -28 | -34 | -22 | -28 | | | | | | | | | | |
| Original Binder | | | | | | | | | | | | | | | | | | | | | |
| Flash Point Temp., AASHTO T 48 | 230 °C MIN. | | | | | | | | | | | | | | | | | | | | |
| Rotational Viscosity, AASHTO T 316 | 3 Pa s Max. @ 135 °C | | | | | | | | | | | | | | | | | | | | |
| Dynamic Shear, AASHTO T 315 | G*/Sin δ = 1.00 kPa Min.; Frequency = 10 rad/s | | | | | | | | | | | | | | | | | | | | |
| | Test Temp. (°C) | | | | | | | | | | | | | | | | | | | | |
| | 58 | | | 64 | | | 70 | | | 76 | | | | | | | | | | | |
| Rolling Thin Film Oven Residue, AASHTO T 240 | | | | | | | | | | | | | | | | | | | | | |
| Mass Loss, AASHTO T 240 | 1.00 Percent Max. | | | | | | | | | | | | | | | | | | | | |
| Dynamic Shear, AASHTO T 315 | G*/Sin δ = 2.20 kPa Min.; Frequency = 10 rad/s | | | | | | | | | | | | | | | | | | | | |
| | Test Temp. (°C) | | | | | | | | | | | | | | | | | | | | |
| | 58 | | | 64 | | | 70 | | | 76 | | | | | | | | | | | |
| Pressure Aging Vessel Residue, AASHTO R 28 | | | | | | | | | | | | | | | | | | | | | |
| PAV Aging Temp., AASHTO R 28 | 100 °C | | | | | | | | | | | | | | | | | | | | |
| Dynamic Shear, AASHTO T 315 | G*/Sin δ = 5,000 kPa Max.; Frequency = 10 rad/s | | | | | | | | | | | | | | | | | | | | |
| | Test Temp. (°C) | | | | | | | | | | | | | | | | | | | | |
| | 22 | | 19 | | 16 | | 25 | | 22 | | 19 | | 28 | | 25 | | 22 | | 31 | | 28 |
| Creep Stiffness, AASHTO T 313 | S= 300 Mpa Max.; m-value= 0.300 Min. | | | | | | | | | | | | | | | | | | | | |
| | Test Temp. @ 60s (°C) | | | | | | | | | | | | | | | | | | | | |
| | -12 | | -18 | | -24 | | -12 | | -18 | | -24 | | -12 | | -18 | | -14 | | -12 | | -18 |

NOTE: All Performance Grade binders not included in this chart must comply with the requirements of Table 1 contained in AASHTO M 320, Performance-Graded Asphalt Binder.

9-02.1(5) RESERVED

1 **9-02.1(6) CATIONIC EMULSIFIED ASPHALTS**

2

Cationic Emulsified Asphalt

| Grade | Type | Rapid Setting | | | | Medium Setting | | | | | | Slow Setting | | | | Special Track | |
|--|--------------------|---------------|------|----------|------|----------------|------|----------|------|----------|------|-----------------------|------|-----------------------|------|---------------|------|
| | AASHTO Test Method | CRS-1 | | CRS-2 | | CMS-2S | | CMS-2 | | CMS-2H | | CSS-1 | | CSS-1H | | STE-1 | |
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| Test On Emulsions | | | | | | | | | | | | | | | | | |
| Viscosity Saybolt Furol S @ 77 °F (25 °C) | T 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 20 | 100 | 20 | 100 | -- | 30 |
| Viscosity Saybolt Furol S @ 122 °F (50 °C) | T 59 | 20 | 100 | 150 | 400 | 50 | 450 | 50 | 450 | 50 | 450 | -- | -- | -- | -- | -- | -- |
| Storage stability test 1 day % | T 59 | -- | 1 | -- | 1 | -- | 1 | -- | 1 | -- | 1 | -- | 1 | -- | 1 | -- | 1 |
| Demulsibility 35 m.l. 0.8% sodium dioctyl sulfosuccinate, % ¹ | T 59 | 40 | -- | 40 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 25 | -- |
| Coating Ability & Water Resistance | | | | | | | | | | | | | | | | | |
| Coating, dry aggregate | T 59 | -- | -- | -- | -- | good | -- | good | -- | good | -- | -- | -- | -- | -- | -- | -- |
| Coating, after spraying | T 59 | -- | -- | -- | -- | fair | -- | fair | -- | fair | -- | -- | -- | -- | -- | -- | -- |
| Coating, wet aggregate | T 59 | -- | -- | -- | -- | fair | -- | fair | -- | fair | -- | -- | -- | -- | -- | -- | -- |
| Coating, after spraying | T 59 | -- | -- | -- | -- | fair | -- | fair | -- | fair | -- | -- | -- | -- | -- | -- | -- |
| Particle charge test | T 59 | positive | | positive | | positive | | positive | | positive | | positive ² | | positive ² | | positive | |
| Sieve Test, % | T 59 | -- | 0.10 | -- | 0.10 | -- | 0.10 | -- | 0.10 | -- | 0.10 | -- | 0.10 | -- | 0.10 | -- | 0.10 |
| Cement mixing test, % | T 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2.0 | -- | 2.0 | -- | -- |
| Distillation | | | | | | | | | | | | | | | | | |
| Oil distillate by vol. Of emulsions % | T 59 | -- | 3 | 1.5 | 3 | -- | 20 | -- | 12 | -- | 12 | -- | -- | -- | -- | -- | 5 |
| Residue, % | T 59 | 60 | -- | 65 | -- | 60 | -- | 65 | -- | 65 | -- | 57 | -- | 57 | -- | 45 | -- |
| Tests On Residue From Distillation Test | | | | | | | | | | | | | | | | | |
| Penetration, 77 °F (25 °C) | T 49 | 100 | 250 | 100 | 250 | 100 | 250 | 100 | 250 | 40 | 90 | 100 | 250 | 40 | 90 | 100 | 200 |
| Ductility, 77 °F (25 °C) 5 cm/min, cm | T 51 | 40 | -- | 40 | -- | 40 | -- | 40 | -- | 40 | -- | 40 | -- | 40 | -- | 40 | -- |
| Solubility in trichlorethylene, % | T 44 | 97.5 | -- | 97.5 | -- | 97.5 | -- | 97.5 | -- | 97.5 | -- | 97.5 | -- | 97.5 | -- | 97.5 | -- |

3

NOTES:

4

1. The demulsibility test must be made within 30 days from date of shipment.

5

2. If the particle charge test for CSS-1 and CSS-1h is inconclusive, material having a maximum pH value of 6.7 is acceptable.

6

7

9-02.1(6)A POLYMERIZED CATIONIC EMULSIFIED ASPHALT – CRS-2P

The asphalt CRS-2P must be a polymerized cationic emulsified asphalt. The polymer must be milled into the asphalt or emulsion during the manufacturing of the emulsion. The asphalt CRS-2P must comply with the following Specifications:

| | AASHTO Test Method | Specifications | |
|---|--------------------|----------------|----------|
| | | Minimum | Maximum |
| Viscosity @122 °F, SFS | T 59 | 200 | 400 |
| Storage Stability 1 day % | T 59 | -- | Note 1 |
| Demulsibility 35 ml. 0.8% Dioctyl Sodium Sulfosuccinate | T 59 | 40 | -- |
| Particle Charge | T 59 | Positive | -- |
| Sieve Test % | T 59 | -- | 0.30 |
| Distillation | | | |
| Oil distillate by vol. of emulsion % | T 59 (Note 1) | 0 | Note 3 |
| Residue | T 59 | 65 | -- |
| Test on the Residue From Distillation | | | |
| Penetration @77 °F | T 49 | 100 | 250 |
| Torsional Recovery % Or Toughness/Tenacity in-lbs | Note 2 Note 3 | 18 50/25 | -- -- |

NOTES:

1. Distillation modified to use 300 grams of emulsion heated to 350 °F ± 9 F° and maintained for 20 minutes.
2. The Torsional Recovery test must be conducted according to the California Department of Transportation Test Method No. 332.
3. Benson method of toughness and tenacity; Scott tester, inch-pounds at 77 °F, 20 inches per minute pull. Tension head 7/8 inch diameter.

At the option of the Supplier, the Benson Toughness/Tenacity test can be used in lieu of Torsional Recovery based on type of modifier used. If the Benson Toughness/Tenacity method is used for acceptance, the Supplier must supply all test data verifying Specification conformance as part of the manufacturer's certificate of compliance.

9-02.1(7) ASPHALT FOR SUB SEALING

Asphalt for sub sealing must conform to the requirements of AASHTO M 238 except that the minimum softening point must be 170 °F.

9-02.1(8) HOT MELT TRAFFIC BUTTON ADHESIVE

The bitumen adhesive Material must conform to the following requirements:

| Specification | ASTM Test Method | Requirement |
|--|------------------|----------------|
| Flash Point, COC °F | D 92 | 550 Min. |
| Softening Point, °F | D 36 | 200 Min. |
| Brookfield Viscosity, 400 °F | D 2196 | 7,500 cP, Max. |
| Penetration, 100g, 5 sec, 77 °F | D 5 | 10-20 dmm |
| Filler Content, % by weight (Insoluble in 1,1,1 trichloroethane) | D 2371 | 50-75 |

Filler material must be calcium carbonate and must conform to the following fineness:

| Sieve Size | Percent Passing |
|------------|-----------------|
| No. 100 | 100 |
| No. 200 | 95 |
| No. 325 | 75 |

Hot melt bitumen adhesive must develop bond pull off strength greater than 100 psi between 0 °F and 120 °F.

9-02.2 SAMPLING AND ACCEPTANCE

9-02.2(1) CERTIFICATION OF SHIPMENT

Bituminous Materials may be accepted by the Engineer based on the asphalt Supplier's manufacturer's certificate of compliance incorporated in their Bill of Lading. This certification must include a statement certifying Specification compliance for each delivery of product shipped. Failure to provide this certification with the shipment is cause for rejection of the Material. The following information is required on this Bill of Lading:

1. Date shipped.
2. Project Name and PW No.
3. Grade of Commodity and manufacturer's certificate of compliance.
4. Anti-stripping additive brand, grade, and percentage.
5. Mass (Net Tons).
6. Volume (Gross Gallons).
7. Temperature of Load (°F).
8. Bill of Lading Number.
9. Consignee and Delivery Point.
10. Signature of Supplier's Representative.
11. Supplier (Bill of Lading Generator Business Name).
12. Supplier's Address.

The Bill of Lading must be supplied at the time of shipment of each load delivered. In addition to the copies the Contractor requires, one copy of the Bill of Lading including the manufacturer's certificate of compliance must be sent with the shipment for the sole use of Engineer.

9-02.2(2) SAMPLES

When requested by the Engineer, the asphalt Supplier must submit, by prepaid express or US mail, samples of asphalt binder that represent current production to the SPU Materials Laboratory as specified in Section 1-05.3(1)C at no cost to the Owner. At the discretion of the Engineer, samples of asphalt binder may be obtained by the Engineer from the Contractor's storage tanks.

9-02.3 TEMPERATURE OF ASPHALT

The temperature of paving asphalts in storage tanks when loaded for transporting must not exceed the maximum temperature recommended by the asphalt binder manufacturer.

9-02.4 ANTI STRIPPING ADDITIVE

When the Engineer requires heat-stable anti-stripping additive be added to the asphalt mix, then at the option of the Contractor, the method of adding anti-stripping additive can either be by direct mixing with the liquid asphalt, or by spraying on the aggregate on the cold feed. Once the method and type of anti-stripping additive proposed by the Contractor have been approved by the Engineer, the method, brand, grade, and amount of anti-stripping additive must not be changed without approval of the Engineer.

The amount of liquid anti-stripping additive designated by the Engineer to be used must not exceed 1 percent by weight of the liquid asphalt.

When polymer additives are sprayed on the aggregate, the amount will be designated by the Engineer, but must not exceed 0.67 percent by weight of the aggregate.

The use of another process or procedure for adding anti-stripping additive to the asphalt mix will be considered based on a proposal from the Contractor.

9-02.5 TEMPORARY PAVEMENT PATCH MATERIAL

Four temporary pavement patch material products approved by the Engineer for use include:

1. Unique Paving Material (UPM): Alpine Products, Phone: (253) 351-9828, E-mail: Skip@alpinetrafficproducts.com, Web-site: <http://www.upm.com>
2. Quality Pavement Repair (QPR): Phone: 1-800-388-4338, Web-site: <http://www.gprcoldpatch.com>
3. E Z Street: Lakeside Industries, PO Box 7016 Issaquah, WA 98027, Phone: (425) 313-2681, E-Mail: rickr@lakesideind.com, Web-site: <http://www.lakesideind.com>
4. U.S. Cold Patch: Phone: (425) 244-5000, Fax: (425) 423-9120, Web-site: <http://www.uscoldpatch.com/>

Other temporary patching products may be submitted to the Engineer for approval.

1 SECTION 9-03 AGGREGATES**2 9-03.0 GENERAL**

3 Mineral Aggregates most commonly used have each been given a Type number to identify a unique Mineral Aggregate
4 blend known as Mineral Aggregate Type (Number). See the definition of Mineral Aggregate in Section 1-01.3. Requirements
5 for each Mineral Aggregate identified by a Type number are specified in Sections 9-03.1, and 9-03.7 through 9-03.14. Mineral
6 aggregates must be composed of clean, and of uniform quality, particulate size groups, and free from wood waste and other
7 deleterious materials. They must be obtained only from sources approved by the Engineer. Written requests for source
8 approval must be submitted to the Engineer not less than 10 Working Days before the intended use of the Mineral Aggregate.
9 If the proposed source is one that the Engineer has no history of material performance with, the Engineer reserves the right to
10 take preliminary samples at the proposed source, and make preliminary tests, to first determine acceptability of the new
11 source and then perform the applicable material approval testing. Continued approval of a source is contingent upon the
12 Mineral Aggregates from that source continuing to comply with Contract Specifications.

13 Mineral aggregates must comply with the Specifications for grading and quality for use in the Work; however, allowable
14 exceptions may be specified in Contract. The Engineer reserves the right to sample and test Mineral Aggregate at any time
15 including at the source.

16 Recycled Materials to be used as aggregates must comply with the Specifications in Section 9-03.16(1).

17 All percentages are by weight unless otherwise specified.

18 9-03.1 AGGREGATES FOR PORTLAND CEMENT CONCRETE**19 9-03.1(1) GENERAL REQUIREMENTS**

20 Portland cement concrete aggregates must be manufactured from ledge rock, talus, or sand and gravel as specified in
21 Section 2-01. They must possess the characteristics of shape and size such that the concrete, resulting from a mixture of fine
22 and coarse aggregates in the specified proportions, has workability acceptable to the Engineer. Regardless of compliance with
23 these Specifications, if the concrete is not of a workable character, or does not exhibit a proper surface when finished, either
24 the fine or the coarse aggregate or both, will be rejected, or must be changed as required by the Engineer.

25 Before approval of any Portland cement concrete mix design, results of tests performed per ASTM C 1293 at an age of
26 12 months for the proposed coarse and fine aggregates must be submitted to the Engineer for evaluation of the potential for
27 alkali silica reaction (ASR). The test must be conducted by a laboratory accredited for the test and the test results must be no
28 older than 24 months from the date of the submittal. If results of ASTM C 1293 testing are not available, the Engineer may
29 accept results of ASTM C 295 for evaluation in the interim until results of ASTM C 1293 tests are available and submitted for
30 evaluation. In no case must the interim between the submittal of ASTM C 295 results and the submittal of ASTM C 1293
31 results exceed 14 months. If the time period between ASTM C 295 evaluation submittal and ASTM C 1293 test results
32 submittal exceeds 14 months, aggregate sources that have been approved for use in mix designs based on the results of
33 ASTM C 295 evaluation will be rejected, and mix design approvals incorporating those aggregates from those sources will be
34 rescinded.

35 It is the intent of this Specification that aggregate sources have current ASTM C 1293 test results on file and that those
36 results must be updated every 24 months at a maximum. The interim ASTM C 295 testing is intended to provide a mechanism
37 to evaluate new aggregate sources until ASTM C 1293 test results can be submitted and not as a means to gain final
38 approval. The 14 month time period between the submittal of ASTM C 295 test results and ASTM C 1293 test results is not
39 limited to a single contract and must begin upon the first submittal of ASTM C 295 test results regardless of project or contract.

40 Based on previous experience or on Laboratory tests, the Engineer may determine that concrete aggregates from a
41 given source are detrimentally reactive with alkalis in Portland cement, in which case that source must not be used. Upon
42 determination of detrimentally reactive aggregates, the Contractor may submit results of testing by ASTM 1567 for each
43 proposed mix design incorporating ASR mitigation measures for evaluation by the Engineer. If the Engineer determines that
44 the Contractor's ASR mitigation is effective for a mix design, the Engineer may approve the mix design for use. Determination
45 of the effectiveness of the proposed mitigation measures for a mix design must lie with the Engineer.

46 9-03.1(2) FINE AGGREGATE FOR PORTLAND CEMENT CONCRETE**47 9-03.1(2)A GENERAL**

48 Fine aggregate for Portland cement concrete must consist of sand or other inert Materials, or combinations thereof,
49 approved by the Engineer, having hard, strong, durable particles free from adherent coating. Fine aggregate must be washed
50 thoroughly to remove clay, loam, alkali, organic matter, or other deleterious matter.

51 9-03.1(2)B DELETERIOUS SUBSTANCES

52 The amount of deleterious substances in the washed aggregate must not exceed the following values:

- 53 1. Particles having a specific gravity less than 1.95 must not exceed 1.0 percent of total weight.
- 54 2. Organic matter, by calorimetric test, must not be darker than the reference standard color (organic plate No. 3)
55 AASHTO T 21 unless other tests prove a darker color to be harmless.

1 **9-03.1(2)C GRADING**

2 Fine aggregate for Portland cement concrete must be graded to conform to the following requirements expressed as
 3 percentages by weight:
 4

| Sieve | Type 6 | | Type 7 | |
|--|---------|------|---------|------|
| | Class 1 | | Class 2 | |
| | Max. | Min. | Max. | Min. |
| 3/8" square | -- | 100 | -- | 100 |
| % Passing U.S. No.4 | 100 | 95 | 100 | 95 |
| % Passing U.S. No.8 | 86 | 68 | -- | -- |
| % Passing U.S. No.16 | 65 | 47 | 80 | 45 |
| % Passing U.S. No.30 | 42 | 27 | -- | -- |
| % Passing U.S. No.50 | 20 | 9 | 30 | 10 |
| % Passing U.S. No.100 | 7 | 0 | 10 | 2 |
| % Passing U.S. No.200 (wet sieving) | 2.5 | 0 | 2.5 | 0 |

5
 6 For fine aggregate Class 1, individual test variations under the minimum or over the maximum will be permitted as
 7 follows, provided the average of 3 consecutive tests is within the Specification limits:
 8

| Sieve Number | Permissible Variation In Individual Tests |
|--------------------|---|
| No. 30 and coarser | 2.0% |
| No. 50 and finer | 0.5% |

9
 10 Within the gradation limits for fine aggregate Class 2, uniformity of gradation must be limited to a range of ± 0.20 of the
 11 reference Fineness Modulus. The reference Fineness Modulus must be determined from a representative sample from the
 12 proposed source as submitted by the Contractor.

13 **9-03.1(2)D USE OF SUBSTANDARD GRADINGS**

14 Fine aggregate with more than the maximum percentage passing any sieve may be accepted provided the cement
 15 content of the finished concrete is increased, at the Contractor's cost, by 1/3 percent for each 1 percent the fine aggregate
 16 passing each sieve is in excess of the maximum.

17 Fine aggregate Class 1 must not be used if it has a grading finer than the following:
 18

| Sieve Size | Percent Passing |
|--------------|-----------------|
| U.S. No. 8 | 95 |
| U.S. No. 16 | 80 |
| U.S. No. 30 | 60 |
| U.S. No. 50 | 25 |
| U.S. No. 200 | 2.5 |

19
 20 **9-03.1(2)E USE OF CRUSHED RECYCLED PORTLAND CEMENT CONCRETE**

21 Recycled Portland cement concrete must not be used as fine aggregate for new Portland cement concrete.

22 **9-03.1(3) COARSE AGGREGATE FOR PORTLAND CEMENT CONCRETE**

23 **9-03.1(3)A GENERAL**

24 Coarse aggregate for Portland cement concrete must consist of gravel, crushed stone, or other inert Material or
 25 combinations thereof approved by the Engineer, having hard, strong, durable pieces free from adherent coatings. Coarse
 26 aggregate must be washed thoroughly to remove clay, silt, bark, sticks, alkali, organic matter, or other deleterious material.

9-03.1(3)B DELETERIOUS SUBSTANCES

The amount of deleterious substances in the washed aggregate must not exceed the following values:

| Deleterious Substance | Not To Exceed |
|---|---------------|
| Amount finer than U.S. No. 200 | 0.5% |
| Pieces with a specific gravity less than 1.95 | 2.0% |
| Clay lumps | 0.5% |
| Shale | 2.0% |
| Wood Waste | 0.05% |

9-03.1(3)C DURABILITY

Coarse aggregate must not have a percentage of wear in the Los Angeles machine in excess of 35 after 500 revolutions per ASTM C 131. Additionally, when tested per WSDOT Test Method T 113, coarse aggregate must not have a Degradation Factor less than 30.

9-03.1(3)D GRADING

Coarse aggregate for Portland cement concrete when separated by means of laboratory sieves must conform to one or more of the following gradings as called for elsewhere in the Specifications, Special Provisions or in the Drawings:

| Sieve Size | Percent Passing | | | | | | | | | | | |
|---------------|------------------------|------|----------------------|------|-----------------------|------|-----------------------|------|----------------------|------|----------------------|------|
| | AASHTO Grading No. 467 | | AASHTO Grading No. 4 | | AASHTO Grading No. 57 | | AASHTO Grading No. 67 | | AASHTO Grading No. 7 | | AASHTO Grading No. 8 | |
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| 2" square | 100 | -- | 100 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1-1/2" square | 95 | 100 | 90 | 100 | 100 | -- | -- | -- | -- | -- | -- | -- |
| 1" square | -- | -- | 20 | 55 | 95 | 100 | 100 | -- | -- | -- | -- | -- |
| 3/4" square | 35 | 70 | 0 | 15 | -- | -- | 90 | 100 | 100 | -- | -- | -- |
| 1/2" square | -- | -- | -- | -- | 25 | 60 | -- | -- | 90 | 100 | 100 | -- |
| 3/8" square | 10 | 30 | 0 | 5 | -- | -- | 20 | 55 | 40 | 70 | 85 | 100 |
| U.S. No. 4 | 0 | 5 | -- | -- | 0 | 10 | 0 | 10 | 0 | 15 | 10 | 30 |
| U.S. No. 8 | -- | -- | -- | -- | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 10 |
| U.S. No. 16 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0 | 5 |

In individual tests, a variation of 4 percent under the minimum percentages or over the maximum percentages will be allowed. The average of 3 successive tests must be within the percentages stated above. Coarse aggregate must contain no pieces larger than two times the maximum sieve size for the specified grading measured along the line of greatest dimension.

Acceptance of grading and quality of the aggregate will be based on samples taken from stockpiles at the concrete plant. The exact point of acceptance will be determined in the field by the Engineer.

When the Engineer approves, the coarse aggregate may be blended from other sizes if:

1. The resulting aggregate complies with all requirements for specified grading;
2. Each size used makes up at least 5 percent of the blend;
3. The Contractor supplies the Engineer with gradings for the proposed sizes, along with their proper proportions. If the aggregate comes from commercial sources, the Contractor must supply this information and have it approved before proportioning and mixing the concrete.

9-03.1(3)E USE OF CRUSHED RECYCLED PORTLAND CEMENT CONCRETE

With the approval of the Engineer, crushed recycled Portland cement concrete may be used as coarse aggregate for classes of concrete with a specified compressive strength of 2,500 psi or less. Crushed recycled Portland cement concrete must comply with the Specifications for coarse aggregate contained in Section 9-03.1(3). Recycled concrete that exhibits effects of alkali silica reaction, carbonate silica reaction, sulfate reaction or any other deleterious condition, must not be used. The concrete producer must submit a certification that the crushed recycled concrete was produced from sound stock and is not affected by these or any other deleterious conditions.

In addition to the Specifications in Section 9-03.1(3)B, crushed recycled Portland cement concrete must contain an aggregated weight of less than 1 percent of asphalt concrete, brick, porcelain or other deleterious substances not otherwise noted.

Crushed recycled Portland cement concrete aggregate must be in a saturated condition before mixing and the water-cement ratio of the final mix must be limited to 0.45 maximum. Should the hardened concrete exhibit excessive cracking, unacceptable compressive strength or other undesirable characteristics, use of the mix must be discontinued.

9-03.1(4) COMBINED AGGREGATE GRADATION FOR PORTLAND CEMENT CONCRETE

As an option to using Coarse and Fine graded aggregates for Portland cement concrete, aggregate gradation may consist of a combined gradation. Aggregates must consist of sand, gravel, crushed stone, or other inert Material or combinations thereof, having hard, strong durable particles free from adherent coatings. Aggregates must be washed to remove clay, loam, alkali, organic matter, silt, bark, sticks, or other deleterious matter.

9-03.1(4)A DELETERIOUS SUBSTANCES

The amount of deleterious substances in the washed aggregate must not exceed the following values:

| Deleterious Substance | Not To Exceed |
|---|---------------|
| Particles of specific gravity less than 1.95 | 2.0% |
| Organic matter, by colorimetric test, must not be darker than the reference Standard color (organic plate No. 3) AASHTO T21 unless other tests prove a darker color to be harmless. | -- |
| Percentage of wear in Los Angeles machine for aggregates retained on the No. 4 sieve after 500 revolutions. | 35% |
| Clay Lumps | 0.3% |
| Shale | 1.00% |
| Wood Waste | 0.03% |
| Amount finer than No. 200 Sieve | 2.0% |

9-03.1(4)B GRADING

If a nominal maximum aggregate size is not specified, the Contractor must determine the nominal maximum aggregate size, using ACI 211.1 as a guide. In no case will the maximum aggregate size exceed 1/5 of the narrowest dimension between sides of the forms, 1/3 the depth of slabs, nor 3/4 of the minimum clear spacing between individual reinforcing bars, bundles of bars, or pretensioning strands.

The combined aggregate must conform to the following requirements based upon the nominal maximum aggregate size.

| Nominal Maximum Aggregate Size | 3 | 2-1/2 | 2 | 1-1/2 | 1 | 3/4 | 1/2 | 3/8 | No. 4 |
|--------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| 3-1/2" | 100 | | | | | | | | |
| 3" | 93-100 ¹ | 100 | | | | | | | |
| 2-1/2" | | 92-100 ¹ | 100 | | | | | | |
| 2" | 76-90 | | 90-100 ¹ | 100 | | | | | |
| 1-1/2" | 66-79 | 71-88 | | 87-100 ¹ | 100 | | | | |
| 1" | 54-66 | 58-73 | 64-83 | | 82-100 ¹ | 100 | | | |
| 3/4" | 47-58 | 51-64 | 55-73 | 62-88 | | 87-100 ¹ | 100 | | |
| 1/2" | 38-48 | 41-54 | 45-61 | | 57-83 | | 81-100 ¹ | 100 | |
| 3/8" | 33-43 | 35-47 | 39-54 | 43-64 | | 60-88 | | 86-100 ¹ | 100 |
| No. 4 | 22-31 | 24-34 | 26-39 | 29-47 | 34-54 | 41-64 | 48-73 | | 68-100 ¹ |
| No. 8 | 15-23 | 16-25 | 17-29 | 19-34 | 22-39 | 27-47 | 31-54 | 39-73 | |
| No. 16 | 9-17 | 10-18 | 11-21 | 12-25 | 14-29 | 17-34 | 20-39 | 24-54 | 28-73 |
| No. 30 | 5-12 | 6-14 | 6-15 | 7-18 | 8-21 | 9-25 | 11-29 | 13-39 | 16-54 |
| No. 50 | 2-9 | 2-10 | 3-11 | 3-14 | 3-15 | 4-18 | 5-21 | 6-29 | 7-39 |
| No. 100 | 0-7 | 0-7 | 0-8 | 0-10 | 0-11 | 0-14 | 0-15 | 0-21 | 0-29 |

| Nominal Maximum Aggregate Size | 3 | 2-1/2 | 2 | 1-1/2 | 1 | 3/4 | 1/2 | 3/8 | No. 4 |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| No. 200 | 0-2.0 | 0-2.0 | 0-2.0 | 0-2.0 | 0-2.0 | 0-2.0 | 0-2.0 | 0-2.0 | 0-2.5 |

1. NOTE: Nominal Maximum Size

Nominal maximum size for concrete aggregate is defined as the smallest standard sieve opening through which the entire amount of the aggregate is permitted to pass. Standard sieve sizes must be those listed in ASTM C 33.

The Owner may sample each component aggregate before introduction to the weigh batcher or as otherwise determined by the Engineer. Each separate component will be sieve analyzed alone per AASHTO Test Method T-11/27. All material components will be mathematically re-combined by proportions (weighted average), supplied by the Contractor.

9-03.1(5) COARSE AGGREGATES FOR PERVIOUS CONCRETE

9-03.1(5)A GENERAL

Aggregate for pervious concrete must be as specified in Sections 9-03.1(3)A, 9-03.1(3)B, and 9-03.1(3)C.

9-03.1(5)B GRADING

Aggregate for pervious concrete must conform to one of the following gradations:

| Total Percent Passing By Weight | Aggregate Gradation | |
|---------------------------------|---------------------------------------|------|
| | AASHTO No. 8 Size Aggregate Gradation | |
| Sieve Size | Min. | Max. |
| 1/2" square | 100% | -- |
| 3/8" square | 85% | 100% |
| U.S. No. 4 | 10% | 30% |
| U.S. No. 8 | 0% | 10% |
| U.S. No. 16 | 0% | 5% |
| U.S. No. 50 | -- | -- |
| U.S. No. 200 | 0% | 0.5% |

In individual tests, a variation of 4 percent under the minimum percentages or over the maximum percentages will be allowed on sieves size No. 16 and larger. For sieves smaller than No. 16, the maximum percentage passing must not exceed the limits shown for any single test. The average of 3 successive tests must be within the percentages stated above. Coarse aggregate must contain no pieces larger than 2 times the maximum sieve size for the specified grading measured along the line of greatest dimension.

Acceptance of grading and quality of the aggregate will be based on samples taken from stockpiles at the concrete plant. The exact point of acceptance will be determined in the field by the Engineer.

When the Engineer accepts, the pervious concrete aggregate may be blended from other sizes if:

1. The resulting aggregate complies with all requirements for the specified grading;
2. Each size used makes up at least 5 percent of the blend; and
3. The Contractor supplies the Engineer with the gradation for the proposed sizes, along with their proper proportions before producing the aggregate. If the aggregate comes from commercial sources, the Contractor must supply this information and have it accepted before proportioning and mixing the concrete.

9-03.2 AGGREGATE FOR BIORETENTION SOIL

9-03.2(1) GENERAL

In general, soil aggregate must be free of wood, waste, coating, or any other deleterious material, and all aggregate passing the No. 200 sieve size must be non-plastic.

9-03.2(2) MINERAL AGGREGATE FOR BIORETENTION SOIL

Sieve Analysis. Mineral aggregate for bioretention soils must be analyzed by an accredited lab using the sieve sizes noted below, and must meet the following gradation:

| Sieve Size | Percent Passing |
|--------------|-----------------|
| 3/8" square | 100 |
| U.S. No. 4 | 60-100 |
| U.S. No.10 | 40-100 |
| U.S. No. 40 | 15-50 |
| U.S. No. 200 | 2-5 |

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9-03.3 STREAMBED AGGREGATE

9-03.3(1) QUALITY

Aggregates for streambed construction must be washed, naturally-formed, round to subangular, hard, strong, sound, durable, fracture-free pieces of igneous and metamorphic rock. Aggregate must be free of soft, weathered materials and seams of soft rock, must not contain any wood and other waste, and must be free of any coating.

The Contractor must submit certified test reports indicating streambed aggregate complies with all requirements of this Section.

All sand size aggregate (passing a U.S. No. 4 sieve and retained on a US No. 200 sieve) must meet the following requirements:

| Property | Standard | Requirement |
|------------------|-------------|--------------|
| Specific Gravity | AASHTO T 84 | Minimum 2.65 |

All gravel (passing a 3-inch sieve and retained on a U.S. No. 4 sieve) and cobble (passing a 12-inch sieve and retained on a 3-inch sieve) aggregate must meet the same requirements for sand size aggregate and the following additional requirements:

| Property | Standard | Requirement |
|---------------|-------------|---------------------------------|
| Soundness | ASTM C 88 | Not greater than 5% loss |
| L.A. Abrasion | AASHTO T 96 | Max 20% loss at 500 revolutions |

All boulder size aggregate (retained on a 12-inch screen) must meet the same requirements for gravel and cobble and the following additional requirements:

| Property | Standard | Requirement |
|-----------------------|-------------|--------------------------------|
| Accelerated expansion | CRD-C-148 | Not greater than 15% breakdown |
| Absorption | AASHTO T 85 | Not greater than 2% |

9-03.3(2) GRADATIONS

Aggregate gradations for streambed construction are on a weight basis and must be as follows:

| Streambed Aggregate Type 1 | |
|----------------------------|-----------------|
| Sieve Size | Percent Passing |
| 8" | 95-100 |
| 3" square | 45-60 |
| 1-1/2" square | 30-40 |
| 3/4" square | 10-20 |
| U.S. No. 4 | 0-3 |

The portion passing the U.S. No. 4 sieve size must have a minimum sand equivalent of 60.

| Streambed Aggregate Type 2 | |
|----------------------------|-----------------|
| Sieve Size | Percent Passing |
| 16" | 95-100 |
| 8" | 55-75 |
| 3" | 20-35 |
| 1-1/2" | 0-15 |
| 3/4" | 0-5 |

| Streambed Aggregate Type 3 | |
|----------------------------|-----------------|
| Sieve Size | Percent Passing |
| 32" | 95-100 |
| 24" | 60-75 |
| 16" | 40-55 |
| 8" | 10-20 |
| 3" | 0-10 |
| 3/4" | 0-2 |

| Streambed Aggregate Type 4 | |
|----------------------------|-----------------|
| Sieve Size | Percent Passing |
| 8" | 90-100 |
| 6" | 45-65 |
| 4" | 15-30 |
| 3/4" | 0-3 |

9-03.4 AGGREGATE FOR BITUMINOUS SURFACE TREATMENT

9-03.4(1) GENERAL REQUIREMENTS

Aggregate for bituminous surface treatment must be manufactured from ledge rock, talus, or gravel, as specified in Section 3-01, which meets the following test requirements:

| Test | Requirements |
|----------------------------|--------------|
| Los Angeles Wear, 500 Rev. | 35% max. |
| Degradation Factor | 30 min. |

9-03.4(2) GRADING AND QUALITY

Aggregate for bituminous surface treatment must conform to the requirements in the following table for grading and quality. The particular type or grading to be used must be as shown on the Drawings. All percentages are by weight.

The Material must comply with these grading and quality Specifications when placed in hauling vehicles for delivery to the roadway, or during manufacture and placement into a temporary stockpile. The Engineer determines the exact point of acceptance.

| Sieve Size | Percent Passing | | | | | |
|-------------|---------------------|-----------|-----------------|-----------------|------------------|---------------|
| | Crushed Cover Stone | 3/4"-1/2" | 5/8" U.S. No. 4 | 1/2" U.S. No. 4 | 3/8" U.S. No. 10 | U.S. No. 4-0" |
| 1" square | 100 | 100 | -- | -- | -- | -- |
| 3/4" square | 100 | 95-100 | 100 | -- | -- | -- |
| 5/8" square | 95-100 | - | 95-100 | 100 | -- | -- |
| 1/2" square | -- | 0-20 | -- | 95-100 | 100 | -- |
| 3/8" square | -- | 0-5 | -- | -- | 90-100 | 100 |
| U.S. No. 4 | 20-45 | -- | 0-10 | 0-15 | 30-56 | 76-100 |

| Sieve Size | Percent Passing | | | | | |
|-----------------------------|---------------------|-----------|-----------------|-----------------|------------------|---------------|
| | Crushed Cover Stone | 3/4"-1/2" | 5/8" U.S. No. 4 | 1/2" U.S. No. 4 | 3/8" U.S. No. 10 | U.S. No. 4-0" |
| U.S. No. 10 | -- | -- | 0-3 | 0-3 | 0-10 | 30-60 |
| U.S. No. 200 | 0-7.5 | 0-1.0 | 0-1.0 | 0-1.0 | 0-1.0 | 0-10.0 |
| % fracture, by weight, min. | 90 | 90 | 90 | 90 | 90 | 90 |
| Sand equivalent min. | 40 | -- | -- | -- | -- | -- |
| Static Stripping Test | Pass | Pass | Pass | Pass | Pass | Pass |

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2 The fracture requirement must be at least one fractured face and applies to Material retained on each sieve size U.S. No.
3 4 and above if that sieve retains more than 5 percent of the total sample.

4 The finished product must be clean, uniform in quality, and free from wood, bark, roots, clay, any organic material, and
5 other deleterious materials.

6 Crushed screenings must be substantially free from adherent coatings. The presence of a thin, firmly adhering film of
7 weathered rock is not considered as coating unless it exists on more than 50 percent of the surface area of any size between
8 successive laboratory sieves.

9 The portion of aggregate for bituminous surface treatment retained on the U.S. No. 4 sieve must not contain more than
10 0.1 percent deleterious materials by weight.

11 **9-03.5 AGGREGATES FOR ASPHALT TREATED BASE (ATB)**

12 **9-03.5(1) GENERAL REQUIREMENTS**

13 Aggregates for asphalt treated base must be manufactured from ledge rock, talus, or gravel, as specified in Section 2-01
14 that meet the following test requirements:

| Test | Requirements |
|------------------------------------|--------------|
| Los Angeles Wear, 500 Rev. | 30% max. |
| Degradation Factor, Wearing Course | 15 min. |

16
17 **9-03.5(2) GRADING**

18 Aggregates for asphalt treated base must meet the following requirements for grading:

| Sieve Size | Percent Passing |
|--------------|-----------------|
| 2" square | 100 |
| 1/2" square | 56-100 |
| U.S. No. 4 | 32-72 |
| U.S. No. 10 | 22-57 |
| U.S. No. 40 | 8-32 |
| U.S. No. 200 | 2.0-9.0 |

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21 **9-03.5(3) TEST REQUIREMENTS**

22 When the aggregates are combined within the limits specified in Section 9-03.5(2) and mixed with the designated grade
23 of asphalt, the mixture must be capable of meeting the following test values:

| Test | Requirements |
|--|----------------------------|
| % of Theoretical Maximum Specific Gravity (G _{MM}) (approximate) | 93 @ 100 gyrations |
| Tensile Strength Ratio Test | 50 min. / no visual damage |

25
26 The sand equivalent value of the Mineral Aggregate for asphalt treated base must not be less than 35.

1 **9-03.6 AGGREGATES FOR HOT MIX ASPHALT (HMA)**

2 **9-03.6(1) GENERAL REQUIREMENTS**

3 Aggregates for HMA must be manufactured from ledge rock, talus, or gravel, as specified in Section 3-01, and must meet
4 the following test requirements:

| Test | Requirements |
|------------------------------------|--------------|
| Los Angeles Wear, 500 Rev. | 30% max. |
| Degradation Factor, Wearing Course | 30 min. |
| Degradation Factor, Other Courses | 20 min. |

6
7 The aggregate must be uniform in quality, and must be free from wood, roots, bark, extraneous materials, and adherent
8 coatings. The presence of a thin, firmly adhering film of weathered rock is not considered as coating unless it exists on more
9 than 50 percent of the surface area of the aggregate retained on any size sieve.

10 Aggregate removed from deposits contaminated with various types of wood waste must be washed, processed, selected,
11 or otherwise treated to remove sufficient wood waste so that the oven dried material retained on a U.S. No. 4 sieve does not
12 contain more than 0.1 percent by weight of material with a specific gravity less than 1.0.

13 **9-03.6(2) HMA TEST REQUIREMENTS**

14 Aggregate for HMA must meet the following test requirements:

- 15 1. The aggregate must meet the flat and elongated shape requirements, measured as percent by weight of flat-
16 elongated per ASTM D 4791. The percent must not exceed 10 percent and the ratio must be 5:1.
17 2. The fracture requirements for the combined coarse aggregate in the table below must apply to the aggregate retained
18 on each sieve U.S. No. 4 and larger when tested per AASHTO T 335:

| "Design ESALs" (Millions) | No. Fractured Faces | % Fracture |
|---------------------------|---------------------|------------|
| <10 | 1 | 90 |
| ≥10 | 2 | 90 |

- 20
21 3. The uncompacted void content for the combined fine aggregate is tested per Test Method for AASHTO T 304,
22 Method A. The minimum voids must be 45 percent.
23 4. The minimum sand equivalent must be 45.

24 During verification by the Laboratory, the mix design must produce HMA mixtures that when combined within the limits
25 specified in Section 9-03.6(6). and mixed with the designated grade of asphalt binder, using the Superpave gyratory
26 compactor per AASHTO T 312, and at the required gyrations for N design with the following properties:

| HMA Mix Criteria | HMA Class | | | | | | | |
|-------------------------------------|------------------------------------|------|----------------------|------|---------------------|------|----------------------|------|
| | 3/8 Inch | | 1/2 Inch | | 3/4 Inch | | 1 Inch | |
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| Voids in Mineral Aggregate (VMA), % | 15.0 | -- | 14.0 | -- | 13.0 | -- | 12.0 | -- |
| ESALs (Millions) | Voids Filled With Asphalt (VFA), % | | | | | | | |
| < 0.3 | 70 | 80 | 70 | 80 | 70 | 80 | 67 | 80 |
| 0.3 to < 3 | 65 | 78 | 65 | 78 | 65 | 78 | 65 | 78 |
| 3 to < 10 | 73 | 76 | 65 | 75 | 65 | 75 | 65 | 75 |
| 10 to < 30 | 73 | 76 | 65 | 75 | 65 | 75 | 65 | 75 |
| ≥ 30 | 73 | 76 | 65 | 75 | 65 | 75 | 65 | 75 |
| Dust / Asphalt Ratio | 0.6 | 1.6 | 0.6 | 1.6 | 0.6 | 1.6 | 0.6 | 1.6 |
| Tensile Strength Ratio | 80 min. / no visible damage | | | | | | | |
| | ESALs (Millions) | | N _{Initial} | | N _{Design} | | N _{Maximum} | |
| % G _{mm} | < 0.3 | | ≤ 91.5 | | 96.0 | | ≤ 98.0 | |
| | 0.3 to < 3 | | ≤ 90.5 | | 96.0 | | ≤ 98.0 | |
| | ≥ 3 | | ≤ 89.0 | | 96.0 | | ≤ 98.0 | |

| HMA Mix Criteria | HMA Class | | | | | | | |
|--|------------|------|----------|------|----------|------|--------|------|
| | 3/8 Inch | | 1/2 Inch | | 3/4 Inch | | 1 Inch | |
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| Gyratory Compaction (number of gyrations) | < 0.3 | | 6 | | 50 | | 75 | |
| | 0.3 to < 3 | | 7 | | 75 | | 115 | |
| | 3 to < 30 | | 8 | | 100 | | 160 | |
| | ≥ 30 | | 9 | | 125 | | 205 | |

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During the production run of each approved JMF, the HMA will not be evaluated for VMA or VFA for quality assurance purposes. The fine aggregate angularity, flat and elongated particles, and fracture and sand equivalent requirements apply at the time of HMA production.

9-03.6(3) GRADING

9-03.6(3)A GRADATION

The Contractor may furnish aggregates for use on the same Contract From a single stockpile or from multiple stockpiles, as long as all aggregate is from the same source. The gradation of the aggregates, including any use of RAP, mineral filler, and blending sand, must be such that the completed mixture complies in all respects with Section 9-03.6(6).

Acceptance of the aggregate gradation will be based on samples taken from the final mix.

9-03.6(3)B RECYCLED ASPHALT PAVEMENT (RAP)

Asphalt concrete planings or old asphalt concrete utilized in the production of asphalt concrete must be sized before entering the mixer so that a uniform and thoroughly mixed asphalt concrete is produced in the mixer. If there is evidence of the old asphalt concrete not breaking down during the heating and mixing of the asphalt concrete, the Engineer may elect to change the maximum size entering the mixer. No contamination by deleterious materials will be allowed in the old asphalt concrete used.

RAP may be added to the mix in the proportions specified in Section 5-04.2(1). The Contractor is responsible for gradation for the new aggregate used in the production of the asphalt concrete, and when combined with recycled material, the combined Material must comply with the gradation Specifications of Sections 9-03.6(6) and 9-03.6(7) for the specified class of HMA, in unless the Contract specifies otherwise. The new aggregate must comply with the general Specifications in Section 9-03.6(1) and must comply with the appropriate fracture Specifications in Section 9-03.6(2) item 2 for coarse aggregate, and sand equivalent requirements specified in Sections 9-03.6(2) and 9-03.6(4) for blending sand.

9-03.6(3)C RECYCLED PORTLAND CEMENT CONCRETE RUBBLE AND STEEL FURNACE SLAG

Recycled Portland cement concrete rubble and/or steel furnace slag may be blended with virgin aggregates in the proportions specified in Section 9-03.16(1)E. The proportion of each of these Materials in the mix will be considered independently and not cumulatively. The final mix must comply with the Specifications in Section 9-03.6. Recycled Portland cement concrete rubble and steel furnace slag must be as specified in Sections 9-03.16(1)B and 9-03.16(1)D respectively.

The Contractor must indicate on the mix design submittal the percentage of each in the proposed mix design.

9-03.6(4) BLENDING SAND

Blending sand must be clean, hard, sound Material, either naturally occurring sand or crusher fines, and must be material which will readily accept an asphalt coating. The exact grading requirements for the blending sand must be such that, when it is mixed with an aggregate, the combined product must comply with Section 9-03.6(6) for the specified class of HMA. Blending sand must have a sand equivalent value of at least 30.

9-03.6(5) MINERAL FILLER

Mineral filler, when used in HMA, must conform to the requirements of AASHTO M 17.

9-03.6(6) HMA PROPORTIONS OF MATERIALS

The Materials of which HMA is composed must consist of such sizes, grading, and quantity that when proportioned and mixed together, produce a well graded mixture complying with the requirements that follow.

The Contractor's HMA mix design must be between the following control points:

| HMA Aggregate Gradation Control Points | | | | |
|--|-----------------------|-----------------------|-----------------------|---------------------|
| Sieve Size | Percent Passing | | | |
| | HMA Class 3/8 Inch | HMA Class 1/2 Inch | HMA Class 3/4 Inch | HMA Class 1 Inch |
| 1 1/2" square | | | | 100 |
| 1" square | | | 100 | 90-100 |
| 3/4" square | | 100 | 90-100 | 90 maximum |
| 1/2" square | 100 | 90-100 | 90 maximum | |
| 3/8" square | 90-100 | 90 maximum | | |
| U.S. No. 4 | 90 maximum | | | |
| U.S. No. 8 | 3-67 | 28-58 | 23-49 | 19-45 |
| U.S. No. 200 | 2.0-7.0 | 2.0-7.0 | 2.0-7.0 | 1.0-7.0 |

The aggregate percentage refers to completed dry mix, and includes mineral filler when used.

9-03.6(7) HMA TOLERANCES AND ADJUSTMENTS

After the Job Mix Formula (JMF) is determined as required in 5 04.3(7)A, the constituents of the mixture at the time of acceptance must conform to the following tolerances:

| Aggregate, Percent Passing ¹ | Tolerance |
|---|--|
| 1", 3/4", 1/2" and 3/8" sieves | ± 6% each sieve |
| U.S. No. 4 sieve | ± 6% |
| U.S. No. 8 sieve | ± 6% |
| U.S. No. 200 sieve | ± 2.0% |
| Asphalt binder | ± 0.5% |
| VMA ² | 1% below minimum value in Section 9-03.6(2) |
| VFA ² | Min. and Max. as listed in Section 9-03.6(2) |
| V _a ³ | 2.5% minimum and 5.5% maximum |

NOTES:

- The tolerance limit for aggregate must not exceed the limits of the control points specified in Section 9-03.6(6), except the tolerance limits for sieves designated as 100 percent passing must be 99 to 100. The tolerance limits on sieves must only apply to sieves with control points.
- The tolerances for VMA and VFA are for mix verification only.
- The tolerance for V_a is for mix verification and acceptance.

Adjustments beyond the limits below require approval by the Engineer and require the development of a new mix design.

- Aggregates: The Engineer may approve the Contractor's written request to adjust the JMF. The maximum adjustment from the approved mix design must be 2 percent for the aggregate retained on the U.S. No. 8 sieve and above, 1 percent for aggregate passing the U.S. No. 8 sieve, and 0.5 percent for the aggregate passing the U.S. No. 200 sieve. These field adjustments to the JMF will only be considered if the changes produce Material of equal or better quality. The adjusted JMF and allowed tolerances must be within the range of the control points specified in Section 9-03.6(7). V_a of the adjusted JMF must remain within the limits shown above.
- Asphalt Binder Content: The Engineer may order the Contractor, or may approve the Contractor's written request, to change the JMF asphalt binder content a maximum of 0.3 percent from the approved mix design.

9-03.7 AGGREGATES FOR BALLAST AND CRUSHED SURFACING

9-03.7(1) BALLAST

Roadway ballast must be manufactured from ledge rock or talus obtained from sources approved by the Engineer. Roadway ballast must be as specified in Section 9-03.14 for Mineral Aggregate Type 14.

That portion of roadway ballast retained on a 1/4 inch square sieve must not contain more than 0.2 percent wood waste.

The Material from which ballast is to be manufactured must have a Degradation Value not less than 15 when tested per WSDOT Test Method T 113.

1 Mineral aggregate type 1 or type 2 may be substituted for roadway ballast in lieu of Mineral Aggregate Type 14 when
2 specified in the Contract.

3 Ballast must be a crushed Material with no naturally occurring surfaces. The term ballast must apply to Material retained
4 on each sieve size U.S. No. 4 and above if that sieve retains more than 5 percent of the total sample.

5 **9-03.7(2) SHOULDER BALLAST**

6 Shoulder ballast must be as specified in Section 9-03.7(1) for ballast except the gradation must be as specified in Section
7 9-03.14 for Mineral Aggregate Type 13. The sand equivalent and dust ratio requirements do not apply; however, the L. A.
8 Abrasion and Degradation Factor requirements do apply.

9 **9-03.7(3) CRUSHED ROCK**

10 Except as otherwise specified in the remainder of this Section, crushed rock must be manufactured from ledge rock or
11 talus and must comply with the grading, sand equivalent, and L. A. Abrasion Specifications of Section 9-03.14 for Mineral
12 Aggregate Type 1, Type 2, and Type 3.

13 Crushed rock must have a Degradation Value of not less than 25 when tested per WSDOT Test Method T 113.

14 Crushed rock must be a totally crushed Material with no naturally occurring faces and must apply to Material retained on
15 each sieve size No. 10 and above if that sieve retains more than 5 percent of the total sample. Crushed rock material retained
16 on a No. 4 sieve must contain no more than 0.15 percent by weight of wood waste.

17 See Section 4-04.2 for possible use of other Mineral Aggregates in lieu of Crushed Rock, Mineral Aggregates Type 1 and
18 Type 2.

19 **9-03.7(4) MAINTENANCE ROCK**

20 Maintenance rock must be as specified in Section 9-03.7(3) for crushed surfacing top course except that it must comply
21 with the grading Specifications for Mineral Aggregate Type 3 in Section 9-03.14.

22 **9-03.7(5) SAND FILLER**

23 Sand filler must be natural deposit angular grains, Mineral Aggregate Type 11 be as specified in Section 9-03.14.

24 **9-03.8 AGGREGATE FOR GRAVEL BASE**

25 Gravel base must be as specified in Section 9-03.10(2) for Mineral Aggregate Type 17.

26 **9-03.9 CRUSHED GRAVEL**

27 Crushed gravel must be manufactured from mechanically crushed clean, washed gravel, and must comply with the
28 grading, sand equivalent, and L. A. Abrasion Specifications of Section 9-03.14 for Mineral Aggregate Types 1G, 2G, and 21
29 through 24.

| Mineral Aggregate Type | Number Of Fractured Surfaces | Minimum Percent Required |
|------------------------|------------------------------|--------------------------|
| 1G | 2 or more | 90% |
| 2G | 2 or more | 90% |
| 21 | 1 or more | 75% |
| 22 | 2 or more | 90% |
| 23 | 1 or more | 75% |
| 24 | 2 or more | 95% |

31
32 These fracture requirements apply to aggregates retained on all sieves sized U.S. No. 4 and larger, retaining at least 5
33 percent of total Mineral Aggregate weight.

34 See Section 4-04.2 for possible use of other Mineral Aggregates in lieu of Crushed Gravel, Mineral Aggregates.

35 Crushed gravel and crushed rock must be substantially free from adherent coatings. The presence of a thin, firmly
36 adhering film of weathered rock is not considered as coating unless it exists on more than 50 percent of the surface area of
37 any size between successive laboratory sieves.

38 The combined portion of Mineral Aggregate retained on the U.S No. 4 sieve must not contain more than 0.1 percent
39 wood waste by weight. The portion of Material passing a U.S. No. 10 sieve must not have wood waste that results in more
40 than 250 parts per million of organic matter by calorimetric tests when tested. The color must be measured after the sample
41 has been in the test solution for 1 hour.

42 If Mineral Aggregates Type 1R and Type 2R is used as base course under asphalt concrete pavement or other non-rigid
43 pavement, then the Mineral Aggregate must have a minimum CBR (California Bearing Ratio) of 70 per AASHTO T 193 (ASTM
44 D1883).

1 **9-03.10 PIT RUN SAND, WASHED SAND, AND GRAVEL BACKFILL**

2 Gravel backfill must consist of crushed, partially crushed, or naturally occurring granular Material corresponding to the
3 Type of Mineral Aggregate specified in the Contract.

4 **9-03.10(1) GRAVEL BACKFILL FOR FOUNDATIONS**

5 **9-03.10(1)A CLASS A BACKFILL**

6 Class A gravel backfill for foundations must be as specified in Sections 9-03.7 and 9-03.14 for Type 2 or Type 14 Mineral
7 Aggregates. When not specified in the Contract, Class A gravel backfill must be Mineral Aggregate Type 2.

8 **9-03.10(1)B CLASS B BACKFILL**

9 Class B gravel backfill for foundations must be Mineral Aggregates Type 17 or Type 27 per Section 9-03.14.

10 **9-03.10(2) GRAVEL BACKFILL FOR WALLS**

11 Gravel backfill for walls must consist of free draining sand and gravel from naturally occurring or screened sources; have
12 such characteristics of size and shape that it readily compacts; and be as specified in Section 9-03.14 for Mineral Aggregate
13 Type 17.

14 The combined portion of Material retained on a U.S. No. 4 sieve must contain no more than 0.20 percent by weight of
15 wood waste.

16 Gravel backfill for mechanically stabilized earth walls must be as specified in the Contract.

17 **9-03.10(3) GRAVEL AND SAND BACKFILL FOR PIPE BEDDING**

18 The Contract specified class of Sewer and Storm Drain pipe bedding must comply with both Standard Plan 285 and
19 Section 7-17.3(1), and must be Mineral Aggregate Type 9 and Type 22 as specified in this Section and Section 9-03.14.

20 Water Main distribution pipe bedding Material must be as specified in Section 9-03.14 for Mineral Aggregates Type 6 or
21 Type 7 and Section 9-03.1(2). Water Main transmission pipe bedding must be as specified in Section 9-03.14 for Mineral
22 Aggregate Type 9 as shown on Standard Plan 350 and this Section. The bedding Class specified on the Drawings must be as
23 shown on Standard Plan 350.

24 Pea gravel bedding, Mineral Aggregate Type 9, must consist of screened sand, gravel, or other inert Materials, or
25 combinations thereof, from sources approved by the Engineer, and must have hard, strong, durable particles free from
26 adherent coatings. The Material must be washed thoroughly to remove clay, loam, alkali, organic matter, or other deleterious
27 substances. The amount of deleterious substances remaining in the washed pea gravel must not exceed values specified in
28 Section 9-03.1(2)B.

29 Crushed gravel bedding, Mineral Aggregate Type 22 must be manufactured from screened crushed gravel. The finished
30 product must be clean, uniform in quality, and free from wood, bark, roots, and other deleterious materials. The crushed
31 screenings must be substantially free from adherent coatings. The presence of a thin, firmly adhering film of weathered rock is
32 not considered as coating unless it exists on more than 50 percent of the surface area of any size between successive
33 laboratory sieves. The portion of Mineral Aggregate Type 22 retained on a U.S. No. 4 sieve must not contain more than 0.1
34 percent deleterious materials by weight.

35 **9-03.10(4) GRAVEL BACKFILL FOR DRAINS**

36 Gravel backfill for drains must comply with the requirements for Mineral Aggregate Type 26 in Section 9-03.10(6).

37 **9-03.10(5) PIT RUN SAND AND GRAVEL**

38 Pit run sand and gravel must consist of free draining granular materials obtained from naturally occurring deposits or
39 manufactured from screened gravel.

40 Pit run sand must be as specified in Section 9-03.14 for Mineral Aggregate Type 10.

41 Pit run sandy gravel must be as specified in Section 9-03.14 for Mineral Aggregate Type 15.

42 **9-03.10(6) WASHED SAND AND GRAVEL**

43 Washed sand and gravel must be as specified in Section 9-03.14 for Mineral Aggregate Types 4, 5, 6, 7, 26, and 28,
44 whichever is specified in the Contract.

45 Washed sand and gravel must consist of screened sand, gravel or other inert Materials, or combinations thereof, from
46 sources approved by the Engineer, having hard, durable particles free from adherent coatings. The Materials must be washed
47 thoroughly to remove clay, loam, alkali, organic matter, or other deleterious substances. The amount of deleterious substances
48 in the washed sand or gravel must not exceed the values specified in Section 9-03.1(2)B for Mineral Aggregate Types 6, 7, 26,
49 and 28 and Section 9-03.1(3)B for Mineral Aggregate Types 4 and 5.

50 **9-03.10(7) QUARRY RUN CRUSHED ROCK**

51 Quarry run crushed rock must:

- 1 1. Be Mineral Aggregate Type 27 complying with the gradation, sand equivalent, dust ratio, and L.A. abrasion
- 2 Specifications of Section 9-03.14.
- 3 2. Be 100 percent crushed.
- 4 3. Have a plasticity index of 4 maximum.
- 5 4. Be free of wood and organic matter.

6 Mineral Aggregate Type 27 may be used as specified in the Contract as a select fill. Also see Section 9-03.10(1)B.

7 **9-03.11 BACKFILL FOR SAND DRAIN**

8 **9-03.11(1) SAND DRAIN BACKFILL**

9 Sand drain backfill must conform to the following gradation, which does not correspond to a Mineral Aggregate Type in
 10 Section 9-03.14:

| Sieve Size | Percent Passing |
|--------------|-----------------|
| 1/2" square | 90-100 |
| U.S. No. 4 | 58-100 |
| U.S. No. 10 | 40-100 |
| U.S. No. 50 | 3-30 |
| U.S. No. 100 | 0-4 |
| U.S. No. 200 | 0-3.0 |

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 13 **9-03.11(2) SAND DRAINAGE BLANKET**

14 Aggregate for the sand drainage blanket must consist of granular material, free from wood and other extraneous
 15 material, and must comply with the following grading requirements, which does not correspond to a Mineral Aggregate Type in
 16 Section 9-03.14:

| Sieve Size | Percent Passing |
|---------------|-----------------|
| 2 1/2" square | 90-100 |
| U.S. No. 4 | 23-100 |

17
 18
 19 The portion passing the U.S. No. 4 sieve must comply with the following grading requirements:

| Sieve Size | Percent Passing |
|--------------|-----------------|
| U.S. No. 10 | 50-100 |
| U.S. No. 50 | 0-30 |
| U.S. No. 100 | 0-7.0 |
| U.S. No. 200 | 0-3.0 |

20
 21
 22 That portion of backfill for sand drains and sand drainage blanket retained on the U.S. No. 4 sieve must contain no more
 23 than 0.05 percent by weight of wood waste.

24 **9-03.12 GRAVEL BORROW**

25 Unless otherwise specified in the Contract, gravel borrow must be as specified in Section 9-03.10(2) and the grading
 26 Specifications in Section 9-03.14 for Mineral Aggregate Type 17.

27 If requested by the Contractor, the screen size may be increased if it is determined by the Engineer that larger size
 28 aggregate will be acceptable for the specified backfilling or embankment construction.

29 **9-03.13 TEST METHODS FOR AGGREGATES**

30 Material properties in these Specifications must be determined using the following test methods:

| Title | Test Method |
|---|-------------|
| Sampling of Aggregates | AASHTO T 2 |
| Organic Impurities in Fine Aggregate for Concrete | AASHTO T 21 |

| Title | Test Method |
|---|--------------|
| Clay Lumps and Friable Particles in Aggregates | AASHTO T 112 |
| Resistance to Degradation of Small-Size Coarse Aggregates by Abrasion and Impact in the Los Angeles Machine | AASHTO T 96 |
| Material Finer than U.S. No. 200 Sieve in Aggregates | AASHTO T 11 |
| Percent Fracture in Coarse Aggregates | AASHTO T 335 |
| Sieve Analysis of Fine and Coarse Aggregates | AASHTO T 27 |
| Method of Test for Determination of Degradation Value | WSDOT T 113 |
| Lightweight Pieces in Aggregates | AASHTO T 113 |
| Flat and Elongated Particles in Coarse Aggregate | ASTM D 4791 |
| Sand Equivalent | AASHTO T 176 |
| Determination of Length Change of Concrete Due to Alkali-Silica Reaction | ASTM C 1293 |
| Petrographic Examination of Aggregates for Concrete | ASTM C 295 |
| Determining the Potential Alkali-Silica Reactivity of Combination of Cementitious Materials and Aggregate (Accelerated Mortar Bar Method) | ASTM C 1567 |
| Specific Gravity and Absorption of Coarse Aggregate | AASHTO T 85 |
| Specific Gravity and Absorption of Fine Aggregate | AASHTO T 84 |
| Determining the Liquid Limit of Soils | AASHTO T 89 |
| Determining the Plastic Limit and Plasticity Index of Soils | AASHTO T 90 |
| Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate | AASHTO T 104 |
| Method of Testing Stone for Expansive Breakdown on Soaking in Ethylene Glycol | CRD-C 148 |
| Resistance of Compacted Hot Mix Asphalt (HMA) to Moisture Induced Damage | AASHTO T 283 |
| Uncompacted Void Content of Fine Aggregate | AASHTO T 304 |
| Preparing and Determining the Density of the Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyrotory Compactor | AASHTO T 312 |
| Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt (HMA) | AASHTO T 209 |
| Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method | AASHTO T 308 |
| Standard Test Method for Potential Expansion of Aggregates from Hydration Reactions | ASTM D 4792 |

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9-03.14 MINERAL AGGREGATE CHART

Commonly used Mineral Aggregates are found in the following Mineral Aggregate Chart. The "No." indicated at the top of column 1 is commonly referred to as Mineral Aggregate "Type" number.

Gradation requirements for Mineral Aggregates Type 6 and Type 7 indicated on the following Mineral Aggregate Chart require additional sieves. These Mineral Aggregate Types are noted with a "*" in the first column labeled "No.". See the specified "Standard Specification Section" for these noted additional required sieves.

1

Mineral Aggregate Chart

| No. | Aggregate Type | Use | Standard Specification Section | Sieve Sizes | | | | | | | | | | | | | | | | | Sand Equivalent (Min.) | Dust Ratio (Max.) | L.A. Abrasion (Max.) % |
|-----|-----------------------------|-----------------------------|--------------------------------|--|-------|-------|-------|--------|------|--------|--------|--------|--------|--------|--------|--------|-------|--------|-------|--------|------------------------|-------------------|------------------------|
| | | | | Sieve Analysis-Percent Passing By Weight | | | | | | | | | | | | | | | | | | | |
| | | | | 200 (wet sieving) | 50 | 40 | 10 | 8 | 6 | 4 | 3/8 | 1/2 | 5/8 | 3/4 | 1 | 1-1/4 | 1-1/2 | 2 | 2-1/2 | 3 | | | |
| 1. | 3/4" Minus Crushed Rock | Top Course & Keystone | 9-03.7(3) | 0-10 | -- | 8-24 | -- | -- | -- | 46-66 | -- | -- | -- | 100 | -- | -- | -- | -- | -- | 40 | -- | 35 | |
| 1G. | 3/4" Minus Crushed Gravel | Top Course & Keystone | 9-03.9 | 0-10 | -- | 8-24 | -- | -- | -- | 46-66 | -- | -- | -- | 100 | -- | -- | -- | -- | -- | 40 | -- | 35 | |
| 2. | 1-1/4" Minus Crushed Rock | Base Course | 9-03.10(1)A | 0-7.5 | -- | 3-18 | -- | -- | -- | 25-45 | -- | -- | 50-80 | -- | 80-100 | 100 | -- | -- | -- | 40 | -- | 35 | |
| 2G. | 1-1/4" Minus Crushed Gravel | Base Course | 9-03.9 | 0-7.5 | -- | 3-18 | -- | -- | -- | 25-45 | -- | -- | 50-80 | -- | 80-100 | 100 | -- | -- | -- | 40 | -- | 35 | |
| 3. | Maintenance Rock | | 9-03.7(3) 9-03.7(4) | 0-7 | -- | 10-25 | -- | -- | -- | 45-66 | -- | 90-100 | 100 | -- | -- | -- | -- | -- | -- | 40 | -- | 35 | |
| 4. | 1-1/2" Washed Gravel | Drain Rock AASHTO #4 | 9-03.10(6) | 0-0.5 | -- | -- | -- | -- | -- | 0-5 | -- | -- | 0-15 | 20-55 | -- | 90-100 | 100 | -- | -- | -- | -- | 35 | |
| 5. | 1" Washed Gravel | Drain Rock AASHTO #57 | 9-03.10(6) | 0-0.5 | 0-1 | -- | -- | 0-5 | -- | 0-10 | -- | 25-60 | -- | -- | 95-100 | -- | 100 | -- | -- | -- | -- | 35 | |
| 6. | Washed Sand | | 9-03.10(6) | 0-2.5 | 9-20 | -- | -- | 68-86 | -- | 95-100 | 100 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| 7. | Building Sand | | 9-03.10(6) | 0-2.5 | 10-30 | -- | -- | -- | -- | 95-100 | 100 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| 9. | 3/8" Washed Gravel | Pipe Bedding AASHTO #8 | 9-03.10(3) | 0-1 | -- | -- | -- | 0-10 | -- | 10-30 | 80-100 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 35 | |
| 10. | Pit Run Sand | Backfill Embankment | 9-03.10(5) | 0-10 | 10-60 | -- | -- | 40-100 | -- | 75-100 | 100 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| 11. | Sand Filler | | 9-03.7(5) | 0-15 | -- | 15-40 | 40-75 | -- | -- | 80-100 | 100 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| 13. | 2-1/2" Minus Crushed Rock | Shoulder Ballast | 9-03.7(2) | 0-1 | -- | -- | -- | -- | -- | 0-5 | -- | -- | -- | 40-80 | -- | -- | -- | 65-100 | 100 | -- | -- | 40 | |
| 14. | 2-1/2" Crushed Rock | Roadway Ballast | 9-03.10(1)A | 0-9 | -- | 0-16 | -- | -- | -- | 26-44 | -- | -- | -- | -- | 50-85 | -- | -- | 65-100 | 100 | -- | 35 | 2/3 | 40 |
| 15. | Pit Run Sandy Gravel | Backfill Embankment | 9-03.10(5) | 0-10 | -- | -- | -- | -- | -- | 19-38 | -- | -- | -- | 100 | -- | -- | -- | -- | -- | -- | -- | 30 | |
| 17. | Bank Run Gravel | Selected Backfill | 9-03.10 | 0-5 | -- | -- | -- | -- | -- | 24-71 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 95-100 | 60 | 2/3 | -- |
| 21. | 1-1/2" Crushed Gravel | | 9-03.9 | 0-3 | -- | -- | -- | -- | -- | 0-24 | -- | 45-70 | 85-100 | -- | -- | -- | 100 | -- | -- | -- | -- | 30 | |
| 22. | 3/4" Crushed Gravel | VCP, PVC & CMP Pipe Bedding | 9-03.9 9-03.10(3) | 0-3 | -- | -- | -- | -- | -- | 0-24 | -- | 45-100 | -- | 100 | -- | -- | -- | -- | -- | -- | -- | -- | |
| 23. | 1/2" Minus Crushed Gravel | Cover Rock | 9-03.9 | 2-12 | -- | -- | 40-75 | -- | -- | 63-100 | -- | 100 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 30 | |
| 24. | 1/2" Minus Crushed Gravel | Chip Rock | 9-03.9 | 0-3 | -- | 0-5 | 0-10 | -- | 0-20 | 25-85 | 90-100 | 100 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 30 | |
| 26. | 3/4" Washed Sandy Gravel | Filter Material | 9-03.10(6) | 0-1 | 3-12 | -- | -- | 20-50 | -- | 28-56 | -- | -- | -- | 100 | -- | -- | -- | -- | -- | -- | -- | 35 | |
| 27. | Quarry Run Crushed Rock | Select Fill | 9-03.10(1)B | 0-15 | -- | 0-50 | -- | -- | -- | 20-70 | -- | -- | -- | 70-100 | -- | -- | -- | 100 | -- | 25 | 2/3 | 35 | |
| 28. | 3/4" Washed Gravel | Drain Rock AASHTO #67 | 9-03.10(6) | 0-1 | -- | -- | -- | 0-5 | -- | 0-10 | 20-55 | -- | -- | 90-100 | 100 | -- | -- | -- | -- | -- | -- | 35 | |

2

9-03.15 ROCK FACING MATERIAL

Rock for constructing new rock facing must be large, broken pieces of igneous and metamorphic rock types. Each rock must be rectangular, intact, fracture free, of sound and durable material, resistant to weathering, and free of soft weathered material and seams of soft rock susceptible to deterioration.

The size categories for rock must be as follows:

| Size | Approx. Weight | Min. Approx. Dimensions | Approx. Volume |
|----------------|----------------|-------------------------|----------------|
| One-man rock | 200-400 lbs | 12" | 2 cf |
| Two-man rock | 500-800 lbs | 13" | 4 cf |
| Three-man rock | 900-1200 lbs | 16" | 6.6 cf |
| Four-man rock | 1300-2000 lbs | 18" | 12.5 cf |
| Five-man rock | 2000-4000 lbs | 24" | 18.5 cf |
| Six-man rock | 4100-6000 lbs | 30" | 31 cf |

Do not use rocks less than 1-1/2 cubic foot in volume.

The Contractor must provide the services of an ASTM or AASHTO accredited testing laboratory approved by the Engineer to sample the rock from the quarry source, ensuring that rock samples are representative of the rock anticipated for use on the project, and to perform the following laboratory tests:

| Characteristic | Standard | Allowance |
|-----------------------|------------------------------|------------------------------------|
| Specific Gravity | ASTM C 127 | Minimum 2.65 |
| Soundness | AASHTO T 104 (section 5.2.2) | Not greater than 5% loss |
| Accelerated Expansion | CRD C 148 | Not greater than 15% breakdown |
| Absorption | ASTM C 127 | Not greater than 2% |
| L. A. Abrasion | ASTM C 131 | Maximum 20% loss @ 500 revolutions |

All rock to be delivered to and incorporated into the project where rock facing is over 6 feet high, must meet the minimum testing requirements noted above; the rock must be stockpiled in a separate pile at the quarry before delivery to the Project Site and must be protected from contamination with other, untested rock sources.

9-03.16 RECYCLED MATERIAL**9-03.16(1) GENERAL REQUIREMENTS**

Recycled materials that are identified below may be used in lieu of, or blended uniformly with, naturally occurring materials for aggregates in the percentages shown in Section 9-03.16(1)E. The final blended product must comply with the requirements for the specified type of aggregate. In addition, each recycled material component included in a blended product, must comply with the specific requirements listed below. The Contractor must provide a certification that the recycled materials are in conformance with the Standard Specifications before delivery. The certification must include the percent by weight of each recycled material.

For recycled materials that are imported to the Job Site, the Contractor must certify that the recycled material is not a Washington State Dangerous Waste per the Dangerous Waste Regulations contained in WAC 173-303. Upon request of the Engineer, the Contractor must provide results of testing supporting the certification.

9-03.16(1)A RECYCLED HOT MIX ASPHALT

For aggregates incorporating recycled hot mix asphalt, the Contractor must verify the maximum bitumen content for the blended mix. The Contractor must use AASHTO T 308 (0.70 may be used as a calibration factor) and AASHTO T 329 or other tests approved by the Engineer to determine the total bitumen content.

9-03.16(1)B RECYCLED PORTLAND CEMENT CONCRETE RUBBLE

Portland cement concrete rubble to be recycled into construction aggregates must not have been painted or exposed to dangerous or hazardous substances. Steel reinforcing must be removed and the concrete rubble must be separated from other debris before processing.

Recycled Portland cement concrete rubble must not be used:

- Where it will be exposed to the elements.
- Where free drainage is required.

3. As structural fill, including pavement base or subbase, where wet conditions exist or are anticipated to exist.

Recycled Portland cement concrete rubble used as base course, fill or bedding material may contain an aggregated maximum of 20 percent by weight of asphalt concrete, brick or porcelain rubble. If used as or included in coarse aggregate for Portland or hydraulic cement concrete, the recycled Portland cement concrete rubble must be free of asphalt concrete, brick or porcelain and must comply with the deleterious materials Specifications in Section 9-03.1(4)A. If used as an aggregate for hot mix asphalt, it must have no more than 5 percent by weight of asphalt concrete, brick or porcelain and must otherwise comply with the deleterious substances Specifications in Section 9-03.6(1).

9-03.16(1)C RECYCLED GLASS CULLET

Recycled glass cullet must be from stock composed primarily of glass food and beverage containers (soda-lime-silica) and must not contain medical, toxic, or hazardous materials. Unless otherwise stipulated in the Special Provisions, recycled glass cullet must not be placed in whole or in any blended product within 3 feet of any final graded surface.

The maximum debris level of the cullet must be 5 percent. Debris is defined as any deleterious material which impacts the performance of the engineered fill and includes all non-glass constituents of the glass feedstock. The percentage of debris in cullet must be quantified using the following visual method: Between 1 and 3 pounds of processed cullet must be placed in a flat pan or plate, 8 to 10 inches in diameter and 1 to 2 inches in depth. The percentage of debris must be estimated using American Geological Institute (AGI) Data Sheets 15.1 and 15.2, "Comparison Charts for Estimating Percentage Composition," 1982.

Total lead content testing must be performed quarterly by the product Supplier. Tests must include a minimum of 5 samples. Sample collection must be conducted according to ASTM D75. The mean of these tests must not exceed 80 ppm. Total lead content testing will be conducted according to EPA Method 3010/6010. All test results must be kept on file by the product Supplier.

9-03.16(1)D RECYCLED STEEL FURNACE SLAG

Recycled Steel Furnace Slag must consist of furnace or tap slag as a direct byproduct of a primary steel furnace and must not contain dust or sludge from electric arc emission controls systems. Ladle slag, raker slag, synthetic slag, pit slag, clean out slag, or any other slag not produced in a primary steel furnace, must not be used.

Recycled Steel Furnace Slag aggregate must have an expansion less than 0.50 percent at 7 days when tested per ASTM D 4792. If expansion test results exceed 0.50 percent at 7 days, the Contractor must wet condition the stockpile for a period of 6 months at a minimum moisture content of 6 percent.

Testing for expansion must be conducted on samples at the rate of one each per 5,000 tons of material produced or once for every 6 months of production, whichever is more numerous. Test data and wet conditioning documentation must be retained by the producer and relevant test data or documentation must be submitted to the Engineer for all Material proposed for incorporation into the project.

Recycled steel furnace slag must not be used:

1. Where it will be exposed to the elements.
2. Where free drainage is required.
3. As pavement base or subbase, where wet conditions exist or are anticipated to exist.
4. As structural fill.
5. As an aggregate for Portland cement concrete.

The Contractor must provide to the Engineer the steel furnace slag blends that will be used in the final product before use. No recycled steel furnace slag must be incorporated into the project without prior approval of the Engineer.

9-03.16(1)E ALLOWABLE RECYCLED MATERIAL CONTENT

The maximum percent by weight of recycled materials that may be used to replace naturally occurring aggregates is shown in the following table:

| Type | Material | Specification | Maximum Allowable Percent of Recycled Material By Weight | | | |
|------|---|---------------|--|-----------------|-----------------------|--------------------|
| | | | Hot Mix Asphalt | Concrete Rubble | Recycled Glass Cullet | Steel Furnace Slag |
| | Fine Aggregate for Portland Cement Concrete | 9-03.1(2) | 0 | 0 | 0 | 0 |
| | Coarse Aggregate for Portland Cement Concrete | 9-03.1(3) | 0 | See 9-03.1(3)E | 0 | 0 |

| Type | Material | Specification | Maximum Allowable Percent of Recycled Material By Weight | | | |
|------|--|---------------------------|--|-----------------|-----------------------|--------------------|
| | | | Hot Mix Asphalt | Concrete Rubble | Recycled Glass Cullet | Steel Furnace Slag |
| | Bituminous Surface Treatment Aggregate | 9-03.4 | 0 | 0 | 0 | 0 |
| | Aggregate for Asphalt Treated Base | 9-03.5 | See 5-04.2 | 50 | 0 | 0 |
| | Aggregates for Hot Mix Asphalt | 9-03.6 | See 5-04.2 | 50 | 0 | 20 |
| 1. | 3/4" Minus Crushed Rock | 9-03.7(3) | 0 | 0 | 15 | 20 |
| 1G. | 3/4" Minus Crushed Gravel | 9-03.9 | 20 | 100 | 15 | 20 |
| 2. | 1-1/4" Minus Crushed Rock | 9-03.10(1)A | 0 | 0 | 15 | 20 |
| 2G. | 1-1/4" Minus Crushed Gravel | 9-03.9 | 20 | 100 | 15 | 20 |
| 3. | Maintenance Rock | 9-03.7(3) 9-03.7(4) | 20 | 100 | 15 | 20 |
| 4. | 1-1/2" Washed Gravel | 9-03.10(6) | 0 | 0 | 0 | 0 |
| 5. | 1" Washed Gravel | 9-03.10(6) | 0 | 0 | 0 | 0 |
| 6. | Washed Sand | 9-03.10(6) | 0 | 0 | 0 | 0 |
| 7. | Building Sand | 9-03.10(6) | 0 | 0 | 0 | 0 |
| 9. | 3/8" Washed Gravel | 9-03.10(3) | 0 | 0 | 0 | 0 |
| 10. | Pit Run Sand | 9-03.10(5) | 0 | 0 | 0 | 0 |
| 11. | Sand Filler | 9-03.7(5) | 0 | 0 | 0 | 0 |
| 13. | 2-1/2" Minus Crushed Rock | 9-03.7(2) | 20 | 100 | 15 | 20 |
| 14. | 2-1/2" Crushed Rock | 9-03.10(1)A | 20 | 100 | 15 | 20 |
| 15. | Pit Run Sandy Gravel | 9-03.10(5) | 20 | 100 | 100 | 20 |
| 17. | Bank Run Gravel | 9-03.12(2)B | 20 | 100 | 100 | 20 |
| 21. | 1-1/2" Crushed Gravel | 9-03.9 | 0 | 0 | 15 | 0 |
| 22. | 3/4" Crushed Gravel | 9-03.9 9-03.10(3) | 0 | 0 | 100 | 0 |
| 23. | 1/2" Minus Crushed Gravel | 9-03.9 | 20 | 100 | 15 | 20 |
| 24. | 1/2" Minus Crushed Gravel | 9-03.9 | 0 | 0 | 0 | 0 |
| 26. | 3/4" Washed Sandy Gravel | 9-03.10(4) | 0 | 0 | 100 | 0 |
| 27. | Quarry Run Crushed Rock | 9-03.10(7) 9-03.10(1)B | 0 | 0 | 100 | 20 |
| 28. | 3/4" Washed Gravel | 9-03.10(6) | 0 | 0 | 0 | 0 |

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None of the values presented in this table must be construed to be overriding any provision restricting the use of recycled materials included elsewhere in these Specifications.

1 **SECTION 9-04 JOINT AND CRACK SEALING MATERIALS**

2 **9-04.1 PREMOLDED JOINT FILLERS**

3 **9-04.1(1) FILLER FOR CONTRACTION JOINTS IN CEMENT CONCRETE PAVEMENT**

4 Premolded joint filler for use in cement concrete transverse and longitudinal contraction joints must consist of a suitable
 5 asphalt mastic encased in asphalt saturated paper or asphalt saturated felt. It must be sufficiently rigid for easy installation in
 6 summer months and not too brittle for handling in cool weather. It must meet the following test requirements:

7 When a strip 2 inches wide and 24 inches long is freely supported 2 inches from each end and maintained at a
 8 temperature of 70°F, it must support a weight of 100 grams placed at the center of the strip without deflecting downward from
 9 a horizontal position more than 2 inches within a period of 5 minutes.

10 The thickness and width of joint filler must be as shown in the Standard Plans unless the Contract specifies otherwise.
 11 Where no premolded joint filler thickness is indicated, the premolded filler thickness must be 3/8 inch.

12 **9-04.1(2) FILLER FOR THROUGH (EXPANSION) JOINTS IN CEMENT CONCRETE PAVEMENT**

13 Premolded joint filler for through (expansion) and isolation joint applications must conform to the Specifications for
 14 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction, AASHTO M 213, except the requirement
 15 for water absorption is not applicable, or ASTM D 7174 Specifications for Preformed Closed-Cell Polyolefin Expansion Joint
 16 Fillers for Concrete Paving and Structural Construction. The thickness and width of premolded joint filler for through
 17 (expansion) joints must be as indicated on the Standard Plans unless otherwise specified in the Contract. Where no
 18 premolded filler thickness is indicated, the thickness must be 3/4 inch.

19 **9-04.1(3) ELASTOMERIC EXPANSION JOINT SEALS**

20 Premolded elastomeric expansion joint seals must conform to AASHTO M 220 and must be formed by an extrusion
 21 process with uniform dimensions and smooth exterior surfaces. The cross-section of the seal must be shaped to allow
 22 adequate compressed width of the seal, as approved by the Engineer.

23 **9-04.2 JOINT SEALANTS**

24 **9-04.2(1) HOT Poured JOINT SEALANTS**

25 Hot poured joint sealants must comply with AASHTO M 324 Type IV, except that the Cone Penetration at 25 °C must be
 26 130 max. Hot poured joint sealants must be sampled per ASTM D 5167 and tested per ASTM D 5329. The hot poured joint
 27 sealant must have a minimum Cleveland Open Cup Flash Point of 205 °C per AASHTO T 48.

28 **9-04.2(2) Poured RUBBER JOINT SEALER**

29 The physical properties of the joint sealer, when mixed per the manufacturer’s recommendations, must be as follows:
 30

| | Physical Property | Physical Property When Mixed |
|---|--|---|
| 1 | Color | Gray or black |
| 2 | Viscosity ¹ | Pourable and self-leveling at 50 °F |
| 3 | Application Life ¹ | Not less than 3 hours at 72 °F and 50% relative humidity |
| 4 | Set to Touch | Not more than 24 hours at 72 °F and 50% relative humidity |
| 5 | Curing Time | Not more than 96 hours at 72 °F and 50% relative humidity |
| 6 | Non Volatile Content | Not less than 92% |
| 7 | Hardness Rating (Durometer: Shore A) | 5-35 |
| 8 | Resiliency | Not less than 80% |
| 9 | Bond test methods must be per WSDOT Test Method No. 412A | |

31 NOTE:

- 32 1. Viscosity and application life may be waived providing the Material is mixed and placed by a pump and mixer
 33 approved by the Engineer, or if the Contract requires fast cure.

34
 35 Suitable primer, if required by the manufacturer, must be furnished with each joint sealer. The primer must be suitable for
 36 brush or spray application at 50°F or higher and must cure sufficiently at 50°F to pour the joint within 24 hours. It must be
 37 considered as an integral part of the sealer system. Any failure of the sealer in the test described here, attributable to the
 38 primer, must be grounds for rejection of the sealer.

39 Acceptance of joint sealing compound for use on a project will be on the basis of Laboratory tests of samples
 40 representative of each batch of Material to be used on the job. A period of at least two weeks must be allowed for completion
 41 of these tests. Each container of the compound must be clearly identified as to manufacturer and batch number.

1 9-04.2(3) POURED JOINT SEALER FOR WALKWAYS

2 Poured joint sealer used to seal sawed joints in sidewalks, stairs, plazas, and other walkways must be a polyurethane
3 sealer conforming to Federal Specification TT S 00227E Type I (self-leveling) Class A or Type II (non-sag) Class A.

4 9-04.3 MORTAR AND NON SHRINK CEMENT SAND GROUT**5 9-04.3(1) JOINT MORTAR**

6 Mortar for hand mortared joints must be as specified in Section 9-20.4(3) and consist of 1 part Portland cement, 3 parts
7 fine sand, and sufficient water to allow proper workability.

8 Cement must conform to AASHTO M 85, Type I or Type II.

9 Sand must conform to AASHTO M 45.

10 Water must be as specified in Section 9-25.1.

11 The mortar mix must be approved by the Engineer before use.

12 9-04.3(2) NON SHRINK CEMENT SAND GROUT**13 9-04.3(2)A GENERAL**

14 Before placing the grout, the contact surface must be thoroughly cleaned, roughened, and wetted with water. The grout
15 must be covered with burlap sacks after the initial concrete set, promptly wetted, and maintained continuously moist until the
16 required strength is obtained.

17 9-04.3(2)B GROUT FOR ANCHOR BOLTS, BRIDGE BEARINGS, AND DRAINAGE STRUCTURE

18 Non shrink cement sand grout used for grouting anchor bolts and bridge bearings, curb section to pavement anchors,
19 and for use in drainage Structures except pipe connections, must be as specified in Section 9-20.3(2) grout type 2 for non-
20 shrink applications.

21 9-04.3(2)C GROUT FOR PIPE CONNECTIONS

22 Grout for pipe connections to maintenance hole, catch basins, inlets, and similar utility appurtenances, and installing tees
23 must comply with Section 9-20.4. Mix grout to a damp packing or ramming consistency.

24 9-04.3(2)D GROUT TYPE 1 FOR POST-TENSIONING APPLICATIONS

25 Grout type 1 for post-tensioning applications must be as specified in Section 9-20.3(1).

26 9-04.3(2)E GROUT FOR POLES AND PEDESTALS

27 Grout for grouting under poles and pedestals, and similar uses must comply with Section 9-20.3(2).

28 9-04.4 RUBBER GASKETS**29 9-04.4(1) RUBBER GASKETS FOR CONCRETE PIPES AND PRECAST MAINTENANCE HOLES**

30 Rubber gaskets for use in joints of concrete Culvert or storm Sewer pipe and precast maintenance hole sections must
31 conform to ASTM C 443.

32 9-04.4(2) SEALS FOR VITRIFIED CLAY PIPE (COMPRESSION)

33 Compression seals for vitrified clay pipe must conform to ASTM C 425. Each load of pipe delivered to the Job Site must
34 be accompanied by a certificate of compliance stating that the compression seals conform to ASTM C 425 and showing test
35 results of the lot from which the load of pipe was chosen.

36 Before shipment of pipe, the manufacturer must submit Shop Drawings illustrating the proposed joint sealing system and
37 results of testing required by ASTM C 425. The Engineer may require that testing be performed in his presence before
38 acceptance of any joint sealing system. Pipe must not be shipped without receiving the Engineer's approval of the jointing
39 system.

40 9-04.4(3) SEALS FOR VITRIFIED CLAY PIPE (FLEXIBLE COUPLINGS)

41 Flexible couplings must comply with ASTM C 1173, Type B, including Figure 2 and Table 3. Before use, a catalogue cut
42 and manufacturer's certification stating that the flexible coupling conform to this Specification must be submitted to the
43 Engineer. This submittal must be made separately for every size and configuration of coupling to be used.

44 9-04.4(4) RUBBER GASKETS FOR ALUMINUM OR STEEL CULVERT OR STORM SEWER PIPE

45 Gaskets for use with metal Culvert or storm Sewer pipe must be continuous closed cell, synthetic expanded rubber
46 gaskets per ASTM D 1056, Grade 2B3.

47 9-04.4(5) RUBBER GASKETS FOR ALUMINUM OR STEEL DRAIN PIPE

48 Gaskets for metal drain pipe must be self-adhering, butyl based scrim supported type. When specified, the gaskets must
49 be as described in the Standard.

1 9-04.4(6) PROTECTION AND STORAGE

2 Rubber gasket Material must be stored in a clean, cool place, protected from contaminants. They must be protected from
3 direct sunlight at all times except during actual installation. Pipes with gaskets affixed must be installed in the line within 28
4 Days of date of delivery from the manufacturer. Rubber gaskets found on-site more than 28 Days after delivery from the
5 manufacturer will be rejected. The Contractor must submit an invoice from the manufacturer stating date of delivery.

6 9-04.5 FLEXIBLE PLASTIC GASKETS

7 The gasket Material must be produced from blends of refined hydrocarbon resins and plasticizing materials reinforced
8 with inert mineral filler and must contain no solvents. It must not depend on oxidizing, evaporating, or chemical action for
9 adhesive or cohesive strength. It must be supplied in extruded rope form of such cross-section and size as to adequately fill
10 spaces between the precast sections.

11 The gasket Material must be protected by a suitable removable two piece wrapper so designed as to permit removing
12 one half, longitudinally, without disturbing the other. Its composition and properties must conform to those set forth as follows:
13

| Property | Test Method | Minimum | Maximum |
|-------------------------------------|-------------|---------|---------|
| Bitumen (Petroleum plastic content) | ASTM D 4 | 50 | 70 |
| Ash inert Mineral Matter | AASHTO T 11 | 30 | 50 |
| Penetration | ASTM D 217 | -- | -- |
| 32 °F (300gm) 60 sec | -- | 75 | -- |
| 77 °F (150gm) 5 sec | -- | 50 | 120 |
| 115 °F (150gm) 5 sec | -- | -- | 150 |
| Softening Point | ASTM D 36 | 320 °F | -- |
| Specific Gravity at 77 °F | ASTM D 71 | 1.20 | 1.35 |
| Weight per gallon, lb | -- | 10.0 | 11.3 |
| Ductility at 77 °F (cm) | ASTM D 113 | 5.0 | -- |
| Flash Point COC, °F | ASTM D 93 | 600 | -- |
| Fire Point COC, °F | ASTM D 92 | 625 | -- |
| Volatile Matter | ASTM D 6 | -- | 2.0 |

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15 9-04.6 EXPANDED POLYSTYRENE

16 Expanded polystyrene must be of a cellular molded type with a density of 1.5 ± 0.25 pounds per cubic foot.

17 9-04.7 EXPANDED RUBBER

18 Closed cell expanded rubber joint filler must conform to ASTM D 1056, Grade No. 2B3.

19 9-04.8 SOLVENT CEMENTS

20 Solvent Cements for PVC underdrain pipe must conform to ASTM D 2564.

21 9-04.9 CRACK SEALING RUBBERIZED ASPHALT

22 Rubberized asphalt for crack sealing asphalt concrete pavement must conform to AASHTO M 173 (ASTM D 1190) and
23 have a COC flash point (AASHTO T 48) of 400 °F minimum. AASHTO M 173 (ASTM D 1190) is modified to delete the Bond
24 Test requirement. AASHTO T 48 is modified to require careful agitation of the rubberized asphalt sample during testing to
25 prevent local overheating.

26 SECTION 9-05 STORM DRAIN AND SANITARY SEWER STRUCTURES, CULVERTS, AND CONDUITS**27 9-05.1 ACCEPTANCE BY MANUFACTURER'S CERTIFICATION**

28 Certain drainage materials may be accepted by the Engineer based on a manufacturer's certificate of compliance as
29 specified in Section 1-06.3. These materials are as follows:

- 30 1. Metal drain and underdrain pipe.
- 31 2. PVC drain pipe and underdrain pipe.
- 32 3. Polypropylene pipe.
- 33 4. Corrugated Polyethylene pipe.
- 34 5. Metal Culvert, Storm Drain pipe, and pipe arch less than 30 inches in diameter.
- 35 6. Metal Culvert end sections.

7. Corrugated metal structural plate pipe, pipe arch, and under passes.
8. Ductile iron pipe, Vitrified clay pipe compression seals.
9. Vitrified clay pipe flexible couplings.

9-05.2 CONCRETE PIPE

9-05.2(1) GENERAL

Concrete pipe must be manufactured by plants certified by the National Precast Concrete Association (NPCA). Concrete pipe must comply with ASTM C 14 Class 3 for pipe less than 12 inches in diameter; ASTM C 76 Class IV for 12 and 15-inch diameter pipe; and ASTM C 76 Class III wall B for pipe 18 inches in diameter and larger. Exceptions may be specified in the Contract.

Pipe ends of reinforced concrete pipe must be bell and spigot, modified bell and spigot, or tongue and groove unless otherwise specified in the Contract.

The identification of the minor axis of elliptical reinforcement must be in accordance to Section 7-02.3(1)B4.

9-05.2(2) BASIS FOR ACCEPTANCE OF CONCRETE PIPE

9-05.2(2)A GENERAL

The basis for acceptance of non-reinforced concrete pipe must be based on load bearing tests, material tests including absorption tests per ASTM C 497, inspection of the product at all stages of fabrication, and a manufacturer's certificate of compliance indicating acceptable results of 3 edge bearing tests performed at the Supplier within the 90 Day period immediately preceding shipment of the pipe to the Project Site. Acceptance of the concrete pipe based on criteria other than these Specifications must require a submittal to the Engineer for approval at least 10 Working Days in advance of delivery, specifying the "other criteria" in detail and how it is equivalent or better than the Specifications; a manufacturer's certificate of compliance stating the pipe must perform as specified in these Specifications; allow for the Engineer to visit the Supplier and observe the "other criteria," and must allow the Engineer to have a minimum 3 pipe samples provided to a location specified by the Engineer for the Engineer to conduct tests.

The basis for acceptance of reinforced concrete pipe 60 inches in diameter and smaller must be determined by the results of the 3 edge bearing test per ASTM C 76 for the load to produce a 0.01-inch crack. Testing to the ultimate load will ordinarily not be required, except as necessary to obtain samples for making the absorption test. In lieu of broken pieces of pipe obtained as before mentioned, 4-inch diameter cores from pipe sections selected by the Engineer, must be furnished to the Engineer for performing the absorption test. Sections of pipe which have been tested to the 0.01-inch crack limit will ordinarily not be further load tested; and such sections, if found without defect, meeting or exceeding the required Specifications will be accepted for use on the project.

Permeability test must be conducted as follows:

The pipe selected by the Engineer for testing must be placed plumb with either end down on a soft rubber impermeable pad and filled with water. The pipe must be kept full of water for a period of 20 minutes. At the end of 20 minutes, the outer surface of the pipe will be examined for leaks.

A leak is defined as a moist spot as determined by the Engineer.

The Engineer may test up to 2 percent of all sections in a size and class of pipe; however, no less than 5 pipe sections of any pipe size and class will be tested.

Concrete pipe larger than 27 inches and no larger than 60 inches in diameter will be inspected by the Engineer during its manufacture and if found acceptable, the Engineer will issue a certification of inspection. Pipe delivered for the Work must be delivered with this certificate of inspection. The Contractor must notify the Engineer a minimum 15 Working Days before delivery to arrange for this inspection by the Engineer.

Acceptance of reinforced concrete pipe larger than 60-inch diameter will be based on inspection of the size and placement of the reinforcing steel, the absorption test and, at the option of the Engineer, on compressive strength tests of 4-inch diameter cores cut from the pipe, or on compressive strength of representative test cylinders cast with and cured with the pipe.

The Contractor must provide a manufacturer's certificate of compliance stating that the gaskets for all concrete pipe comply with ASTM C 443, and that the pipe age at shipment is as specified in Section 9-05.2(3). The Contractor must also submit actual Shop Drawings detailing pipe reinforcement and joint design.

9-05.2(2)B PIPE ACCEPTANCE REPORT (PAR)

Concrete pipe with diameters of 27 inches and smaller must be accompanied with a Pipe Acceptance Report when delivered to the Project Site. A PAR can be prepared either by WSDOT or by the SPU Materials Laboratory for a specific size and class of concrete pipe. Pipe delivered for incorporation into the Work must comply with all Contract requirements. Approval of the pipe upon delivery by the SPU Materials Laboratory does not constitute acceptance of the pipe at any time.

9-05.2(3) AGE AT SHIPMENT

Concrete pipe may be shipped when it complies with all specified test requirements. Unless it is tested and accepted at an earlier age, it must not be considered acceptable and ready for delivery to the Work sooner than 28 Days after manufacture

1 when made with Type II Portland cement, nor sooner than 7 Days after manufacture when made with Type III Portland
 2 cement.

3 **9-05.2(4) BEVELED CONCRETE END SECTIONS**

4 Beveled concrete end sections must be plain concrete conforming to AASHTO M 86 or reinforced concrete conforming to
 5 the applicable sections of AASHTO M 170 with the design requirements as listed in Table 2, Wall B, Circular Reinforcement in
 6 circular pipe, and WSDOT Standard Plan B-70.20.

7 **9-05.2(5) CONCRETE PIPE JOINTS AND TESTING**

8 **9-05.2(5)A GENERAL**

9 All concrete pipe must be joined with rubber gaskets. The joints and gasket material must comply with the Specifications
 10 of ASTM C 443. Gasket Material must be protected as specified in Section 9-04.4(6).

11 Both bell and spigot must be reinforced in all pipe 30 inches or larger in diameter.

12 **9-05.2(5)B TESTING CONCRETE PIPE JOINTS**

13 **9-05.2(5)B1 GENERAL**

14 When a particular type of pipe joint design, joint material, and/or joining method has not previously been tested and
 15 approved by the Engineer, the following tests must be made on one test length of the assembled concrete pipe, or test length
 16 assembly as defined in Section 9-05.2(5)B2, to qualify the design, joint material, and/or joining method for acceptance. As
 17 determined by the Engineer, additional testing may be required if subsequent field testing of installed pipe indicates difficulty in
 18 verifying acceptable joined pipe performance. The tests must be conducted at the Supplier and the Contractor must make
 19 available space and facilities to accommodate the testing in an efficient and workmanlike manner.

20 **9-05.2(5)B2 HYDROSTATIC PRESSURE ON PIPES IN STRAIGHT ALIGNMENT**

21 Hydrostatic pressure tests on pipes in straight alignment must be made per the procedure outlined in paragraph 8(a) of
 22 AASHTO M 198, except that they must be performed on a test length assembly consisting of not less than 3 nor more than 5
 23 pipe sections selected from stock by the Engineer and assembled as specified in the Contract requirements. The end sections
 24 must be bulkheaded and restrained to prevent leakage.

25 **9-05.2(5)B3 HYDROSTATIC PRESSURE TESTS ON PIPES IN MAXIMUM DEFLECTED POSITION**

26 Upon completion and acceptance by the Engineer of testing as specified in Section 9-05.2(5)B2, the test length assembly
 27 must be deflected until at least two of the pipe joints are deflected to the maximum as per the manufacturer's installation
 28 instruction. When thus deflected, the test length assembly must be braced and the end sections must be bulkheaded and
 29 restrained to prevent leakage. The test length assembly must then be pressurized to an internal hydrostatic pressure of 5 psig
 30 minimum, and no leakage at any joint for a 15 minute test duration will indicate acceptance by the Engineer.

31 **9-05.2(5)B4 HYDROSTATIC PRESSURE TEST ON 15-INCH DIAMETER AND LARGER PIPE UNDER
 32 DIFFERENTIAL LOAD**

33 For concrete pipe 15 inches or larger, upon completion and acceptance of testing as specified in Section 9-05.2(5)B3,
 34 the test length assembly must be suitably supported so that one of the pipes of the test assembly is suspended freely between
 35 adjacent pipes, be supported only by the joint connections. The suspended pipe must then be loaded at its midpoint with an
 36 additional point load per the following schedule:

| Pipe Diameter | Load |
|----------------------|------------|
| 15 inches | 7,400 lbs |
| 18 inches | 8,800 lbs |
| 21 inches | 10,000 lbs |
| 24 inches and larger | 11,000 lbs |

37

38
 39 Point load must be interpreted as not more than 2 linear feet spread over not more than 1 linear foot beyond the midpoint
 40 of the pipe section supported.

41 While under this load, the test length assembly must be braced and the end sections must be bulkheaded and restrained
 42 to prevent leakage. The stressed joints, or joints at each end of the supported test section, must show no leakage when
 43 subjected to an internal hydrostatic pressure of 5 psi for a 15 minute time duration. At the option of the Supplier or Contractor,
 44 1/2 of the specified load may be applied on the bell end of the suspended pipe in lieu of the full load at the midpoint of the
 45 suspended pipe if the total half-load is applied over not more than an 18-inch length measured from the end of the pipe.

1 9-05.2(6) PERFORATED CONCRETE SUBSURFACE DRAIN PIPE

2 Perforated concrete subsurface drain pipe must comply with the Specifications of AASHTO M 175, Type I, except that
3 the perforations must be approximately 1/2 inch in diameter. Strength requirements must be as shown in Table I of AASHTO
4 M 86.

5 9-05.3 DUCTILE IRON PIPE

6 Ductile iron pipe must conform to ANSI A21.51 or AWWA C151 and must be cement mortar lined, push on joint, or
7 mechanical joint. The ductile iron pipe must be Class 50 unless indicated otherwise in the Contract.

8 Joints for ductile iron pipe must be rubber gasketed conforming to the Specifications of ANSI A21.11 or AWWA C111.

9 Cast iron fittings may be used with ductile iron pipe with Engineer's approval, and require the Contractor to submit a
10 minimum of 10 Working Days in advance, the proposed fittings including a manufacturer's certificate of compliance stating the
11 fitting meets or exceeds the performance of the material specified.

12 Saddles fastened to pipe with external bands will not be acceptable on any new ductile iron pipe installation as specified
13 in 7-17.3(2)C3 item 3. All fittings must be the same material as the pipe being connected.

14 9-05.4 POLYVINYL CHLORIDE (PVC) PIPE

15 PVC pipe must conform to the Specifications of ASTM D 3034 for diameter sizes 4-inch through 15-inch, and of ASTM F
16 679 for diameter sizes 18-inch through 48-inch. The minimum pipe stiffness must be 46 lb./in./in.

17 Joints for PVC pipe must conform to ASTM D 3212 using an elastomeric gasket conforming to ASTM F 477.

18 Fittings for PVC pipe must conform to ASTM D 3034, ASTM F 679, or ASTM F 1336. All fittings must be the same
19 material as the pipe being connected except that fittings using other materials or constructed with more than one material may
20 be used subject to the approval of the Engineer. The Contractor must submit the proposed alternate material at least 10
21 Working Days in advance, and must include a manufacturer's certificate of compliance stating the alternate material meets or
22 exceeds the handling and load stress performance of that specified.

23 9-05.4(1) SLOTTED PVC SUBSURFACE DRAIN PIPE

24 Perforated polyvinyl chloride sub-surface drain (SSD) pipe and fittings must be either ASTM D2241 SDR 21 (Class 200)
25 or ASTM D1785 Schedule 40. ASTM 2241 pipe must have rubber gasket joints, and ASTM D1785 pipe must have solvent
26 welded joints. The slotted perforations must be 0.0064" wide x 1.00" long and spaced 0.3 inch apart on center. The slotted
27 perforations on the pipe must be oriented as specified in the Contract. Minimum pipe diameter is 6 inches and must not
28 exceed 8 inches unless specified otherwise in the Contract.

29 9-05.5 VITRIFIED CLAY PIPE (VCP)

30 Vitrified clay pipe must conform to ASTM C 700, and all joints must be factory manufactured in conformance with Section
31 9-04.4(2) Vitrified clay pipe must be installed as specified in Section 7-17.

32 Vitrified Clay Pipe must be load tested per ASTM C301 for 3 edge bearing. Vitrified Clay Pipe must withstand the
33 minimum following loads:

34 Minimum Test Loads

| Extra Strength | | High Strength | |
|-------------------|---------------|-------------------|---------------|
| Nominal Size (in) | Load (lbs/ft) | Nominal Size (in) | Load (lbs/ft) |
| 4 | 2000 | 4 | 2200 |
| 6 | 2000 | 6 | 2200 |
| 8 | 2200 | 8 | 2400 |
| 10 | 2400 | 10 | 2600 |
| 12 | 2600 | 12 | 2900 |
| 15 | 3100 | 15 | 3400 |
| 18 | 3600 | 18 | 4000 |
| 21 | 4200 | 21 | 4600 |
| 24 | 4800 | 24 | 5300 |
| 27 | 5200 | 27 | 5700 |
| 30 | 5500 | 30 | 6100 |
| 33 | 5800 | 33 | 6400 |
| 36 | 6300 | 36 | 6900 |
| 39 | 6600 | 39 | 7300 |

| Extra Strength | | High Strength | |
|-------------------|---------------|-------------------|---------------|
| Nominal Size (in) | Load (lbs/ft) | Nominal Size (in) | Load (lbs/ft) |
| 42 | 7000 | 42 | 7700 |

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9-05.5(1) PIPE ACCEPTANCE REPORT (PAR)

Vitrified clay pipe must be inspected by the SPU Materials Laboratory at the point of delivery. When delivered, vitrified clay pipe must be accompanied by all specified certifications and test results. No vitrified clay pipe must be incorporated into the Work that has not been inspected and approved by the SPU Materials Laboratory. A pipe acceptance report will be completed by SPU Materials Laboratory personnel upon inspection of the pipe. Approval of pipe upon delivery by the SPU Materials Laboratory does not constitute acceptance of the pipe at any time.

9-05.6 POLYETHYLENE PIPE

9-05.6(1) CORRUGATED POLYETHYLENE DRAINAGE TUBING PIPE

9-05.6(1)A CORRUGATED POLYETHYLENE DRAINAGE TUBING DRAIN PIPE

Corrugated polyethylene drainage tubing drain pipe must comply with the Specifications of AASHTO M 252. The maximum size pipe allowed must not be larger than 10-inch diameter.

9-05.6(1)B PERFORATED CORRUGATED POLYETHYLENE DRAINAGE TUBING SUBSURFACE DRAIN PIPE

Perforated corrugated polyethylene drainage tubing subsurface drain pipe must comply with the Specifications of AASHTO M 252 Type 5. The maximum size pipe is 10 inches in diameter.

9-05.6(2) CORRUGATED POLYETHYLENE DRAIN PIPE

9-05.6(2)A GENERAL

Corrugated polyethylene drain pipe must be high density polyethylene (HDPE) complying with the Specifications of AASHTO M 294, Type S. The size of pipe allowed must range from a minimum 12-inch diameter through a maximum 48-inch diameter. All HDPE pipe delivered and used must be certified through the Plastic Pipe Institute (PPI) Third Party Certification program and must bear the Third Party Administered PPI seal.

9-05.6(2)B COUPLING BANDS

Joints for corrugated polyethylene drain pipe must be made with a bell/bell or bell and spigot coupling using elastomeric gaskets conforming to ASTM F 477. Joints for Storm Drain pipe must be made with a bell/bell or bell and spigot coupling and must conform to ASTM D 3212 using elastomeric gaskets conforming to ASTM F 477. All gaskets must be factory installed on the pipe per the Materialperson's recommendations.

9-05.6(3) STEEL REINFORCED POLYETHYLENE PIPE FOR DETENTION

Steel Reinforced Polyethylene Pipe must comply with the specifications of ASTM F2562. Resins must comply with the specifications of ASTM D3350 and cell classification 345464C. Steel ribs must comply with the specifications of ASTM A 1008 or ASTM A 1011.

Joints must be as specified on the Drawings; either bell and spigot or welded couplers. Welded couplers must be installed by electrofusion welding or extrusion welding technology. The joints must be laboratory tested to 15 psi as specified in ASTM 3212.

9-05.6(4) PERFORATED CORRUGATED POLYETHYLENE SUBSURFACE DRAIN PIPE

9-05.6(4)A GENERAL

Perforated corrugated polyethylene subsurface drain pipe must be HDPE complying with the Specifications of AASHTO M 294, Type S. The size of pipe allowed must range from a minimum 12 inches in diameter through a maximum of 48-inch diameter. Perforations must be per AASHTO M 294. All HDPE pipe delivered and used must be certified through the Plastic Pipe Institute (PPI) Third Party Certification program and must bear the Third Party Administered PPI seal.

9-05.6(4)B COUPLING BANDS

Joints for perforated corrugated polyethylene subsurface drain pipe must be made with a bell/bell or bell and spigot coupling using elastomeric gaskets conforming to ASTM F 477. All gaskets must be factory installed on the coupling or on the pipe by the Materialperson.

9-05.6(5) POLYETHYLENE END SECTIONS

High density polyethylene (HDPE) end sections must be manufactured out of polyethylene resin complying with ASTM D 3350.

1 **9-05.7 ALUMINUM PIPE**

2 **9-05.7(1) GENERAL**

3 See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

4 Corrugated aluminum drain pipe, aluminum Culvert pipe, and aluminum pipe without perforations must conform to the
5 applicable Specifications of AASHTO M 196.

6 The protective coating for aluminum pipe must be Treatment 5 as specified in Section 9-05.8(2)D, and the pipe must be
7 constructed of helically corrugated lock seam aluminum pipe. An exception is allowed when gasketed helically corrugated lock
8 seam aluminum pipe is specified in the Contract and Treatment 5 is not required.

9 Aluminum surfaces that are to be in contact with any Portland cement product (such as controlled density fill (CDF),
10 concrete, grout, and mortar.) must be protected by first cleaning the aluminum surface in contact with Portland cement product
11 with solvent and then painting this surface with two coats of paint extending a minimum 2 feet beyond the area of contact with
12 the Portland cement product. The paint must conform to Federal Specification TT P 645 (Primer, Paint, Zinc Chromate, Alkyd
13 Vehicle).

14 **9-05.7(1)A BASIS FOR ACCEPTANCE FOR ALUMINUM PIPE**

15 The basis for acceptance of aluminum pipe will be the same as specified in Section 9-05.1, except when gasketed
16 helically corrugated lock seam aluminum pipe is specified in the Contract. A qualification test, conducted by the Engineer, will
17 be required of the Materialperson for gasketed helically corrugated lock seam aluminum pipe, as the Engineer is required to
18 identify specific pipe sizes and gasket materials that perform acceptably and reliably with confidence in specific applications.

19 **9-05.7(1)B COUPLING BANDS**

20 **9-05.7(1)B1 COUPLING BANDS FOR DRAIN PIPE**

21 Coupling bands for corrugated aluminum alloy drain pipe must comply with the Specifications of AASHTO M 196 for
22 coupling bands for Type I pipe, except that bands using projections (dimples) will not be allowed. The bands must be
23 fabricated of the same material as the pipe.

24 Coupling bands for aluminum corrugated pipe must be 24 inch, two piece half circle corrugated pipe held together with
25 angles and bolts. A neoprene gasket must be placed between the pipe and the bands. The bands must be made of the same
26 material and have the same corrugation as the pipe, and must be as specified in Section 9-05.7(1)B2.

27 **9-05.7(1)B2 COUPLING BANDS FOR CULVERT PIPE**

28 Coupling for bands must comply with AASHTO M 196. Bands having projections in lieu of corrugations will not be
29 allowed.

30 Steel bolts and nuts for coupling bands must comply with ASTM A 307 and must be galvanized per AASHTO M 232 or
31 AASHTO B 633.

32 Aluminum angles must be of the same material as the coupling bands.

33 Rods, when required, must comply with ASTM B 221, Alloy 6061 T6.

34 Asphalt coating must not be used on coupling bands.

35 Coupling bands and aluminum pipe must be the product of the same Materialperson.

36 **9-05.7(1)B3 COUPLING BANDS FOR ALUMINUM PIPE**

37 Section 9-05.7(4)B must apply to aluminum pipes, except the band must have a range of thicknesses from not less than
38 0.60 inches to not larger than 0.105 inches.

39 Coupling bands and aluminum pipe must be the product of the same Materialperson.

40 **9-05.7(1)C MITERED ENDS**

41 The ends of aluminum pipe must not be beveled unless specified otherwise in the Contract. If beveled ends are
42 specified, the ends of aluminum pipe over 30 inches in diameter must be mitered to conform to the slope of the embankment
43 in which the pipe is to be placed whether the pipe is constructed normal to or at an angle with the centerline of the roadway.

44 **9-05.7(1)D ALUMINUM END SECTIONS**

45 Beveled aluminum pipe end sections 12 inches through 30 inches in diameter must be of the same Material and
46 thickness and have the same protective coating as the pipe to which they are attached. Beveled pipe ends of these
47 dimensions must be constructed in conformance with WSDOT Standard Plans

48 Construction of end sections and toe plate extensions for aluminum pipes must comply with AASHTO M 196. In addition,
49 they must be as specified in Section 9-05.7(2)G.

50 Do not use asphalt coating on aluminum end sections.

1 9-05.7(2) PERFORATED CORRUGATED ALUMINUM SUBSURFACE DRAIN PIPE**2 9-05.7(2)A GENERAL**

3 Perforated corrugated aluminum subsurface drain pipe must comply with AASHTO M 196, except that the perforations
4 may be located at any location on the tangent of the corrugations provided the other perforation spacing complies with
5 Specifications.

6 See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

7 9-05.7(2)B COUPLING BANDS

8 Coupling bands for corrugated aluminum subsurface drain pipe must comply with AASHTO M 196 for coupling bands for
9 Type III pipe. The bands must be fabricated of the same material as the pipe if metallic bands are used.

10 Acceptable coupling bands are two piece, helically corrugated with nonreformed ends and integrally formed flanges;
11 universal bands (dimple bands); a smooth sleeve type coupler; and those bands specified in Section 9-05.7(1)B2. Smooth
12 sleeve type couplers may be either plastic or aluminum, suitable for holding the pipe firmly in alignment without the use of
13 sealing compound or gaskets.

14 9-05.7(3) ALUMINUM SPIRAL RIB PIPE**15 9-05.7(3)A GENERAL**

16 See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

17 Aluminum spiral rib pipe must comply with AASHTO M 196 and these Specifications. The size, alloy, and protective
18 treatment must be as specified in the Contract.

19 The Materialperson of spiral rib pipe must submit to the Engineer a manufacturer's certificate of compliance stating that
20 the Material furnished complies in all respects with these Specifications. The Engineer may require additional information or
21 tests to be performed by the Contractor, at no expense to the Owner.

22 Unless indicated otherwise in the Contract, spiral rib pipe must be furnished with pipe ends cut perpendicular to the
23 longitudinal axis of the pipe. Pipe ends must be cut evenly. Spiral rib pipe must be fabricated by using a continuous helical lock
24 seam with a seam gasket.

25 For spiral rib pipe, helical ribs must project outwardly from the smooth pipe wall and must be fabricated from a single
26 uniform thickness material. The ribs must be 3/4" wide x 3/4" deep with a nominal spacing of 7-1/2 inches center to center.
27 Pipe must be fabricated with ends that can be acceptably jointed with coupling bands.

28 For narrow pitch spiral rib pipe, helical ribs must project outwardly from the smooth pipe wall and must be fabricated from
29 a single thickness of material. The ribs must be 3/8" x 1/8" wide (measured outside to outside) and a minimum of 0.4375
30 inches high (measured as the minimum vertical distance from the outside of pipe wall to top surface of the rib). The maximum
31 spacing of ribs must be 4.80 inches center to center (measured normal to the direction of the ribs). The radius of bend of the
32 metal at the corners of the ribs must be a minimum of 0.0625 inches with an allowable tolerance of ± 10 percent.

33 For wide pitch spiral rib pipe, helical ribs must project outwardly from the smooth pipe wall and must be fabricated from a
34 single thickness of material. The ribs must be 3/4" x 1/8" wide (measured outside to outside) and a minimum of 0.95-inch high
35 (measured as the minimum vertical distance from the outside of pipe wall to top surface of the rib). The maximum spacing of
36 ribs must be 11-3/4 inches center to center (measured normal to the direction of the ribs). The radius of bend of the metal at
37 the corners of the ribs must be 0.0625 inches with an allowable tolerance of ± 10 percent.

38 9-05.7(3)B CONTINUOUS LOCK SEAM PIPE

39 Pipes fabricated with continuous helical lock seam parallel to the rib may be used for full circle pipe. The lock seam must
40 be formed in the flat between ribs and must conform to Section 13.2.1 through 13.2.5 of AASHTO M 196.

41 9-05.7(3)C BASIS FOR ACCEPTANCE FOR ALUMINUM SPIRAL RIB PIPE

42 The basis for acceptance will be a qualification test conducted by the Engineer for the Materialperson of helically
43 corrugated spiral rib, narrow pitch spiral rib or wide pitch spiral rib lock seam pipe, as the Engineer is required to identify
44 specific pipe sizes and gasket materials that perform acceptably and reliably with confidence in specific applications.

45 Continuous lock seam pipe must be sampled and tested per AASHTO T 249 and a manufacturer's certificate of
46 compliance stating the results must be submitted to the Engineer.

47 9-05.7(3)D COUPLING BANDS

48 Coupling bands must be of the same material as the pipe. Coupling bands and gaskets must conform to Section 9-
49 05.7(4)B.

50 9-05.7(4) ALUMINUM PIPE FOR DETENTION

51 See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

1 Aluminum detention pipe must be helical or annular corrugated aluminum pipe, comply with the Specifications of
 2 AASHTO M 196, Type I with the gauge as indicated on the Drawings. The end plate and all end plate reinforcement must be
 3 aluminum alloy 6061 T6 structural plate with the thickness as indicated on the Drawings.

4 Coupling bands for corrugated aluminum detention pipes must be Type "D" per WSDOT Standard Plan B-60.40.

5 **9-05.8 STEEL PIPE**

6 **9-05.8(1) GALVANIZED STEEL DRAIN PIPE**

7 Galvanized steel pipe must be 4-inch inside diameter, Schedule 40 pipe complying with the Specifications of ASTM A 53.

8 **9-05.8(2) STEEL CULVERT PIPE AND PIPE ARCH**

9 **9-05.8(2)A GENERAL**

10 Steel Culvert pipe and pipe arch must comply with the Specifications of AASHTO M 36, Type I and Type II. Welded seam
 11 aluminum coated (aluminized) corrugated steel pipe and pipe arch with metallized coating applied inside and out following
 12 welding is acceptable.

13 See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

14 **9-05.8(2)B ELLIPTICAL FABRICATION**

15 When elongated pipes are specified, circular pipes must be fabricated 5 percent out of round to form an elliptical section.
 16 The vertical or longer axis of the elliptical section must be clearly marked before shipping.

17 **9-05.8(2)C COUPLING BANDS**

18 Coupling bands must be flange bands or corrugated bands as shown on the Drawings, WSDOT Standard Plan B 60.40
 19 Type D or as specified in the Contract, and must be fabricated of the same material as the pipe and with the same metallic
 20 protective treatment as the pipe. The corrugated bands must conform to the pipe and must comply with all applicable
 21 Specifications of AASHTO M 36 except that coupling bands for all sizes of steel pipe arch with 3" x 1" corrugations must be 24
 22 inches wide. Bands having projections in lieu of corrugations will not be allowed.

23 Steel bolts and nuts for coupling bands must comply with ASTM A 307 and must be galvanized per ASTM A 153.

24 Steel angles, when required for coupling bands, must comply with AASHTO M 36.

25 Asphalt coating must not be used on coupling bands.

26 Coupling bands as specified in Section 9-05.7(4)B are also acceptable.

27 Coupling bands and pipe must be made by the same Materialperson.

28 **9-05.8(2)D STEEL CULVERT PIPE ARCH**

29 Steel pipe arch must be as specified for steel pipe and pipe arch except in the method of fabrication. Circular pipe must
 30 be fabricated in two semi circles, and the pipe arch must be fabricated in two separate sections, the upper portion or arch, and
 31 the bottom section including the connecting arcs.

32 Both longitudinal edges of the lower section of the pipe arch must be notched to provide interlocking seams which form
 33 the two segments into the full section when it is erected in the field. Hook and eye bolts, or other approved means, must be
 34 provided to hold the segments firmly together.

35 Individual plates must be a minimum of 2 feet in length except for short or half sections required to complete the end
 36 section of the Culvert.

37 When protective treatment is specified on the Drawings, pipe arch must be coated with one of the following treatments:
 38

| Treatment Name | Description |
|----------------|---|
| Treatment 1 | Coated uniformly inside and out with asphalt. |
| Treatment 2 | Coated uniformly inside and out with asphalt and with an asphalt paved invert. |
| Treatment 3 | Coated inside & out with fibers embedded in the spelter coating, then covered on both sides with asphalt. |
| Treatment 4 | Coated as in Treatment 3 and with an asphalt paved invert. |
| Treatment 5 | Coated inside and out with asphalt and a 100 percent periphery inside spun asphalt lining. |
| Treatment 6 | Coated as in Treatment 3 and with a 100 percent periphery inside spun asphalt lining. |

1 9-05.8(2)E STEEL END SECTIONS**2 9-05.8(2)E1 GENERAL**

3 Construction of steel end sections must comply with the applicable provisions of AASHTO M 36, except that the end
4 sections must be fabricated of the same material with the same metallic protective treatment as the pipe.

5 Do not use asphalt coating on steel end sections.

6 9-05.8(2)E2 FABRICATION

7 The shape, thickness, dimensions, and number of pieces must conform to WSDOT Standard Plan B-70.60 for the size
8 and shape of pipe shown on the Drawings. They must be manufactured as integral units or so formed that they can be readily
9 assembled and erected in place. When bolts are used for assembly, they must be 3/8-inch diameter or larger and must be
10 galvanized. No field welding or riveting will be permitted.

11 9-05.8(2)E3 GALVANIZED HARDWARE

12 Bolts, nuts, and miscellaneous hardware must be galvanized per AASHTO M 232.

13 9-05.8(2)E4 TOE PLATE EXTENSIONS

14 Toe plate extensions must be furnished only when so specified in the Contract. When required, the toe plate extensions
15 must be punched with holes to match those in the lip of the skirt and fastened with 3/8-inch or larger galvanized nuts and bolts.
16 Toe plate extensions must be the same material and thickness as the end section and must be fabricated of the same material
17 with the same metallic protective treatment as the end section.

18 9-05.8(3) STEEL SPIRAL RIB DRAIN PIPE**19 9-05.8(3)A GENERAL**

20 See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

21 Steel spiral rib drain pipe must comply with AASHTO M 36 and these Specifications. The size, coating, metal and
22 protective treatment must be as specified in the Contract.

23 The Materialperson of spiral rib drain pipe must furnish to the Engineer a manufacturer's certificate of compliance stating
24 that the Material furnished complies in all respects with these Specifications. The Engineer may require additional information
25 or tests to be performed by the Contractor, at no expense to the Owner.

26 Unless otherwise specified in the Contract, spiral rib drain pipe must be furnished with pipe ends cut perpendicular to the
27 longitudinal axis of the pipe and must be cut evenly. Spiral rib pipe must be fabricated either by using a continuous helical lock
28 seam with a seam gasket or a continuous helical welded seam paralleling the rib.

29 Spiral rib drain pipe must have helical ribs that project outwardly, must be formed from a single thickness of material, and
30 must conform to one of the following configurations:

- 31 1. AASHTO M 36 Section 7.2.2.
- 32 2. 0.375 inch \pm 1/8" wide x 0.4375" (minimum) deep at 4.80 inches center to center.
- 33 3. 3/4" wide x 5/8" deep at 12 inches center to center.

34 Pipe must be fabricated with ends that can be acceptably jointed with coupling bands.

35 When required, spiral rib pipe must be bituminous treated or paved. The bituminous treatment for spiral rib pipe must be
36 as specified in Sections 9-05.8(2)C and 9-05.8(2)D.

37 9-05.8(3)B CONTINUOUS LOCK SEAM PIPE**38 9-05.8(3)B1 GENERAL**

39 See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

40 Pipes fabricated with a continuous helical seam parallel to the rib may be used for full circle pipe. The lock seam must be
41 formed in the flat between ribs and must conform to Sections 7.5.1 through 7.5.3 of AASHTO M 36.

42 For narrow pitch spiral rib pipe, the lap width specified in AASHTO M 36, Section 7.5.1 must be 1/4 inch.

43 For use in applications without bituminous treatment, the continuous lockseam must require prior acceptance by
44 qualification testing conducted by the Engineer. The Contractor must provide the Engineer at least 3 Working Days advance
45 notice to arrange for this testing.

46 9-05.8(3)B2 BASIS FOR ACCEPTANCE

47 The basis for acceptance will be a qualification test conducted by the Engineer for each Materialperson of helically
48 corrugated, gasketed spiral rib, or narrow pitch spiral rib lock seam steel pipe as the Engineer is required to identify specific
49 pipe sizes and gasket materials that perform acceptably and reliably with confidence in specific applications.

50 Continuous lock seam pipe must be sampled and tested per AASHTO T 249 and a manufacturer's certificate of
51 compliance must be submitted to the Engineer indicating compliance of the pipe with these Specifications.

9-05.8(3)C CONTINUOUS WELDED SEAM PIPE

See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

Pipes fabricated with a continuous helical welded seam parallel to the ribs may be used for full circle pipe. The welding process for galvanized steel pipe must be so controlled that the combined width of the weld and adjacent spelter coating burned by the welding does not exceed 3 times the thickness of the metal. If spelter is burned outside these limits, the weld and burned spelter must be acceptably repaired for damaged galvanizing. Testing for welded seam quality control must conform to AASHTO T 241. Welded pipe fabricated from aluminized steel pipe must have the coating of the welded area repaired by flame sprayed metallizing inside and out after welding.

Repair of Damaged Galvanizing: When the galvanized (zinc coated) surface has welding burn, all surfaces of the welded connections must be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked galvanizing removed, after which the areas must be repaired by flame spray metallizing both inside and out.

9-05.8(3)D COUPLING BANDS

Coupling bands must be of the same material as the pipe. Coupling bands and gaskets must conform to Section 9-05.8(4).

9-05.8(4) STEEL PIPE FOR DETENTION

See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

Steel detention pipe must be aluminized helical or annular corrugated steel pipe, complying with the Specifications of AASHTO M 36, Type 2 with the gauge as specified in the Contract. The end plate and all end plate reinforcement must be structural steel plate of the type and thickness as designated in the Contract. Coupling bands for steel detention pipes must be Type "D" per WSDOT Standard Plan B 60.40 unless the Contract specifies otherwise.

9-05.9 PIPE COATINGS**9-05.9(1) ALUMINUM COATED (ALUMINIZED) CORRUGATED IRON OR STEEL DRAIN PIPE****9-05.9(1)A GENERAL**

Aluminum coated (aluminized) corrugated iron or steel drain pipe must comply with the Specifications of AASHTO M 36. The aluminized sheet thickness must be 0.052 inch for 6-inch diameter drain pipe, and 0.064 inch for 8-inch and larger diameter drain pipe. Welded seam aluminum coated (aluminized) corrugated iron or steel drain pipe with metallized coating applied both inside and outside after welding is acceptable.

See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

9-05.9(1)B COUPLING BANDS

Coupling bands for aluminum coated (aluminized) corrugated iron or steel drain pipe must comply with the Specifications of AASHTO M 36 for coupling bands for Type 2 pipe, except that bands using projections (dimples) are not permitted. The bands must be fabricated of the same material as the pipe, and with the same metallic protective treatment as the pipe.

Acceptable coupling bands for corrugated metal pipe must be made using a 2 piece, 24-inch wide corrugated coupling band, held together with angles and bolts. A neoprene gasket between the pipe and the band must be of the same material and corrugations as the pipe, and be as specified in Section 9-05.8(2)E.

9-05.9(2) ALUMINUM COATED (ALUMINIZED) CORRUGATED IRON OR STEEL SUBSURFACE DRAIN PIPE**9-05.9(2)A GENERAL**

Aluminum coated (aluminized) corrugated iron or steel subsurface drain pipe must comply with AASHTO M 36, except that perforations required in Class I, Class II, and Class III pipe may be located anywhere on the tangent of the corrugations, provided the other perforation spacing complies with Specifications. Welded seam aluminum coated (aluminized) corrugated iron or steel subsurface drain pipe with metallized coating applied both inside and outside after welding is acceptable.

The pipe may conform to any one of the Type III pipes specified in AASHTO M 36, and perforations in Class I, Class II, and Class III pipe may be drilled or punched. The aluminized sheet thickness must be 0.052 inch for 6-inch diameter subsurface drain pipe, and 0.064 inch for 8-inch and larger diameter subsurface drain pipe.

See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

9-05.9(2)B COUPLING BANDS

Coupling bands for aluminum coated (aluminized) corrugated iron or steel subsurface drain pipe must comply with AASHTO M 36 for coupling bands for Type III pipe. The bands must be fabricated of the same material as the pipe and with the same metallic protective treatment as the pipe, if metallic bands are used.

Acceptable coupling bands are the two piece, helically corrugated band, with nonreformed ends and integrally formed flanges, universal bands (dimple bands), a smooth sleeve type coupler, and those bands meeting the Specifications of Section 9-05.8(2)E. Smooth sleeve type couplers may be either plastic or steel suitable for holding the pipe firmly in alignment without the use of sealing compound or gaskets.

1 **9-05.10 PLASTIC FOAM (ETHAFOAM)**

2 Polyethylene plastic foam used in underground utility separation must comply with the Federal Specification Cid A-A
3 59136 Type 1, Class 1, Grade A (Ethafom).

4 **9-05.11 ABS COMPOSITE PIPE**

5 ABS (acrylonitrile butadiene styrene) material must not be used unless specified in the Contract or permitted by the
6 Engineer.

7 ABS composite pipe must comply with AASHTO M 264.

8 ABS composite pipe must be provided with Type OR (flexible gasketed) joints. Rubber gasketed joints must conform to
9 ASTM C 443.

10 Fittings for ABS composite pipe must be specifically designed for connection to ABS composite pipe with solvent cement.
11 Normally, all fittings must be the same material as the pipe being connected, except that fittings using other materials or
12 constructed with more than one material may be used subject to advance approval of the Engineer. Fittings must have
13 sufficient strength to withstand handling and load stresses encountered.

14 **9-05.12 SAFETY BARS FOR CULVERT PIPE**

15 Steel pipe used as safety bars and steel pipe used as sockets must conform to ASTM A 53, Grade B. Steel tubing used
16 as safety bars must conform to ASTM A 500, Grade B. Steel plate must conform to ASTM A 36.

17 **9-05.13 FLOW CONTROL STRUCTURE**

18 See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

19 The flow control Structure must be made from a standard maintenance hole section as shown on Standard Plan 270 with
20 diameter as indicated on the Drawings.

21 Where surface water is to enter directly through the cover of the flow control Structure, the frame and grate must be as
22 shown on Standard Plan 264, and the precast slab must be as shown on Standard Plans 243a and 243b with opening details
23 to fit the diameter of the chamber. In all other cases, standard ring and cover (see Standard Plan 230) must be used with a
24 precast slab conforming to 200 Series Standard with a 24-inch round opening. Maintenance hole sections, castings and slabs
25 must be as specified in Section 7-05.

26 The flow control device and connection must consist of a PVC pipe cross with an orifice, a pipe connection, and shear
27 gate with a galvanized steel chain. The diameters of the control device and connection must be the same as the diameter of
28 the outlet pipe as specified in the Contract. The PVC pipe used for the cross and connection must comply with ASTM D 1785,
29 Schedule 40. The PVC material used for the orifice plate and the shear gate must be plate material in compliance with ASTM
30 D 1784, PVC Class 12454 B. The orifice plate material must be 1/4-inch thick and the shear gate material must be 1/2-inch
31 thick. The shear gate pin must be of the same PVC material as the shear gate. The sheargate chain must be 1/8-inch diameter
32 Type 304 stainless steel straight link chain permanently attached to the Structure.

33 **9-05.14 GALVANIZED IRON PIPE**

34 Galvanized iron pipe 4-inch diameter and smaller must be ASTM A 53 schedule 40 pipe.

35 **9-05.15 CEMENT SLURRY ABANDONING PIPE OR FILLING ANNULAR SPACE BETWEEN 2 PIPES**

36 Cement slurry used to fill the annular space between an inner and outer pipe must be pumpable, flowable, and must
37 completely fill the annular space. Materials must have the following properties:

38

| Material Reference | Material Property |
|-----------------------------------|------------------------|
| Cement, ASTM C 150 | Type I / II |
| Slurry Density, ASTM C 138 | 65 pcf (minimum) |
| Foamed Slurry Density, ASTM C 138 | 45 pcf (minimum) |
| Water / Cement Ratio | 0.90 (maximum) |
| Flow, ASTM C 939 | 18 seconds (maximum) |
| Shrinkage, ASTM C 827 | non shrink |
| Bleeding, ASTM C 232 | no bleed |
| Set Time, ASTM C 403 | 3-6 hours ¹ |
| Compressive Strength | |
| ASTM C 403 @ 24 hours | 75 psi (minimum) |
| ASTM C 495 @ 7 Days | 150 psi (minimum) |
| ASTM C 495 @ 28 Days | 250 psi (minimum) |

39 NOTE:

1 1. Set time depends on temperature and site conditions.

2 **9-05.16 SIDE SEWER AND SERVICE DRAIN**

3 Sanitary side Sewer and service drain side Sewer Material must be per the SMC Title 21 and other current Director's
4 Rules, as applicable.

5 **9-05.17 POLYPROPYLENE PIPE**

6 Polypropylene Pipe, corrugated, single wall and double wall for diameter sizes 12-inch through 30-inch must conform to
7 the Specifications of ASTM F2736. Third party certification that it complies with ASTM F2764 must accompany all delivered
8 pipe.

9 Triple wall polypropylene pipe for diameter sizes 30-inch through 60-inch diameter must conform to ASTM F2764. Third
10 party certification that it complies with ASTM F2764 must accompany all delivered pipe.

11 **9-05.18 COUPLINGS FOR PIPE JOINTING**

12 All couplings must form a watertight joint when installed. Couplings used for jointing pipe must be per the requirements in
13 the table below:

14

| Application | Flexible Gasketed Coupling with Stainless Steel Shield | Heavy Duty Ductile Iron Body Gasketed Coupling | Stainless Steel Body Gasketed Coupling |
|--|--|--|--|
| Side Sewer Construction | X | X ¹ | X ¹ |
| Catch Basin Construction | X | X ¹ | X ¹ |
| Mainline Break-out and Reconnect, Mismatched Wall Thickness | X | -- | -- |
| Mainline Repair, Matching Wall Thickness (VCP, Concrete) | X | -- | X |
| Mainline Repair, Matching Wall Thickness (DI, CI, PVC, HDPE) | X | X | X |

15 NOTE: "X" denotes acceptable coupling type.

16 1. May not be used for the last connection between side sewer and mainline pipe.

17

18 Flexible gasketed couplings with stainless steel shielding must conform to the specifications of ASTM C 1173 for a Type
19 B classification. Couplings must be sized to fit the specific pipe and material to which it is designed to join, such that the outer
20 diameters of the pipes being coupled fall within the manufacturer's specified sizing range. The stainless steel shielding must
21 perform as a shear ring for the coupling, and must be at least 0.012 inches thick. Interior shear rings are not acceptable for
22 transitions from new to existing pipe.

23 Heavy duty ductile iron body gasketed couplings must be configured for the size and type of pipe to be jointed. Gaskets
24 must be compounded for water and sewage service. Ductile iron bodies must be shop coated. Bolts must be corrosion
25 resistant steel.

26 Stainless steel body gasketed couplings must be constructed of type 304 stainless steel. Bolts, nuts, and washers must
27 be type 304 stainless steel. Gaskets must be compounded for water and sewage service.

28 **SECTION 9-06 STRUCTURAL STEEL AND RELATED MATERIALS**

29 **9-06.1 STRUCTURAL CARBON STEEL**

30 Structural carbon steel must conform to the Specifications of AASHTO M 270, Grade 36, Structural Steel For Bridges,
31 unless the Contract specifies AASHTO M 183, Structural Steel.

32 **9-06.2 STRUCTURAL LOW ALLOY STEEL**

33 Structural low alloy steel must conform to the Specifications of AASHTO M 270, Grades 50 or 50W as specified in the
34 Contract, unless the Contract specifies AASHTO M 223 or AASHTO M 222.

35 **9-06.3 STRUCTURAL HIGH STRENGTH STEEL**

36 Structural high strength steel must be high yield strength, quenched and tempered structural steel conforming to the
37 Specifications of AASHTO M 270, Grades 70W, 100, or 100W as called out in the Contract, unless the Contract specifies
38 AASHTO M 244.

1 **9-06.4 BOLTS**

2 **9-06.4(1) UNFINISHED BOLTS**

3 Unfinished bolts (ordinary machine bolts) must conform to the Specifications of ASTM A 307, Grade A or B. Nuts must
 4 comply with ASTM A 563, Grade A requirements. Washers, unless otherwise specified in the Contract, must comply with
 5 ASTM F 844 Specifications.

6 The Contractor must submit a manufacturer's certificate of compliance for the bolts, nuts, and washers before installing
 7 any of them.

8 **9-06.4(2) HIGH STRENGTH BOLTS**

9 High-strength bolts for structural steel joints must conform to either ASTM A 325 Type 1 or 3 or ASTM A 490 Type 1 or 3,
 10 as specified on the Drawings or in the Project Manual. Tension control bolt assemblies, complying with all Specifications of
 11 ASTM F 1852 may be substituted where ASTM A 325 high-strength bolts and associated hardware are specified.

12 When bolts are specified to be galvanized, tension control bolt assemblies must be galvanized after fabrication per ASTM
 13 B 695 Class 55 Type I.

14 Bolts conforming to ASTM A 490 must not be galvanized.

15 Bolts for unpainted and non-galvanized Structures must conform to ASTM A 325 Type 3, ASTM A 490 Type 3, or ASTM
 16 F 1852 Type 3, as specified on the Drawings or in the Project Manual.

17 Nuts for high-strength bolts must comply with the following requirements:
 18

| Bolt | Requirement |
|-----------------------------|---|
| ASTM A 325 Bolts | |
| Type 1 (black) | ASTM A 563 Grade C, C3, D, DH, and DH3 AASHTO M 292 Grade 2H |
| Type 3 (black weathering) | ASTM A 563 Grade C3 and DH3 |
| Type 1 (hot-dip galvanized) | ASTM A 563 Grade DH AASHTO M 292 Grade 2H |
| ASTM A 490 Bolts | |
| Type 1 (black) | ASTM A 563 Grade DH and DH3 AASHTO M 292 Grade 2H |
| Type 3 (black weathering) | ASTM A 563 Grade DH3 |

19
 20 Nuts that are to be galvanized must be tapped oversized the minimum required for proper assembly. The amount of
 21 overlap must be such that the nut will assemble freely on the bolt in the coated condition and must comply with the mechanical
 22 Specifications of ASTM A 563 and the rotational capacity test specified in ASTM A 325.

23 Galvanized nuts must be lubricated per ASTM A 563 including supplementary requirement S2. Documentation must
 24 include the name, method of application, and dilution of the lubricant applied to the nuts.

25 Washers for ASTM A 325 and ASTM A 490 bolts must comply with the Specifications of ASTM F 436 and may be
 26 circular, beveled, or extra thick, as required. The surface condition and weathering characteristics of the washers must be the
 27 same as for the bolts being specified.

28 Direct Tension Indicators must conform to the Specifications of ASTM F 959 and may be used with either ASTM A 325 or
 29 M 253 bolts. Direct tension indicators must be galvanized by mechanical deposition per ASTM B 695 class 55. Hot-dip
 30 galvanizing will not be allowed.

31 All bolts, nuts, and direct tension indicators must be marked and identified as required in the pertinent Specifications.

32 Lock-pin and collar fasteners which comply with the materials, manufacturing, and chemical composition Specifications
 33 of ASTM A 325 or ASTM A 490, and which comply with the mechanical property Specification in full size tests, and which have
 34 a body diameter and bearing areas under lock-pin head and collar not less than those provided by a bolt and nut of the same
 35 nominal size may be used. The Contractor must submit a detailed installation procedure to the Engineer for approval. Approval
 36 from the Engineer to use a lock-pin and collar fasteners must be received by the Contractor before use.

37 The Contractor must provide manufacturer's certificate of compliance for all bolts, nuts, washers, and load indicators.
 38 The manufacturer's certificate of compliance must include certified mill test reports and test reports performed on the finished
 39 bolt confirming that all of the materials provided comply with the Specifications of the applicable AASHTO or ASTM
 40 Specification. The documentation must also include the name and address of the test laboratory, the date of testing, the lot
 41 identification of the bolts and nuts, and coating thickness for galvanized bolts and nuts. Shipping containers (not lids) must be
 42 marked with the lot identification of the item contained therein.

1 Bolts must be sampled before incorporating into a Structure. For the purposes of selecting samples, a lot of bolts must be
 2 the quantity of bolts of the same nominal diameter and same nominal length in a consignment shipped to the Project Site. The
 3 minimum number of samples from each lot must be as follows:

| Lot Size | Sample Size ^{1,2} |
|-----------------|----------------------------|
| 0-50 | Note 3 |
| 51-150 | 4 |
| 151-1,200 | 6 |
| 1,201-10,000 | 10 |
| 10,001-35,000 | 16 |
| 35,001 and over | 24 |

5 NOTES:

- 6 1. If bolts are galvanized, increase the sample size by 1.5 times the table value for the number of bolts being sampled.
 7 2. Nuts, washers, and load indicator devices must be sampled at the same frequency as the bolts.
 8 3. Manufacturer's certificate of compliance required — samples not required.

10 All testing of bolts, nuts, washers, and load indicating devices must be performed on specimens as they are to be
 11 installed.

12 All samples must include a manufacturer's certificate of compliance for each lot of bolts provided as defined in Section 1-
 13 06.3.

14 **9-06.4(3) ANCHOR BOLTS**

15 Anchor bolts must comply with the Specifications of ASTM F 1554 and, unless otherwise specified, must be Grade 105
 16 and must conform to Supplemental Requirements S2, S3, and S4.

17 Nuts for ASTM F 1554 Grade 105 black anchor bolts must conform to ASTM A 563, Grade D or DH. Nuts for ASTM F
 18 1554 Grade 105 galvanized bolts must conform to either ASTM A 563, Grade DH, or AASHTON M 292, Grade 2H, and must
 19 conform to the overtapping, lubrication, and rotational testing requirements in Section 9-06.4(2). Nuts for ASTM F 1554 Grade
 20 36 or 55 black or galvanized anchor bolts must conform to ASTM A 563, Grade A. Washers must conform to ASTM F 436.

21 The bolts must be tested by the manufacturer in accordance with the pertinent Specifications. Anchor bolts, nuts, and
 22 washers must be inspected before shipping to the Project Site. The Contractor must submit to the Engineer for approval a
 23 manufacturer's certificate of compliance for the anchor bolts, nuts, and washers, as defined in Section 1-06.3. The Contractor
 24 must provide a sample of the anchor bolt, nut, and washer for testing upon request.

25 All bolts, nuts, and washers must be marked and identified as required in the pertinent Specification.

26 **9-06.5 STEEL CASTINGS**

27 Steel castings must conform to the Specifications of AASHTO M 103, Mild to Medium Strength Carbon Steel Castings for
 28 General Application, grade 70-36, unless otherwise designated in the Contract.

29 **9-06.6 GRAY IRON CASTINGS**

30 Gray iron castings must conform to the Specifications of AASHTO M 105. The class of castings to be furnished must be
 31 as designated in the Contract.

32 **9-06.7 MALLEABLE IRON CASTINGS**

33 Malleable iron castings must conform to the Specifications of ASTM A 47.

34 **9-06.8 STEEL FORGINGS AND STEEL SHAFTING**

35 Steel forgings must conform to the Specifications of AASHTO M 102. The classes of forgings to be furnished must be
 36 those specified in the Contract.

37 Steel shafting must conform to the Specifications of AASHTO M 169, Grade Designation 1016 to 1030 inclusive, unless
 38 otherwise specified in the Contract.

39 **9-06.9 BRONZE CASTINGS**

40 Bronze castings must conform to the Specifications of AASHTO M 107, Bronze Castings for Bridges and Turntables.

41 **9-06.10 COPPER SEALS**

42 Copper sheets for seals must conform to the Specifications of AASHTO M 138. They must be UNS C12500, light cold
 43 rolled, and furnished in flat sheets each not less than 0.018 inches in thickness.

All splices or joints must be carefully brazed or soldered to produce a continuous water tight seal for the full length of each unit.

9-06.11 DUCTILE IRON CASTINGS

Ductile iron castings must conform to the Specifications of ASTM A 536, Grade 80 55 06, unless otherwise specified in the Contract.

9-06.12 WELDED SHEAR CONNECTORS

Welded shear studs must be made from cold drawn bar stock conforming to the Specifications of AASHTO M 169, Grades 1010 through 1020, inclusive, either semi killed or killed deoxidation.

The Material must conform to the following mechanical properties:

| Property | Allowance |
|-------------------|-----------------|
| Tensile Strength | 60,000 psi min. |
| Yield Strength | 50,000 psi min. |
| Elongation | 20% min. |
| Reduction of Area | 50% min. |

Mechanical properties must be determined per AASHTO Methods and Definitions T 244.

At the manufacturer's option, mechanical properties of the studs must be determined by testing either the steel after cold finishing, or the full diameter finished studs.

9-06.13 ROADSIDE SIGN STRUCTURES

Materials in this Section apply to Division 6. See Section 9-28 for signing materials and fabrication.

All bolts must conform to AASHTO M 164. Washers for bolts must be per AASHTO M 293.

Posts for single post sign Structures must comply with ASTM A 500, Grade B or ASTM A 53, Grade B.

Posts for multiple post sign Structures must comply with AASHTO M 183. Posts complying with AASHTO M 222 or AASHTO M 223, Grade 50 may be used as an acceptable alternate to the AASHTO M 183 posts. All steel not otherwise specified must conform to AASHTO M 183.

Triangular base stiffeners for one directional multi post sign posts must comply with AASHTO M 222 or AASHTO M 223, Grade 50.

Base connectors for multiple directional steel breakaway posts must conform to the following:

| Base Connectors | Standard |
|-----------------------------|--|
| Bracket | Aluminum Alloy 6061 T-6 |
| Bosses for Type 2B Brackets | ASTM A 582 |
| Coupling Bolts | AASHTO M 164 |
| Anchor Bolts | Type 304 stainless steel for threaded portion, AISI 1038 steel rod, and AISI 1008 coil for cage portion. |

Anchor couplings for multiple directional steel breakaway posts must have a tensile breaking strength range as follows:

| Anchor Couplings | Tensile Breaking Strength Range |
|------------------|---------------------------------|
| Type 2A | 17,000-21,000 lbs |
| Type 2B | 47,000-57,000 lbs |

For multi directional breakaway base connectors, shims must be fabricated from pregalvanized sheet steel. For one directional breakaway base connectors, single-post or multipost, shims must be fabricated from brass conforming to ASTM B 36.

9-06.14 METAL BRIDGE RAILING

Metal bridge railing must conform to the type and material Specifications set forth in the Contract.

Section 8, part (b) of the Aluminum Association Standard Specifications for Aluminum Railing Posts Alloy A 344 T4 is hereby revised to provide that no x-ray inspection will be required after a foundry technique has been established for each

1 mold which ensures production of castings that are free from harmful defects. Inspection for approval of castings will be made
2 by the Engineer after the finished castings have been anodized as noted on the Drawings.

3 Welding of aluminum must be per Section 6.9 of the AASHTO Standard Specifications for Structural Supports for
4 Highway Signs, Luminaires, and Traffic Signals, Fourth Edition-2001.

5 **9-06.15 BOLTS, WASHERS, AND OTHER HARDWARE**

6 Ordinary machine bolts and flat head bolts must be made from commercial bolt stock complying with ASTM A 307, and
7 must be grade A. Drift bolts and dowels may be either wrought iron or medium steel. Washers may be cast iron or malleable
8 iron or may be cut from medium steel or wrought iron plate.

9 All bolts and other hardware which are to be galvanized and which require bending or shaping must be hot forged to the
10 required shape before galvanizing. Cold bending of such Material will not be permitted because of the tendency toward
11 embrittlement during the galvanizing process. Galvanizing must be per AASHTO M 232.

12 Split rings for log cribbing of 4 inches inside diameter must be manufactured from hot rolled, low carbon steel conforming
13 to ASTM A 711 AISI, Grade 1015. Each ring must form a true circle with the principle axis of the cross-section of the ring metal
14 parallel to the geometric axis of the ring. The thickness of the metal section must be 0.195 inches \pm 0.010 inches and the
15 section must be beveled from the central portion toward the edges to a thickness of 0.145 inches \pm 0.010 inches. It must be
16 cut through in one place in its circumference to form a tongue and slot. Split ring connectors must be galvanized per AASHTO
17 M 232.

18 Spike grid timber connectors must be manufactured according to ASTM A 47 for malleable iron castings. They must
19 consist of 4 rows of opposing spikes forming a 4-1/8 inch square grid with 16 teeth which are held in place by fillets which are
20 diamond shaped in cross-section.

21 Nails must be round wire of standard form. Spikes must be wire spikes or boat spikes, as specified on the Drawings.
22 Bolts, dowels, washers, and other hardware, including nails, must be black or galvanized as specified on the Drawings, but if
23 not so specified must be galvanized when used in treated timber Structures.

24 **SECTION 9-07 REINFORCING STEEL**

25 **9-07.1 GENERAL**

26 Deformed steel bar must be free from loose mill scale, dirt, grease, or other defects affecting the strength of bond with
27 concrete. Deformed steel bar coated with rust must be vigorously wire brushed clean. Size numbers must be taken to
28 represent the diameter of the bar in 1/8-inch units, except where standard wire gauge sizes are specified in the Contract.

29 **9-07.1(1) ACCEPTANCE BY MANUFACTURER'S CERTIFICATION**

30 Reinforcing steel may be accepted by the Engineer based on the manufacturer's certificate of compliance.

31 **9-07.1(1)A ACCEPTANCE OF MATERIALS**

32 Steel reinforcing bar manufacturers use either English or a Metric size designation while stamping rebar. The actual size
33 of the bar, whether stamped with an English or a Metric size designation is acceptable. The Drawings and the Standard Plans
34 will continue to use an English size designation. The table below shows the comparable reinforcing steel bar size designations
35 in the both units of measure:

| English Designation | Bar Diameter | Metric Designation |
|---------------------|--------------|--------------------|
| #3 | 0.375 in | #10 |
| #4 | 0.500 in | #13 |
| #5 | 0.625 in | #16 |
| #6 | 0.750 in | #19 |
| #7 | 0.875 in | #22 |
| #8 | 1.000 in | #25 |
| #9 | 1.128 in | #29 |
| #10 | 1.270 in | #32 |
| #11 | 1.410 in | #36 |
| #14 | 1.690 in | #43 |
| #18 | 2.260 in | #57 |

37

38 **9-07.1(2) BENDING**

39 Steel reinforcing bars must be cut and bent by careful and competent workers. They must be bent cold to templates,
40 which must not vary appreciably from the shape and dimension shown on the Drawings.

1 Hooks and bends of steel reinforcing bars must be bent to the following inside diameters unless shown otherwise on the
 2 Drawings:

| Bar Size | Stirrups And Ties | All Other Bars |
|-----------------------|-------------------|------------------|
| No. 3 | 1-1/2 " | 6 bar diameters |
| No. 4 | 2" | 6 bar diameters |
| No. 5 | 2-1/2 " | 6 bar diameters |
| No. 6 | 4-1/2 " | 6 bar diameters |
| No. 7 | 5-1/4" | 6 bar diameters |
| No. 8 | 6" | 6 bar diameters |
| No. 9 through No. 11 | -- | 8 bar diameters |
| No. 14 through No. 18 | -- | 10 bar diameters |

4
 5 The supplementary Specifications of AASHTO M 31 for bend tests must apply to size No. 14 and No. 18 steel reinforcing
 6 bars which have hooks or bends.

7 Hooked ends of steel reinforcing bars must be standard hooks unless shown otherwise in the Drawings. Standard hooks
 8 must consist of a 90, 135, or 180 degree bend as shown in the Drawings plus a minimum bar extension at the free end of the
 9 bar shown in the table below. Seismic hooks must consist of a 135 degree bend plus a minimum bar extension at the free end
 10 of the bar shown in the table below.

11 **Minimum Bar Extensions for Standard and Seismic Hooks**

| Bar Size | 180° Hook | 135° Hook | | 90° Hook | |
|----------|-----------|--------------|----------------|-------------------|----------------|
| | All Bars | Seismic Hook | All Other Bars | Stirrups And Ties | All Other Bars |
| No. 3 | 2-1/2" | 3" | 2-1/4" | 2-1/4" | 4-1/2" |
| No. 4 | 2-1/2" | 3" | 3" | 3" | 6" |
| No. 5 | 2-1/2" | 3-3/4" | 3-3/4" | 3-3/4" | 7-1/2" |
| No. 6 | 3" | 4-1/2" | 4-1/2" | 9" | 9" |
| No. 7 | 3-1/2" | 5-1/4" | 5-1/4" | 10-1/2" | 10-1/2" |
| No. 8 | 4" | 6" | 6" | 12" | 12" |
| No. 9 | 4-3/4" | -- | -- | -- | 13-3/4" |
| No. 10 | 5-1/4" | -- | -- | -- | 15-1/4" |
| No. 11 | 5-3/4" | -- | -- | -- | 17" |
| No. 14 | 7" | -- | -- | -- | 20-1/2" |
| No. 18 | 9-1/4" | -- | -- | -- | 27-1/4" |

13
 14 **9-07.1(3) LENGTHS**

15 Net lengths of bent bars shown in the length column of the bar list on the Drawings are rounded to the nearest inch. Net
 16 length is the length of bar after all bend deductions are subtracted from the gross length.

17 **9-07.2 DEFORMED STEEL BARS**

18 Deformed steel bars for concrete reinforcement must conform to either AASHTO M 31 Grade 60, or ASTM A 706, except
 19 as otherwise noted. Steel reinforcing bar for the cast-in-place components of bridge Structures (excluding sidewalks and
 20 barriers but including shafts and concrete piles), and for precast substructure components of bridge Structures, must conform
 21 to ASTM A 706 only. However, in computing the ultimate unit tensile stress from test data, the area may be corrected for mass
 22 per linear foot of the bar within the weight tolerances listed. No such correction for mass must be used in calculating the yield
 23 stress; the nominal area of the bar, as provided in Table 1 of AASHTO M 31 or ASTM A 706, must be used in this
 24 computation.

25 Deformed steel bars are referred to in the Drawings and Specifications by number: for example, No. 3, No. 4, No. 5,

26 **9-07.3 EPOXY COATED STEEL REINFORCING BARS**

27 Epoxy coated rebar must be coated per AASHTO M 284 with the additional following modifications:

- 28 1. The list of steel reinforcing bars acceptable for coating must include ASTM A 706.

2. The Contractor must furnish a written certification that properly identifies the material, the number of each batch of coating material used, quantity represented, date of manufacture, name and address of manufacturer, and a statement that the supplied coating material complies with the Specifications of AASHTO M 284.
3. The Contractor must supply to the Engineer an 8 ounce representative sample of the coating material from each batch of coating material. The sample must be packaged in an airtight container and identified as epoxy coating material by batch number.
4. Before coating the bars, the Contractor must submit the coating material manufacturer's recommendation on the proper use and application requirements of the coating material to the Engineer for review.
5. A manufacturer's certificate of compliance stating that all bars have been coated per the coating material manufacturer's recommendations and these Specifications must be furnished with each shipment. This certification must include for each bar size the preheat temperatures, cure times, thickness checks, holidays detected, and test results.
6. The Contractor must provide advance notice to the Engineer of the coating schedule at the coating facility so that Engineer inspection for approval may be provided.
7. The patching material, compatible with the coating material and inert in concrete, must be supplied with each shipment.
8. For projects where epoxy-coated steel reinforcing bars are used in the top mat of bridge decks only, the maximum amount of damage to the coating must not exceed 0.25 percent of the surface area of each bar.
9. The thickness of epoxy-coating must be 10 mils \pm 2 mils.
10. All samples must be submitted to the SPU Materials Laboratory as specified in 1-05.3(1)C.

9-07.4 PLAIN STEEL BARS

Where plain steel bars are specified, they must conform to the chemical and physical properties of AASHTO M 31, Grade 60, unless specifically noted otherwise. Plain steel bars are specified in the Contract by fractions of an inch of diameter; for example, 3/8-inch diameter, 1/2-inch diameter, or 5/8-inch diameter.

9-07.5 DOWEL BARS (FOR CEMENT CONCRETE PAVEMENT)

Epoxy coated dowel bars must be round plain steel bars of the dimensions shown in the Standard Plans. They must conform to AASHTO M 31, Grade 60 or AASHTO M 255, Grade 60 and must be coated per ASTM A 934. The thickness of the epoxy coating must be 10 mils \pm 2 mils. In addition, Section 9-07.3, Items 2, 3, 4, 5, 6, 7, and 10 must apply.

9-07.6 TIE BARS (FOR CEMENT CONCRETE PAVEMENT)

Tie bars must conform to the Standard Specifications for Deformed Billet Steel Bars for Concrete Reinforcement, AASHTO M 31, Grade 60 and must be coated per AASHTO M 284. Deformed bar must be 5/8-inch diameter and 30 inches long.

The form of the deformed bar is subject to approval by the Engineer.

Tie bars must be free from dirt, grease, or other defects affecting the strength or bond with the concrete. Tie bars must be epoxy encapsulated.

9-07.7 WIRE MESH

Wire mesh for concrete reinforcement must conform to AASHTO M 55, Welded Steel Wire Fabric for Concrete Reinforcement or AASHTO M 221, Welded Deformed Steel Wire Fabric for Concrete Reinforcement. All wire mesh must be of an approved kind and quality of manufacture.

9-07.8 DEFORMED WIRE

Deformed wire must conform to AASHTO M 225.

Deformed wire is noted in the Contract by the letter D, followed by a number indicating the cross-sectional area of the wire; for example, D2, D5, or D20.

9-07.9 COLD DRAWN WIRE

Cold drawn wire must conform to AASHTO M 32.

Cold drawn wire is noted in the Contract by the letter W followed by a number indicating the cross-sectional area of the wire; for example, W2, W5, or W20.

9-07.10 PRESTRESSING REINFORCEMENT STRAND

Prestressing reinforcement must be 1/2-inch diameter for precast-prestressed concrete piles and 1/2-inch or 0.6-inch diameter for pretensioned concrete girders, post-tensioned segmental precast concrete girders, or cast-in-place prestressed concrete.

Prestressing reinforcement must be mill bright high tensile strength 7-wire low relaxation strand conforming to AASHTO M 203, Grade 270.

1 All prestressing reinforcement furnished for a given structural member must have a maximum elongation differential of 3
 2 percent at stress of 0.8 of the ultimate strength of the prestressing steel. Each reel of prestressing reinforcement must be
 3 accompanied by a manufacturer's certificate of compliance, a mill certificate, and a test report. The mill certificate and test
 4 report must include the yield and ultimate strengths, elongation at rupture, modulus of elasticity, and the stress strain curve for
 5 the actual prestress reinforcing intended for use. All values certified must be based on test values and actual sectional areas
 6 of the Material being certified.

7 For every 5 reels furnished, one sample, not less than 5-1/2 feet long, must be sent to the SPU Materials Lab for testing
 8 as specified in Section 1-05.3. Samples of the furnished reels with manufacturer's certificate of compliance, a mill certificate,
 9 and test report may be shipped directly by the manufacturer to the Engineer. An independent inspector, approved by the
 10 Owner, must be present during sampling and must provide a written certification to the Engineer.

11 **9-07.11 PRESTRESSING REINFORCEMENT BAR**

12 High-strength steel bars must conform to AASHTO M 275, Type II.

13 Nuts must conform to either ASTM A 29 Grade C1045, or ASTM A 536 Grade 100-70-03, and must be capable of
 14 developing the larger of either 100 percent of the minimum ultimate tensile strength (MUTS), or 95 percent of the actual
 15 ultimate tensile strength (AUTS), of the bar. The anchor nuts must conform to the specified strength requirement while
 16 permitting a maximum 5 degree misalignment between the nut and the bearing plate. A minimum of 3 tests, each from a
 17 different heat, are required.

18 Couplers, if required, must be AASHTO M 169 Grade 1144, or equivalent steel, developing the larger of either 100
 19 percent of the MUTS, or 95 percent of the AUTS, of the bar. The test must be performed with the coupler having a 1 inch
 20 unengaged segment between the two coupled bars. A minimum of 3 tests, each from a different heat, are required.

21 For unbonded bars under dynamic loading, the connections must withstand at least 500,000 cycles from 60 percent to 66
 22 percent MUTS followed by at least 50 cycles between 40 percent MUTS and 80 percent MUTS. A minimum of 3 tests, each
 23 from a different heat, are required.

24 **SECTION 9-08 PAINTS AND RELATED MATERIALS**

25 **9-08.1 PAINT**

26 **9-08.1(1) DESCRIPTION**

27 Paints must be made from materials complying with the applicable Federal and State Paint Specifications, Department of
 28 Defense (DOD), American Society on Testing of Materials (ASTM), and Steel Structures Painting Council (SSPC)
 29 Specifications in effect at the time of manufacture. The colors, where designated, must conform to Section 9-08.1(8).

30 **9-08.1(2) PAINT TYPES**

31 **9-08.1(2)A VINYL PRETREATMENT**

32 Vinyl pretreatment must be a two-component basic zinc chromate-vinyl butyral wash primer conforming to DOD-P-15328
 33 (Formula 117 for Metals) and SSPC Paint 27. Zinc chromate must be the insoluble type. The paint must be supplied as two
 34 components that are mixed together just before use.

35 **9-08.1(2)B GALVANIZING REPAIR PAINT, HIGH ZINC DUST CONTENT**

36 Galvanizing repair paint must conform to Federal Specification MIL-P-21035B.

37 **9-08.1(2)C INORGANIC ZINC-RICH PRIMER**

38 Inorganic zinc-rich primer must be a two-component, self-curing, inorganic zinc-rich paint, conforming to either AASHTO
 39 M 300 or SSPC Paint 20 Type I.

40 **9-08.1(2)D ORGANIC ZINC-RICH PRIMER**

41 Organic zinc-rich primer must be a high-performance two-component epoxy conforming to SSPC Paint 20 Type II.

42 **9-08.1(2)E EPOXY POLYAMIDE**

43 Epoxy polyamide primer must be a two-component, VOC-compliant epoxy system, conforming to MIL-DTL-24441.

44 **9-08.1(2)F PRIMER, ZINC-FILLED, SINGLE-COMPONENT, MOISTURE-CURED POLYURETHANE**

45 Zinc-rich primer must comply with the following requirements:
 46

| Characteristic | Requirement |
|-----------------|-------------------------------------|
| Vehicle Type | Moisture-cured polyurethane |
| Pigment Content | 80% min. zinc by weight in dry film |
| Volume Solids | 60% min. |

| Characteristic | Requirement |
|-----------------|-------------|
| Min. weight/gal | 22.0 lbs |

1
2 **9-08.1(2)G INTERMEDIATE AND STRIPE COAT, SINGLE COMPONENT, MOISTURE-CURED POLYURETHANE**

3

| Characteristic | Requirement |
|----------------|---|
| Vehicle Type | Moisture-cured polyurethane |
| Pigment | A minimum of 3.0 lbs of micaceous iron oxide per gallon |

4
5 Intermediate and any stripe coat must comply with the following requirements:

- 6 1. Minimum volume solids 50 percent.
7 2. A minimum of 3.0 lbs/gal of micaceous iron oxide.

8 The intermediate coating must be certified by the manufacturer to be able to be recoated by the top coat in a minimum of
9 4 days.

10 **9-08.1(2)H TOP COAT, SINGLE-COMPONENT, MOISTURE-CURED POLYURETHANE**

11

| Characteristic | Requirement |
|----------------|--|
| Vehicle Type | Moisture-cured aliphatic polyurethane |
| Color | As specified in the Drawings or Special Provisions |

12
13 The Top Coat must comply with the following requirements:

- 14 1. The resin must be an aliphatic urethane.
15 2. Minimum-volume solids 50 percent.
16 3. The top coat must be a semi-gloss.

17 **9-08.1(2)I RUST-PENETRATING SEALER**

18 Rust-penetrating sealer must be a two-component, chemically-cured, 100 percent solids epoxy with maximum VOC 1.7
19 pounds/gallon.

20 **9-08.1(2)J BLACK ENAMEL**

21 The enamel must conform to Federal Specification MIL PRF 2463D Type II Class II.

22 **9-08.1(2)K ORANGE EQUIPMENT ENAMEL**

23 The enamel must be an alkyd gloss enamel conforming to Federal Specification TT-E-489, except that the Sag Index
24 must be 7 minimum. The color, when dry, must match that of Federal Standard 595, color number 12246.

25 For factory application to individual items of new equipment, samples and testing of the enamel must not be required;
26 however, the equipment manufacturer must match the color specified and must certify the quality of enamel used.

27 **9-08.1(2)L EXTERIOR ACRYLIC LATEX PAINT-WHITE**

28 This paint must conform to Federal Specification TT-P-96, Paint, Acrylic Emulsion, Exterior, except that the viscosity
29 must be 75-85 K.U.

30 This paint may be used self-primed in multiple coats over salts-treated wood and on interior and exterior masonry
31 surfaces.

32 **9-08.1(3) WORKING PROPERTIES**

33 The paint must contain no caked material that cannot be broken up readily by stirring. When applied to a clean vertical
34 surface, the paint must dry without running, streaking, or sagging.

35 **9-08.1(4) STORAGE PROPERTIES**

36 Paints manufactured under these Specifications must show no skin over the surface after 48 hours in a filled container,
37 when tested as outlined in Federal Test Method Standard No. 141D. A slight amount of skin or gel formation where the surface
38 of the paint meets the side of the container may be disregarded. Variable percentages of anti-skinning agents are shown in
39 those formulas set forth above that are susceptible to undesirable skin formation. The manufacturer will be allowed to vary the
40 amount of anti-skinning agent given in the formulas provided the above results are accomplished and provided the paint does
41 not dry to a nonuniform or nonelastic film.

9-08.1(5) FINENESS OF GRINDING

The paint must be ground so that all particles of pigment will be dispersed and be coated with vehicle, and the residue on a 325 sieve will not exceed 1 percent by weight of the pigment. Paint must be homogeneous, free of contaminant, and of a consistency suitable for use under intended application. Finished paint must be well ground, and the pigment must be properly dispersed in the vehicle, conforming to the requirements of the paint. Dispersion in the vehicle must be such that the pigment does not settle excessively, does not cake or thicken in the container, and does not become granular or curdled.

9-08.1(6) TEST METHODS

Except as otherwise specified, all paints must be sampled and tested in the ready-mixed form. The test methods must be as specified in Federal Test Method Standard No. 141D or as specified under AASHTO R 31, as applicable.

9-08.1(7) ACCEPTANCE

Except for batches of paint in total project quantities of 20 gallons or less that are accepted upon the manufacturer's certificate of compliance, the manufacturer must not ship any batch of paint until the paint has been tested and released by the SPU Materials Laboratory. This release will not constitute final acceptance of the paint. Final acceptance will be based on inspection or testing of Job Site samples as determined by the Engineer.

Project quantities of 20 gallons or less of the above paint types will be accepted without inspection upon the manufacturer's notarized certificate of compliance. This certificate must contain a statement by the manufacturer to the effect that the material complies with the paint type Specification, and it must include a list of materials and quantities used. One copy of the certificate must accompany the paint when shipped and one copy with a drawdown sample of the paint must be sent to the Laboratory. The paint may be used at once without further release from the Laboratory.

9-08.1(8) STANDARD COLORS

When paint is required to match a Federal Standard 595 color, the paint manufacturer or the Contractor may obtain a sample of the required color through the following internet link: <http://www.colorserver.net>. For the City of Seattle, the following colors are defined:

| Color | Color Number |
|-----------------------|--------------|
| Black | 27030 |
| Seattle Safety Yellow | 23594 |
| Seattle Narrows Green | 34227 |

Unless otherwise specified, all top or finish coats must be semigloss, with the paint falling within the range of 35 to 70 on the 60-degree gloss meter.

The Contractor must submit two minimum 4" x 6" paint chip samples to the Engineer at least 10 Working Days before the scheduled application as specified in Section 1-05.3. The color of the paint when dry must match the color of a Standard 595 color chip.

Commission Internationale de l'Eclairage (CIELAB) color system has determined standard values that are used worldwide to measure color. The values used by CIE are called L*, a* and b* and the color measurement method is called CIELAB.

The calculated Delta E must not exceed 1.0 deviation from the Commission Internationale de l'Eclairage (CIELAB) color measurement analysis method for each color.

For the City of Seattle, the following colors are defined:

| Color | III/OBS | L* | a* | b* |
|-----------------|----------------|-------|-------|-------|
| Washington Gray | D65/10-degrees | 62.59 | 0.98 | 5.23 |
| | A/10-degrees | 63.06 | 1.80 | 5.70 |
| | CWF/10-degrees | 63.02 | 0.73 | 6.08 |
| Cascade Green | D65/10-degrees | 36.62 | -6.53 | -0.89 |
| | A/10-degrees | 35.82 | -7.15 | -2.53 |
| | CWF/10-degrees | 36.34 | -5.09 | -1.18 |
| Mt. Baker Gray | D65/10-degrees | 45.94 | 1.38 | 4.46 |
| | A/10-degrees | 46.40 | 1.70 | 5.05 |
| | CWF/10-degrees | 46.46 | 1.07 | 5.48 |

| Color | III/OBS | L* | a* | b* |
|------------------------|----------------|-------|-------|-------|
| Mt. St. Helens Gray | D65/10-degrees | 56.07 | 2.15 | 6.68 |
| | A/10-degrees | 56.76 | 3.08 | 7.52 |
| | CWF/10-degrees | 56.67 | 1.64 | 7.85 |
| Seattle Railroad Green | D65/10-degrees | 27.32 | -0.97 | 0.01 |
| | A/10-degrees | 27.22 | -1.14 | -0.22 |
| | CWF/10-degrees | 27.35 | -0.73 | 0.14 |

1

2 The Contractor must submit the specified and spectrophotometer or colorimeter readings taken per ASTM D 2244 to the
3 Engineer at least 10 Working Days before the scheduled application as specified in Section 1-05.3. The Contractor must not
4 begin applying until receiving the Engineer's written approval of the color samples.

5 When requested by the Engineer, the Contractor must submit a one-quart wet sample companion drawdown color
6 sample for each batch of material.

7 The 1 quart wet sample must be submitted in the manufacturer's labeled container with product number, batch number,
8 and size of batch. The companion drawdown color sample must be labeled with the product number, batch number, and size
9 of batch. The Contractor must submit the specified samples to the Engineer at least 10 Working Days before the scheduled
10 application or upon request by the Engineer with in accordance Section 1-05.3. The Contractor must not begin applying until
11 receiving the Engineer's written approval of the samples.

12 9-08.2 POWDER COATING MATERIALS FOR COATING GALVANIZED SURFACES

13 The powder coating system must consist of two components: an epoxy primer coat and a polyester finish coat. The
14 epoxy primer coat and the polyester finish coat materials must be from the same manufacturer.

15 The epoxy primer coat must be an epoxy powder primer conforming to the following requirements:

16

| Property | Specification | Performance Requirement |
|------------------|----------------------|-------------------------|
| Adhesion | ASTM D 3359 Method B | 5B (no failure) |
| Flexibility | ASTM D 522 Method B | Pass 1/8" mandrel bend |
| Pencil Hardness | ASTM D 3363 | H Plus |
| Specific Gravity | ASTM D 792 | 1.25 minimum |

17

18 The polyester finish coat must conform to American Architectural Manufacturers Association (AAMA) Specification 2604.

19 Degassing additives may be added as necessary to prevent pin holes in the finish coat. The degassing additives must be
20 added per manufacturer's recommendations.

21 The color of the powder coating system polyester finish coat must be as specified in the Drawings or Special Provisions.

22 9-08.3 PIGMENTED SEALER MATERIALS FOR COATING OF CONCRETE SURFACES

23 The pigmented sealer must be a semi-opaque, colored toner containing only methyl methacrylate-ethyl acrylate
24 copolymer resins, toning pigments suspended in solution at all times by a chemical suspension agent, and solvent. Toning
25 pigments must be laminar silicates, titanium dioxide, and inorganic oxides only. There must be no settling or color variation.
26 Tinting must occur at the factory at the time of manufacture and placement in containers, before initial shipment. Use of
27 vegetable or marine oils, paraffin materials, stearates, or organic pigments in any part of coating formulation must not be
28 permitted. The Contractor must submit a 1 quart wet sample, a drawdown color sample, and spectrophotometer or colorimeter
29 readings taken per ASTM D 2244, for each batch. The calculated Delta E must not exceed 1.0 deviation from the Commission
30 Internationale de l'Eclairage (CIELAB) color measurement analysis method for each pigmented sealer color.

31 The 1 quart wet sample must be submitted in the manufacturer's labeled container with product number, batch number,
32 and size of batch. The companion drawdown color sample must be labeled with the product number, batch number, and size
33 of batch. The Contractor must submit the specified samples and readings to the Engineer at least 14 Calendar Days prior to
34 the scheduled application of the sealer. The Contractor must not begin applying pigmented sealer until receiving the
35 Engineer's written approval of the pigmented sealer color samples

36 9-08.4 ABRASIVE BLAST MATERIALS

37 9-08.4(1) ABRASIVE BLAST MEDIA

38 Material used for field abrasive blasting must conform to Military Specification MIL A 22262B(SH) as listed on QPL-
39 22262-28 as maintained by the Department of the Navy. The Contractor must provide the Engineer with certified test results
40 from the abrasive blast media manufacturer showing that the abrasive blast material complies with the Military Specification.
41 The Contractor must select the type and size of abrasive blast media to produce a roughened, sharp, angular surface profile
42 conforming to the surface requirements specified by the manufacturer of the selected paint system.

9-08.4(2) LEAD ABATEMENT ADDITIVE

Lead abatement additive must be a granular chemical abrasive additive consisting of a complex calcium silicate designed to stabilize lead through multiple mechanisms, including, but not limited to, ph adjustment, chemical reactions, and encapsulation. The additive must be specifically designed and manufactured for lead paint abatement.

9-08.5 SURFACE CLEANING MATERIALS

9-08.5(1) BIRD GUANO TREATMENT

Bird guano treatment must consist of a 5.25 percent sodium hypochlorite solution.

9-08.5(2) FUNGICIDE TREATMENT

Fungicide treatment must consist of a 5.25 percent sodium hypochlorite solution.

9-08.5(3) WATER

Water used for water jetting steel surface cleaning operations must be clean, fresh water only, without any detergents, bleach, or any other cleaning agents or additives. Recycling of rinse water for water jetting operations is not allowed.

9-08.6 FILTER FABRIC

Filter fabric for water jetting operations must be a polypropylene, nonwoven, needle-punched geosynthetic, or equivalent material conforming to the following requirements:

| Property | Specification | Performance Requirement |
|-----------------------|---------------|-------------------------|
| Grab Tensile Strength | ASTM D 4632 | 100 pounds minimum |
| Apparent Opening Size | ASTM D 4751 | #70 sieve |
| Permittivity | ASTM D 4491 | 1.0 sec-1 or better |

9-08.7 SINGLE-COMPONENT URETHANE SEALANT

Single-component urethane sealant must conform to ASTM C 920 Grade NS Class 25.

9-08.8 FOAM BACKER ROD

Foam backer rod must be closed-cell expanded polyethylene or polyurethane foam.

SECTION 9-09 TIMBER AND LUMBER

9-09.1 GENERAL REQUIREMENTS

All timber and lumber for Structures must be Douglas Fir Larch, unless specified otherwise in the Contract. The allowable species of timber and lumber for guardrail posts must be Douglas Fir Larch or Hem Fir. Timber and lumber for sign posts, mileposts, sawed fence posts, and mailbox posts, must be Western Red Cedar, Douglas Fir Larch, or Hem Fir.

9-09.2 GRADE REQUIREMENTS

Timber and lumber must conform to the grades and usage as follows. Grades must be determined by the current standards of the West Coast Lumber Inspection Bureau (WCLIB) or the Western Wood Products Association (WWPA).

Timber and lumber for Structures, unless specified otherwise in the Contract, must conform to these grades:

| Material | Requirement |
|---|---|
| Materials 2" to 4" nominal thick, 5" nominal and wider (Structural Joists and Planks) | No. 1 and better, grade (Section 123 b of WCLIB) or (Section 62.11 of WWPA) |
| Materials 5" nominal and thicker (Beams and Stringers) | No. 1 and better, grade (Section 130 b of WCLIB) or (Section 70.11 of WWPA) |

Timber lagging for soldier pile walls must be Douglas Fir Larch, grade No. 2 or better.

Timber and lumber for guardrail posts (classified as Posts and Timbers) must conform to these grades:

| Material | Requirement |
|-------------|--|
| Douglas Fir | No. 1 and better, grade (Section 131 b WCLIB) or (Section 80.11 WWPA) |
| Hem Fir | Select Structural, grade (Section 131 a WCLIB) or (Section 80.10 WWPA) |

Mileposts, sawed fence posts, and mailbox posts must conform to these grades:

| Material | Requirement |
|----------------------|---|
| 4 x 4 | Construction grade (Light Framing, Section 122 b WCLIB) or (Section 40.11 WWPA) |
| 4 x 6 | No. 1 and better, grade (Structural Joists and Planks, Section 123 b WCLIB) or (Section 62.11 WWPA) |
| 6 x 6, 6 x 8, 8 x 10 | No. 1 and better, grade (Posts and Timbers, Section 131 b WCLIB) or (Section 80.11 WWPA) |
| 6 x 10, 6 x 12 | No. 1 and better, grade (Beams and Stringers, Section 130b WCLIB) or (Section 70.11 WWPA) |

Sign and parking meter posts must comply with the material Specifications in Section 9-28.2.

9-09.2(1) SURFACING AND SEASONING

All timber and lumber must be sized as shown on the Drawings.

All timber and lumber to be painted must be surfaced on all sides. All timber and lumber to be painted must be thoroughly air or kiln dried to an equilibrium moisture content and must be stored in such a manner as to remain in a thoroughly dry condition until placed into the Work.

9-09.2(2) INSPECTION

Timber and lumber must be marked with a certified lumber grade stamp provided by one of the following agencies:

1. West Coast Lumber Inspection Bureau (WCLIB)
2. Western Wood Products Association (WWPA)
3. Pacific Lumber Inspection Bureau (PLIB)
4. Any lumber grading bureau certified by the American Lumber Standards Committee

A grading certificate must accompany each order of timber and lumber for use in Structures as specified in Section 9-09.2. In consideration of being acceptable, the certificate must be issued by either the grading bureau whose stamp is shown on the material, or by the lumber mill which is under the supervision of one of the grading bureaus listed above. The grading certificate must include the following:

- a. Name of the mill performing the grading.
- b. The grading rules being used.
- c. Name of the person doing the grading with current certification.
- d. Signature of a responsible mill official.
- e. Date the lumber was graded at the mill.
- f. Grade, dimensions, and quantity of the timber or lumber.

When the Material is delivered to the project, the Engineer will check the order for the appropriate grade stamp. The invoice and grading certificate accompanying the order must be accurate and complete with the information listed above. The grading certificate and grade markings will not constitute final acceptance of the Material. The Engineer may reject any or all of the timber or lumber that does not comply with the Specifications or has been damaged during shipping or upon delivery.

9-09.3 PRESERVATIVE TREATMENT

All timber and lumber requiring preservative treatment must be treated per AASHTO M 133. As specified by AASHTO M 133, the American Wood-Preservers' Association (AWPA) standards must govern the Specifications. These Specifications include: storing and curing the timber and lumber, the wood preservatives, the preservative treatment process, recording the results of the treatment, inspection, testing, and the identification of properly treated timber. Unless otherwise specified in the Contract, all timber and lumber must be treated per Sections U1 and T1 of the latest edition of the AWPA standards.

All cutting, boring, chamfering, routing, surfacing, and trimming must be done prior to treating. Any field drilling or cutoffs must be treated by two liberal applications of a compatible preservative. The applications must be per AWPA Standard M4-15 Standard for the Care of Preservative-Treated Wood Products.

All charges must consist of pieces of the same species that are similar in form, size, moisture content, and receptivity to treatment. The pieces in the charge must be separated to ensure contact of treating medium with all surfaces. The method of determining the retention of the preservatives must be by assay.

As specified in the Contract, all orders of treated timber and lumber will be accompanied by a Certificate of Treatment.

The Certificate of Treatment must include:

- 1 1. Name and location of the wood preserving company.
- 2 2. Customer identification.
- 3 3. Date of treatment and charge number.
- 4 4. Type of chemical used and amount of retention.
- 5 5. Treating process and identification of the Specification used.
- 6 6. Description of material that was treated.
- 7 7. Signature of a responsible facility official.

8 In addition to the Certificate of Treatment, all orders of treated timber or lumber must be accompanied by a Grading
 9 Certificate as specified in Section 9-09.2(2). Such certification or approved for shipment tag must not constitute final
 10 acceptance of the Material. The Engineer may reject any or all of the timber or lumber that does not comply with the
 11 Specifications or has been damaged during prolonged storage, shipping, or upon delivery.

12 All timber and lumber to be used in aquatic environments, unless specified otherwise in the Contract, must be chemically
 13 treated using BMPs. The producer of the chemically treated products must supply a written certification that the BMPs were
 14 utilized, including a description and appropriate documentation of the BMPs used. This information may be included on the
 15 Certificate of Treatment.

16 **SECTION 9-10 PILES**

17 **9-10.1 TIMBER PILES**

18 **9-10.1(1) GENERAL**

19 Timber piles must be untreated or treated with the preservatives specified on the Drawings and completely described in
 20 Section 9-09.3.

21 Timber piles must have the following limiting diameters:

22

| Length in Feet | Min. Butt Diameter 3 ft. Above Butt (inch) | Max. Butt Diameter 3 ft. Above Butt (inch) | Min. Tip Diameter (inch) |
|----------------|--|--|--------------------------|
| Under 40 | 12 | 20 | 7 |
| 40-54 | 12 | 20 | 7 |
| 55-74 | 13 | 20 | 7 |
| Over 74 | 14 | 20 | 7 |

23

24 Timber piles must be strapped with at least 3 straps: one approximately 18 inches from the butt, one approximately 24
 25 inches from the butt, and one approximately 12 inches from the tip. Additional straps must be provided at approximately 15-
 26 foot centers between the butt and tip. Strapping must encircle the pile once and be tensioned as tightly as possible. Straps
 27 must be 1-1/4 inches wide, 0.031 inch thick, cold rolled, fully heat treated, high tensile strapping, painted, and waxed, with an
 28 ultimate tensile strength of 5,100 pounds. The seal must be 2-1/4 inches long, 20 gage, crimped with a notch type sealer to
 29 furnish a joint yielding 80 percent of the strap tensile strength. Treated timber piles must be strapped after treatment.

30 **9-10.1(2) UNTREATED PILES**

31 Except where specifically provided otherwise, untreated timber piles must be Douglas fir, Western red cedar, or larch.
 32 Piles for foundations must be Douglas fir. Piles must be cut from sound, live trees and must contain no unsound knots. Sound
 33 knots will be permitted, provided the diameter of the knot does not exceed 4 inches, or 1/3 of the small diameter of the pile at
 34 the point where they occur, whichever is smaller. Any defect or combination of defects that impair the strength of the pile more
 35 than the maximum allowable knot will not be permitted.

36 Piles must be cut above the butt swell and must have a uniform taper from butt to tip. A line drawn from the center of the
 37 tip to the center of the butt must not fall outside the center of the pile at any point more than 1 percent of the length of the pile.
 38 A spiral grain or twist in excess of 1/4 turn in 10 feet of length will be cause for rejection.

39 Untreated timber trestle piles must have an average of at least 5 annual rings per inch measured radially over a distance
 40 of 3 inches at the butt, beginning at a point 3-1/2 inches from the heart. At least 9 inches of heartwood must show at the butt.

41 Ring count requirements for untreated timber foundation piles and detour trestle piles will be waived.

42 **9-10.1(3) CREOSOTE TREATED PILES**

43 For creosote treated piles, Douglas fir timber must be used. All other requirements must be the same as for untreated
 44 piles except that the ring count requirement will be waived.

1 9-10.1(4) TIMBER COMPOSITE PILES

2 Timber composite piles must consist of a pile made up of two timber sections. The lower section must be untreated, and
3 the upper section must be creosote treated.

4 The treated and untreated sections of timber composite pile must comply with the respective Specifications above for full
5 length of treated and untreated timber piles.

6 9-10.1(5) PEELING

7 Untreated and creosote treated piles must be peeled by removing all of the rough bark and at least 80 percent of the
8 inner bark. Any strip of inner bark remaining on the pile must not exceed 3/4 inch wide or 8 inches long, and there must be at
9 least 1 inch of clean wood surface between any two such strips. At minimum, 80 percent of the surface on any circumference
10 must be clean wood. All knots must be trimmed close to the body of the pile.

11 9-10.2 CONCRETE PILES**12 9-10.2(1) CONCRETE**

13 Portland cement as specified in Section 9-01 must be used in all precast concrete piles.

14 The concrete for precast prestressed piles must be as specified in Section 9-19. The concrete for prestressed piles must
15 have a minimum compressive strength of 6,000 psi at the age of 28 Days. The minimum compressive strength of concrete at
16 the transfer of prestress must be 3,300 psi.

17 The concrete for all other precast piles must be Class 4000P. Mixing, transporting, and placing concrete must be as
18 specified in Section 6-02.3.

19 The Contractor must mold and test a sufficient number of concrete test cylinders to determine the strength of the
20 concrete as required by the Specifications. Under the surveillance of the Engineer, the test cylinders must be molded, cured,
21 and tested per the procedures established by the Laboratory.

22 If a sufficient number of concrete test cylinders are not molded to satisfy all testing required on any one pile, cores
23 measuring 4 inches in diameter by 5 inches in height must be taken and tested by the Contractor. If the strength of the core
24 meets the required compressive strength of the concrete, the pile may be accepted. The coring and testing of the core must be
25 done under the surveillance of the Engineer.

26 9-10.2(2) REINFORCEMENT

27 Reinforcement must be as specified in Section 9-07.

28 9-10.3 CAST IN PLACE CONCRETE PILES**29 9-10.3(1) REINFORCEMENT**

30 Reinforcement for cast in place concrete piles must conform to AASHTO M 31, Grade 60.

31 9-10.4 STEEL PILE TIPS AND SHOES

32 Steel pile tips and shoes must be fabricated of cast steel conforming to ASTM A 148, Grade 90-60 [620-415] or ASTM A
33 27, Grade 65 35 [450-240] and be free from any obvious defects. Pile tips must be accompanied by a mill test report stating
34 the chemical and physical properties (tensile and yield) of the steel.

35 9-10.5 STEEL PILES

36 The Material for steel piles and pile splices must conform to ASTM A 36, except the Material for steel pipe piles, and
37 splices must conform to the Specifications of ASTM A 252, Grade 2. All steel piles may be accepted by the Engineer based on
38 the manufacturer's certificate of compliance.

39 SECTION 9-11 WATERPROOFING**40 9-11.1 ASPHALT FOR WATERPROOFING**

41 Asphalt for waterproofing must conform to the Specifications of ASTM D 312, Type 4.

42 The Material used as primer must conform to the Specifications of ASTM D 41, Primer for Use with Asphalt in
43 Dampproofing and Waterproofing.

44 Acceptance must be as specified in Section 9-02.2(1).

45 9-11.2 WATERPROOFING FABRIC

46 Waterproofing fabric must be a saturated cotton fabric complying with the Specifications of ASTM D 173, Woven Cotton
47 Fabrics Saturated with Bituminous Substances for Use in Waterproofing.

48 9-11.3 PORTLAND CEMENT MORTAR

49 Portland cement and fine sand for the mortar protection course must conform to the following Specifications:

| Material | Section |
|-----------------|--------------------|
| Portland Cement | Section 9-01 |
| Sand | Section 9-03.1(2)C |
| Mortar | Section 9-20.4 |

SECTION 9-12 MAINTENANCE HOLES, CATCH BASINS, AND INLETS

9-12.1 REINFORCED CONCRETE

9-12.1(1) GENERAL

Reinforced concrete must consist of Portland cement, fine and coarse aggregates and water, in which steel has been embedded in such manner that the steel and concrete act together.

All cast in place concrete placed under these Standard Specifications must be Class 4000 as specified in 6-02.3(1) and 6-02.3(2). Strength determination must be per ASTM C 39. Precast components must conform to ASTM C 478 strength requirements.

The use of admixtures must require prior approval of the Engineer. Concrete with air entraining admixture must comply with ASTM C 175.

9-12.1(2) CEMENT

Portland cement must be as specified in Section 9-01.

9-12.1(3) STEEL REINFORCEMENT

Reinforcement must consist of wire conforming to ASTM A 82 or ASTM A 496, or wire fabric conforming to ASTM A 185 or ASTM A 497, or Grade 60 steel bars conforming to ASTM A 615 or Grade 80 steel bars conforming to ASTM A 306.

9-12.1(4) AGGREGATES

Aggregates for cast in place concrete must conform to ASTM C 33.

9-12.2 STEPS, HANDHOLDS, AND LADDERS

9-12.2(1) GENERAL

The Material for maintenance hole steps, ladders, and handholds must be the same material in any individual drainage Structure. See Section 7-05.3(1)M for submittal requirement. Sizes of components, dimensions, and layout must conform to Standard Plan 232.

9-12.2(2) POLYPROPYLENE ENCAPSULATED REINFORCING STEEL

Polypropylene steel reinforced steps must be made of copolymer polypropylene plastic that encapsulates a 1/2-inch diameter grade 60 steel reinforcing steel. Steel reinforcing must conform to the Specifications of ASTM A 615, and copolymer polypropylene plastic must conform to Specifications of ASTM D 4101. Steps must have serrated tread, measure 13 inches center to center between legs of the step, and be designed to withstand pullout forces of 1500 pounds.

The Contractor may, with the Engineer’s approval, use Plastic Maintenance Hole Steps manufactured by Lane International Corporation, or Steps manufactured by M.A. Industries, Inc.

9-12.3 MORTAR AND GROUT FOR SEWER AND DRAINAGE STRUCTURES

9-12.3(1) MORTAR FOR JOINTS

Mortar for jointing precast or masonry maintenance hole, catch basin, or inlet units must be one part Portland cement to not less than one part nor more than two parts plaster sand, mixed with the least amount of clean water necessary to provide a workable mortar. Joints between precast maintenance hole elements must also be rubber gasketed as noted in Section 7-05.3(1)l.

9-12.3(2) MORTAR FOR PLASTER COATING

Mortar for plaster coating or lining masonry unit maintenance holes must be proportioned according to either of the two alternates below:

| Alternate | Parts By Volume Portland Cement | Parts By Volume Masonry Cement | Parts By Volume Hydrated Lime Or Lime Putty | Plaster Sand Measured In Damp Loose Condition |
|-----------|---------------------------------|--------------------------------|---|---|
| 1 | 1 | 1 (Type II) | 0 | Not less than 2-1/4 and not more than 3 times the sum of volumes of cement and lime |
| 2 | 1 | 0 | 1/4 | |

1

9-12.3(3) GROUT

Grout for filling the void in Sewer and Drainage Structures where pipe connections are made must be non-shrink cement sand grout as specified in Section 9-04.3(2).

9-12.4 CONCRETE MASONRY UNITS

Concrete masonry unit (also called concrete masonry block) must conform to ASTM C 139, Specification for Concrete Masonry Units for Construction of Catch Basins and Maintenance Holes, except that nominal horizontal thickness must be 6 inches measured radially, and blocks must have semicircular mortar grooves approximately 1-inch radius at the ends.

9-12.5 CONCRETE BRICK

Concrete brick must conform to ASTM C 55, Grade S.

9-12.6 CLAY BRICK

Clay brick must conform to ASTM C 32, Grade MM unless otherwise specified in the Contract.

9-12.7 METAL CASTINGS**9-12.7(1) MAINTENANCE HOLE RING AND COVER**

Ring and cover casting dimensions must conform to the Standard. Rings and ring extensions must be manufactured from gray iron ASTM A 48, Class 30 or ductile iron ASTM A 536, Grade 80 55 06. Covers must be manufactured from ductile iron ASTM A 536, Grade 80 55 06. Rings and covers must be free of defects such as porosity, pittings, shrink cavities, cold shuts, cracks, and other surface defects which would impair serviceability. Repair of defects by welding or by the use of smooth on plasticized metals or similar material will not be accepted. Manufacturer must certify that the product conforms to these Specifications. As specified in Section 1-06.1, where source of material is different from manufacturer, the Contractor must also provide the name and location of the manufacturer

Castings must be bare metal. Artificially coated or painted castings will be cause for rejection.

Castings must be machine finished on the horizontal seating surface and the vertical facing surface common to the ring and cover, so as to assure full bearing (nonrocking) for the entire width and circumference of the bearing surface, and permit interchangeability with other castings of the same design, no matter what the source. The vertical face common to the ring and cover must be beveled as shown on the Standard. Upon request of the Engineer, the manufacturer must furnish at the foundry standard ring and covers for use by inspectors in testing fit and seating.

All covers must be labeled with the following information:

1. Name or symbol of the manufacturer;
2. Owner's name (City of Seattle, min. 1/2-inch letters recessed flush with adjacent surface);
3. Material label "DUC" for Ductile Iron;
4. Identification of its use in 3-inch high lettering (such as Sewer or Drain,); and
5. Country of manufacture/origin.

Items 2. and 4. must be on the exposed face of the cover. Items 1., 3., and 5. must be located at the manufacturer's option. If located on the exposed face of the cover, item 1. and 3. must be adjacent to each other and must be set in at least 1/2-inch high recessed letters. Where lock type castings are called for, a locking device must permit the cover to be readily released from the ring. Movable parts must be made of non-corrosive metals and be designed to avoid possible binding. Upon request by the Engineer, the manufacturer must furnish testing apparatus at the foundry capable of applying uplift pressure on the lid of at least 20-foot head of water which the assembly needs to withstand without failure.

All maintenance hole rings must be labeled with the name or symbol of the manufacturer and the type of material.

9-12.7(2) METAL FRAME AND GRATE AND METAL COVER FOR CATCH BASINS OR INLETS

The frame may be made of gray iron, ASTM A 48, Class 30, or ductile iron, ASTM A 536, Grade 80 55 06, at the manufacturer's option. The grate and cover must be made of ductile iron only. Other applicable Specifications of Section 9-12.7(1) apply, except item (4) for identification marking.

Catch Basins, Type 242A and 242B and Inlets, Type 250A and 250B must be furnished with a vaned grate as shown on Standard Plans 265 and 266.

1 9-12.7(3) CAST METAL INLETS

2 The castings for cast metal inlets must be cast steel or ductile iron as specified in Section 9-06.5 or Section 9-06.11.
3 Substitutions may be accepted as specified in 1-06.1. Vaned grates must be embossed as shown on Standard Plan 264.

4 9-12.8 JUNCTION BOX

5 Junction box must comply with Standard Plan 277 and reinforcing must be per WSDOT Standard Plan for Type 1 catch
6 basin.

7 9-12.9 SHOP FABRICATED CORRUGATED METAL MAINTENANCE HOLES

8 Where corrugated metal maintenance holes are specified, they must conform to the details as specified in the Contract.
9 All pipe connections to the maintenance hole stubs must be made with a standard band type as shown on the Drawings.

10 See Section 7-16.2 for restrictions on the use of corrugated metal pipe.

11 9-12.10 MONOLITHIC CONCRETE MAINTENANCE HOLES

12 Monolithic concrete maintenance holes must conform to the Standard Plans.

13 9-12.11 OUTLET TRAPS

14 Catch Basin outlet traps must be constructed per Standard Plan 267.

15 9-12.12 GRATE INLETS AND DROP INLETS

16 Steel in grates, angles, and anchors for grate inlets and drop inlets must conform with AASHTO M 183, except structural
17 tube must conform with ASTM A 500, Grade B. After fabrication, the steel must be hot dip galvanized with a minimum coating
18 of 2 ounces of zinc per square foot per AASHTO M 111 or galvanized with a hot sprayed (plasma flame applied) 6 mm
19 minimum thickness zinc coating.

20 Steel grating must be fabricated by weld connections. Bearing bars and cross bars must be resistance welded at the
21 intersecting joints. Welds, welding procedures, and welding materials must conform to Standard Specifications for Welding
22 issued by the American Welding Society.

23 Vaned grates must be embossed as shown on Standard Plan 264.

24 Substitution of grate designs will be permitted with the approval of the Engineer if:

- 25 1. The hydraulic capacity is not decreased.
- 26 2. The overall dimensions are the same allowing the grate to be interchangeable.
- 27 3. The strength is at least equal to the grate shown in the Standard.
- 28 4. A manufacturer's certificate of compliance is submitted indicating compliance with items 1, 2, and 3.

29 The Contractor has the option of furnishing either cast in place or precast inlets unless otherwise shown in the Contract.
30 Alternate designs are acceptable provided they conform to fabricator's Shop Drawings approved by the Engineer for projects
31 prior to Award of Contract.

32 SECTION 9-13 RIPRAP, QUARRY SPALLS, AND SLOPE PROTECTION**33 9-13.1 GENERAL**

34 The stone for riprap and quarry spalls must be hard, sound, and durable. It must be free from segregation, seams,
35 cracks, and other defects tending to destroy its resistance to weather. Riprap and quarry spalls used for new rock facing or
36 slope stabilization must comply with Specifications in Section 9-03.15.

37 9-13.2 LOOSE RIPRAP

38 Loose riprap must be free of rock fines, soil, or other extraneous material.

39 Should the riprap contain insufficient 4-inch to 8-inch spalls, as defined in Section 9-13.6, the Contractor must furnish and
40 place supplementary spall material from a source approved by the Engineer, at the Contractor's sole expense.

41 The grading of the riprap will be determined by the Engineer by visual inspection of the load before it is dumped into
42 place, or, if so directed by the Engineer, by dumping individual loads on a flat surface and sorting and measuring the individual
43 rocks contained in the load.

44 9-13.2(1) HEAVY LOOSE RIPRAP

45 Heavy loose riprap must comply with the following grading requirements:
46

| | Minimum Size | Maximum Size |
|--------|----------------|-----------------|
| 40-90% | 1 ton (1/2 cy) | -- |
| 70-90% | 300 lbs (2 cf) | -- |
| 10-30% | 3" | 50 lbs (spalls) |

1
2 **9-13.2(2) LIGHT LOOSE RIPRAP**

3 Light loose riprap must comply with the following grading requirements:
4

| | Size Range | Maximum Size |
|--------|------------------------------------|-----------------|
| 20-90% | 300 lbs to 1 ton (2 cf to 1/2 cy) | -- |
| 15-80% | 50 lbs to 1 ton (1/3 cf to 1/2 cy) | -- |
| 10-20% | 3" | 50 lbs (spalls) |

5
6 **9-13.3 HAND PLACED RIPRAP**

7 Hand placed riprap must be as nearly rectangular as possible, 60 percent must have a volume of not less than 1 cubic
8 foot. All stones used must be a minimum of 6 inches thick, and must extend through the wall.

9 **9-13.4 SACK RIPRAP**

10 Sack riprap must consist of concrete placed in sacks made of at least 10 ounce burlap and having a capacity of
11 approximately 2.5 cubic feet. Each sack must be filled with approximately 1 cubic foot of concrete having a consistency in
12 conformance with Section 6-02.3(4)C for non-vibrated concrete.

13 For sack riprap exposed to fresh water, the concrete must be unreinforced Class 3000; and for sack riprap exposed to
14 salt water, the concrete must be Class 3000 as specified in Section 6-02.3.

15 The Portland cement and fine and coarse aggregates must conform to the requirements for Portland cement and fine
16 and coarse aggregate of Section 9-01 and Section 9-03.1, respectively.

17 **9-13.5 CONCRETE SLOPE PROTECTION**

18 **9-13.5(1) GENERAL**

19 Concrete slope protection must consist of reinforced Portland cement concrete poured or pneumatically placed upon the
20 slope with a rustication joint pattern or semi open concrete masonry units placed upon the slope closely adjoining each other.

21 **9-13.5(2) SEMI OPEN CONCRETE MASONRY UNITS SLOPE PROTECTION**

22 Precast cement concrete blocks must conform to the Specifications of ASTM C 90, Type II.

23 **9-13.5(3) POURED PORTLAND CEMENT CONCRETE SLOPE PROTECTION**

24 Cement concrete for concrete slope protection must be Class 3000 in conformance with Section 6-02.3.

25 Wire mesh reinforcement must conform to Section 9-07.7.

26 **9-13.5(4) PNEUMATICALLY PLACED PORTLAND CEMENT CONCRETE SLOPE PROTECTION**

27 Cement must be Portland cement as specified in Section 9-01.

28 Aggregate must be fine aggregate as specified in Section 9-03.1. The moisture content of the fine aggregate at the time
29 of use must be between 3 percent and 6 percent by weight.

30 Wire mesh reinforcement must be as specified in Section 9-07.7.

31 Water must be as specified in Section 9-25.1.

32 **9-13.6 QUARRY SPALLS**

33 The spall must be hard, sound, and durable. It must be free from fracture, seams, cracks, and other discontinuities
34 tending to adversely impact its resistance to weathering. The quarry spall must meet the 5 test requirements specified in
35 Section 9-03.15. Quarry spalls must comply with the following gradation requirements:
36

2-inch to 4-inch Quarry Spall

| Sieve Size | Percent Passing |
|------------|-----------------|
| 4" | 100 |
| 2" | 40 max. |
| 1-1/4" | 5 max. |

4-inch to 8-inch Quarry Spall

| Sieve Size | Percent Passing |
|------------|-----------------|
| 8" | 100 |
| 4" | 40 max. |
| 2" | 5 max. |

All percentages are by weight.

SECTION 9-14 EROSION AND LANDSCAPE MATERIALS

9-14.1 SOILS

The following soils and soil mixes are specified on Drawings or by the Engineer, according to project needs, and are all subject to the General Testing and Submittal Specifications of Section 9-14.1(A):

1. Topsoil Type A – Imported. A general purpose mix of sandy loam and compost as needed to comply with minimum organic matter content requirements. Similar to WSDOT’s Topsoil Type A Specification.
2. Reused Amended Site Soil. Soil from the Project Site that is either amended in place or moved/stockpiled during grading operations and then amended with compost as needed to comply with minimum organic matter content requirements.
3. Bioretention Soil. An imported mix made of Mineral Aggregate and compost specified to comply with the infiltration and filtration requirements of stormwater management Structures. Bioretention soil must be procured only from suppliers holding an active feedstock processing license from the Washington Department of Ecology per Washington Administrative Code 173-350.
4. Planting Soil. An imported soil mix for planting beds, planted medians and planting strips.
5. General Turf Area Soil. An imported soil mix for passive-recreation turf areas.
6. High Performance Turf Mixes. An imported soil mix for intensive-use turf areas, including 3 different mixes of sand and compost to optimize drainage and fertility in different sites and uses.

9-14.1(1) GENERAL TESTING AND SUBMITTAL REQUIREMENTS

At least 10 Working Days prior to placement of any soils specified in Section 9-14, the Contractor must submit to the Engineer the following as specified in Section 1-05.3. All test results must be from samples collected and tested less than 90 days prior to date of submittal.

1. Aggregate and Loam Analysis. Grain size analysis results of the Mineral Aggregate or sandy loam portion of each soil mix, performed by an accredited laboratory per ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
2. Compost Analysis. Quality analysis results for the compost portion of each soil mix performed per STA standards, as specified in Section 9-14.4(8).
3. Mix Analysis. Test results from an accredited soil laboratory, including the following content values:
 - a. Total Nitrogen and Soluble Nitrogen (NO3 + NH3)
 - b. Phosphorous
 - c. Potassium
 - d. pH
 - e. Organic Matter percent (Loss on Ignition method)
 - f. Conductivity
 - g. Calcium
 - h. Sulfur
 - i. Boron
 - j. Weed seed (for general turf area soil and high performance turf mixes)

4. Recommendations. Fertilizer and amendment recommendations for the specified plant type (turf, shrubs/groundcovers, or annuals: with special provisions for bioretention applications) and soil application depth; from the accredited laboratory, an accredited soil scientist or agronomist.
5. Mix Samples. Two 1-gallon samples of each soil mix two 5-gallon samples for bioretention and high performance turf mixes.
6. Manufacturer. The manufacturer's certificate of compliance as specified in Section 1-06.3 from the Supplier of the soil mix, and (if different) the Suppliers of the compost, including their name and address.
7. Laboratory Information. Include the following information about the testing laboratories:
 - a. Name of laboratory including contact person,
 - b. Address,
 - c. Phone contact,
 - d. Email address,
 - e. Qualifications of laboratory and personnel including date of current certification by STA, ASTM, AASHTO, or approved equal.
8. Acceptance of Soils Prior to Placement. The Contractor must not place any soils or soil mixes specified in Section 9-14 until the Engineer has reviewed and confirmed the following:
 - a. Soil mix delivery tickets. Delivery tickets must show that the full delivered amount of soil matches the product type, volume and Manufacturer named in the submittals.
 - b. Visual match with submitted samples. Delivered product will be compared to the submitted sample, to verify that it matches the submitted sample.

The Engineer may inspect any loads of soil on delivery and stop placement if it is determined that the delivered soil does not appear to match the submittals; and require sampling and testing of the delivered soil, before authorizing soil placement. The Contractor is responsible for all testing costs.

9-14.1(2) TOPSOIL TYPE A - IMPORTED

Topsoil Type A must consist of an imported sandy loam as defined by the United States Department of Agriculture Classification System, and documented by a Particle Size Analysis performed by an accredited laboratory.

Topsoil Type-A must have an organic matter content of at least 5 percent by dry weight where turf will be installed, and at least 10 percent by dry weight for all other landscape areas. Organic matter must be determined by Loss-on-Ignition test (ASTM D2974, or TMECC 05.07A). If additional organic content is needed to comply with these Specifications, soil must be amended with compost as specified in Section 9-14.4(8). Compost amendment requirements may be added at default rates of 22 percent by volume for turf or 38 percent for planting beds (1-3/4-inch amendment tilled to 8-inch depth for turf, 3-inch amendment tilled to 8-inch depth for beds); or calculated based on tests of the soil and compost, using the Soil Amendment Rate Calculator at <http://your.kingcounty.gov/solidwaste/compost-calculator.htm> or similar calculator available at http://www.soilsforsalmon.org/excel/Compost_Calculator.xls.

In addition to meeting the particle size requirements of USDA sandy loam, Topsoil Type-A must meet the following sieve Specifications:

| Sieve Size | Percent Passing |
|------------|-----------------|
| 1" | 100 |
| 1/2" | >90 |
| No.10 | >70 |

Topsoil Type-A must be free from: materials toxic to plant growth; visible seeds, rhizomes or roots; any King County-listed noxious weeds, or invasive root-propagating plants including but not limited to horsetail, ivy, clematis, and knotweed. Soil found to contain these prohibited viable plant materials must be removed and replaced at the Contractor's expense.

Testing and submittals must comply with Section 9-14.1.

9-14.1(3) REUSED AMENDED SITE SOIL

Reused amended site soil must be native topsoil taken from within the Project Site, either from areas where construction excavation is to be performed; from borrow, pit, or quarry sites strippings; or other designated sources. The general limits of the material to be utilized for topsoil will be specified in the Contract. The Engineer will make the final determination of the areas where the most suitable material exists within these general limits, and depth of excavation. The Contractor must reserve this material for the specified use.

In the production of reused amended site soil, all vegetative matter must become a part of the topsoil, except large brush and trees over 4 feet in height. Prior to removal, the Contractor must mow or otherwise reduce the height of the native vegetation to 1 foot or shorter. Plants on the King County Noxious Weed Lists or invasive root-propagating plants including but

not limited to horsetail, ivy, clematis, and knotweed must not be incorporated in the topsoil. Such plants must be removed and disposed.

The final reused amended site soil must have a minimum organic matter content by dry weight of 5 percent for areas where turf will be installed, and 10 percent for all other landscape areas. Organic matter must be determined by Loss-on-Ignition test (ASTM D2974, or TMECC 05.07A). Native site topsoil must be amended with Compost as described in Section 9-14.4(8), if more organic content is needed to comply with these Specifications. Compost amendment may be added at default rates of 22 percent by volume for turf or 38 percent for planting beds (1-3/4-inch amendment tilled to 8-inch depth for turf, 3-inch amendment tilled to 8-inch depth for beds); or calculated based on tests of the soil and compost, using the Soil Amendment Rate Calculator at <http://your.kingcounty.gov/solidwaste/compost-calculator.htm> or similar calculator available at http://www.soilsforsalmon.org/excel/Compost_Calculator.xls.

Designated material must be placed at locations approved by the Engineer that do not interfere with the construction of the Project. The Contractor must take all precautions to avoid disturbing the existing ground beyond the Project Site or other areas designated by the Engineer.

Testing and submittals must be as specified in Section 9-14.1

9-14.1(4) BIORETENTION SOIL

Procure bioretention soil only from suppliers holding an active feedstock processing license from the Washington Department of Ecology per Washington Administrative Code 173-350.

Bioretention soil must be a well-blended mixture of Mineral Aggregate and compost measured on a volume basis. Bioretention soil must consist of approximately two parts fine compost (approximately 35 to 40 percent) by volume as specified in Section 9-14.4(8) and 3 parts Mineral Aggregate (approximately 60 to 65 percent) by volume as specified in Section 9-03.2(2). The mixture must be well blended to produce a homogeneous mix, and have an organic matter content of 4 percent to 8 percent determined using the Loss on Ignition Method.

9-14.1(5) PLANTING SOIL

Planting soil must consist of a mix of 2 to 3 parts Sandy loam soil and 1 part compost by volume. The resulting mix must contain approximately 8 to 15 percent organic matter by weight, tested by the Loss on Ignition method.

Sandy loam must be imported and must be as defined by the United States Department of Agriculture Classification System, and documented by a Particle Size Analysis performed by an accredited laboratory. The sandy loam fraction of mix must be screened through a 1/2-inch mesh, to remove all rocks, plant parts and other debris.

Compost used must be as specified in Section 9-14.4(8).

Sandy loam must be free from: materials toxic to plant growth; visible seeds, rhizomes or roots; for any King County-listed noxious weeds, or invasive root-propagating plants including but not limited to horsetail, ivy, clematis, and knotweed.

Testing and submittals must be as specified in Section 9-14.1.

9-14.1(6) GENERAL TURF AREA SOIL

General turf area soil is for general-use and passive recreation lawn areas, in areas where year-round maintenance and positive drainage are important. For sports fields or high-traffic lawn areas such as Seattle Center, the Contractor must use high performance turf mix, as specified in Section 9-14.1(6).

General turf area soil must consist of 2 parts sand complying with the particle distribution table in this Section, and 1 part Compost by volume. The resulting mix must contain approximately 4 to 6 percent organic matter by weight, tested by the Loss on Ignitions method.

Sand used must meet the following particle distribution.

| Screen Size | Percent Retained |
|-------------|------------------|
| 3/8 inch | 0 |
| #4 | <3% |
| #6 | <5% |
| #10 | <20% |
| #18 | <20% |
| #20 | 25-50% |
| #30 | |
| #35 | |
| #40 | >20% |
| #60 | |
| #100 | <10% |
| #200 | <5% |

| Screen Size | Percent Retained |
|-------------|------------------|
| #270 | <5% |
| 2um | <5% |
| <2um | <3% |

1
2 Compost used must be as defined in Section 9-14.4(8) and be certified in compliance with the US Composting Council
3 STA program.

4 Testing and submittals must be as specified Section 9-14.1

5 General turf area soil must not contain any viable seeds or roots capable of sprouting of any State-listed noxious weed,
6 or invasive root-propagating plants including but not limited to horsetail, ivy, clematis, and knotweed. Soil found to contain
7 these prohibited viable plant materials must be removed and replaced at the Contractor's expense.

8 **9-14.1(7) HIGH PERFORMANCE TURF SOIL**

9 High performance turf soil is for athletic fields or high traffic lawn areas such as those used for events, with sub-surface
10 drainage and in-ground irrigation.

11 High performance turf soil must consist of 80-95 percent quartz based sands, uniformly blended with 5-20 percent
12 compost by volume. The ratio of sand to organic amendment must be determined by the Engineer, depending on the intended
13 turf use:

- 14 1. High Performance - Standard Mix: 90 percent sand plus 10 percent compost
- 15 2. High Performance - Fertility Mix: 80 percent sand plus 20 percent compost
- 16 3. High Performance - Drainage Mix: 95 percent sand plus 5 percent compost

17 Sand must be free of weed seeds and propagules; and meet the following particle size distribution with a Coefficient of
18 Uniformity between 2.5 and 4.5:

| Size Fraction | Particle Size Range | Screen | Incremental % Retained | |
|------------------|---------------------|---------------|------------------------|---------------|
| Gravel | 3/8" | 3/8" | 0% | |
| Gravel | >4.75 mm | #4 | <3% | <30% combined |
| Gravel | 3.44-7.5 mm | #6 | <5 % | |
| Fine gravel | 2.0-3.4 mm | #10 | <20 % | |
| Very coarse sand | 1.0-2.0 mm | #18 | <20 % | |
| Coarse sand | 0.5-1.0 mm | #35 | 25-50 % | >60% of sand |
| Medium sand | 0.25-0.5 mm | #60 | >20 % | |
| Fine sand | 0.15-0.25 mm | #100 | <10 % | |
| Very fine sand | 0.05-0.15 mm | #270 | <5 % | <15% combined |
| Silt | 0.002-0.05 mm | By Hydrometer | <5 % | |
| Clay | <0.002 mm | | <3 % | |

20
21 Compost used must be free of weed seeds and propagules, and be as specified in Section 9-14.4(8).

22 Sand and organic amendment must be thoroughly blended off-site, after samples of sand and amendment have been
23 submitted for testing and approval.

24 At least 10 Working Days prior to placement of high performance turf soil, the Contractor must submit to the Engineer the
25 following as specified in Section 1-05.3:

- 26 1. Compost analysis performed per STA standards, as specified in Section 9-14.4(8);
- 27 2. Sand grain size analysis results of the Mineral Aggregate performed by an independent laboratory per ASTM D 422,
28 Standard Test Method for Particle Size Analysis of Soils.
- 29 3. Report the following mix property values, from an accredited independent lab. Testing and recommendations will be
30 at the Contractor's expense.
 - 31 a. pH
 - 32 b. Organic Matter: Using the Walkley-Black Method.
 - 33 c. Nutrients: Total Nitrogen, NO-3 and NH-3; Phosphorus, Potassium, Calcium, Sulfur, Magnesium, Boron.
 - 34 d. Conductivity.

- e. Weed Seeds: High performance turf mixes must be free of viable weed seeds or propagules, as determined by bioassay using TMECC 05.09-A, Shields Rinse Method.
- f. Amendment Recommendations: Fertilizer and amendment recommendations for turf, from an accredited Agronomist or Soil Scientist.
- g. Laboratory Information: Name, address, phone, and e-mail contact information; and qualifications of laboratory and personnel including a copy of current certification by STA, AAHTO, or approved equal.

At least 10 Working Days prior to placement of high performance turf soil, the Contractor must submit to the Engineer two 5 gallon samples of the high performance turf mix, along with the following information:

- 1) The manufacturer’s certificate of compliance as specified in Section 1-06.3 accompanying the test results from the Supplier of the high performance turf mix, and (if different) the Suppliers of the Mineral Aggregate and compost components, including their name and address;
- 2) A description of the equipment and methods to mix the Mineral Aggregate and compost to produce high performance turf mix.

The Contractor must not place high performance turf soil until the Engineer has reviewed and confirmed the following:

- a) Soil mix delivery tickets. Delivery tickets must show that the full delivered amount of high performance turf soil matches the product and Manufacturer named in the submittals.
- b) Visual match with submitted samples. Delivered product will be compared to the submitted 5 gallon sample, to verify that it matches the submitted sample.

The Engineer may inspect the high performance turf soil on delivery and stop placement if the delivered soil does not appear to match the submittals. The Engineer may also require sampling and testing of the delivered soil before authorizing soil placement. All testing conducted is at the Contractor’s expense.

9-14.2 SEED

9-14.2(1) General

Grasses, legumes, or cover crop seed of the type specified must conform to the standards for certified grade seed or better as outlined by the State of Washington Department of Agriculture Rules for Seed Certification, current edition.

Seed must be furnished in standard sealed containers and must include:

- 1. Common name of seed;
- 2. Name of variety, when applicable;
- 3. Lot number;
- 4. Net weight;
- 5. Percentage of purity;
- 6. Percentage of germination (in case of legumes percentage of germination to include hard seed);
- 7. Percentage of weed seed content and inert material clearly marked for each kind of seed per applicable state and federal law; and
- 8. Germination test date.

Upon request, the Contractor must furnish to the Engineer duplicate copies of a statement signed by the Materialperson certifying that each lot of seed has been tested by a recognized and accredited seed testing laboratory within 6 months before the date of delivery to the Project Site. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

Turf varieties must include only those ranked "Best" by the 2011 or most current succeeding year’s WSU Turfgrass Cultivars Evaluated In Western Washington/Oregon In Recent Years list. (Puyallup.wsu.edu/turf)

9-14.2(2) SEED MIX #1 (EROSION MIX)

The seed mixture and rate of application must be as follows:

| Kind and Variety of Seed in Mixture | Percent by Weight |
|---|-------------------|
| Turf type Perennial Rye Blend (2 or more varieties) | 50% |
| Creeping Red Fescue | 20% |
| Chewings Fescue | 20% |
| Hard Fescue | 10% |

The rate of application must be 5 pounds per 1000 square feet.

The seed mixture must be no less than 98 percent pure, must have a minimum germination rate of 90 percent, and contain less than 1.5 percent inert material. No noxious weeds will be permitted. Seed must be certified grown in Washington, Oregon or Idaho and tagged with the information specified in Section 9-14.2(1).

9-14.2(3) SEED MIX #2 (NON IRRIGATED LAWN SEED MIX)

The seed mixture and rate of application must be as follows:

| Kind and Variety of Seed in Mixture | Percent by Weight |
|---|-------------------|
| Turf type Perennial Rye Blend (2 or more varieties) | 50% |
| Chewings Fescue | 30% |
| Hard Fescue | 20% |

The rate of application must be 6 pounds per 1000 square feet.

The seed mixture must be no less than 98 percent pure, and must have a minimum germination rate of 90 percent, and contain less than 1.5 percent inert material. No noxious weeds will be permitted. Seed must be certified grown in Washington, Oregon or Idaho and tagged with the information specified in Section 9-14.2(1).

9-14.2(4) SEED MIX #3 (IRRIGATED LAWN OR ATHLETIC TURF AREA)

The seed mixture and rate of application must be as follows:

| Kind and Variety of Seed in Mixture | Percent by Weight |
|--|-------------------|
| Turf type Perennial Rye Blend (3 approved varieties) | 100% |

The rate of application must be 6 pounds per 1000 square feet.

The seed mixture must be no less than 98 percent pure, and must have a minimum germination rate of 90 percent, and contain less than 1.5 percent inert material. No noxious weeds will be permitted. Seed must be certified grown in Washington, Oregon or Idaho and tagged with the information specified in Section 9-14.2(1).

9-14.2(5) SEED MIX #4 (BIOFILTRATION SWALE MIX)

The seed mixture and rate of application must be as follows:

| Wet Biofiltration Swale Mix | | Biofiltration Swale Mix | |
|---|-------------------|--|-------------------|
| Kind and Variety | Percent by Weight | Kind and Variety | Percent by Weight |
| Tall fescue or meadow fescue <i>Festuca arundinacea</i> or <i>Festuca elatior</i> | 60-70% | Tall or meadow fescue <i>Festuca arundinacea</i> or <i>Festuca elatior</i> | 75-80% |
| Seaside/Colonial bentgrass <i>Agrostis palustris</i> | 10-15% | Seaside/Colonial bentgrass <i>Agrostis palustris</i> | 10-15% |
| Meadow foxtail <i>Aleopocurus pratensis</i> | 10-15% | Redtop bentgrass <i>Agrostis alba</i> or <i>A. gigantea</i> | 5-10% |
| Alsike clover <i>Trifolium hybridum</i> | 6-10% | -- | -- |
| Redtop bentgrass <i>Agrostis alba</i> | 1-6% | -- | -- |

The rate of application must be:

1. Wet Biofiltration Swale Mix: 4 pounds per 1000 square feet.
2. Biofiltration Swale Mix: 6 pounds per 1000 square feet.

The seed mixture must be no less than 98 percent pure, and must have a minimum germination rate of 90 percent, and contain less than 1.5 percent inert material. No noxious weeds will be permitted.

9-14.2(6) SEED MIX #5 (LOW GROWING, DROUGHT TOLERANT GRASS AND HERBACEOUS MIX)

The seed mixture and rate of application must be as follows:

| Kind and Variety | Percent by Weight |
|--|---------------------|
| Dwarf Perennial Rye | 50-70% ¹ |
| Hard Fescue | 0-20% ¹ |
| Strawberry Clover (<i>Trifolium fragiferum</i>) | 5% |
| Dutch White Clover (<i>Trifolium repens</i>) | 5% |
| Microclover | 5% |
| Dwarf Yarrow, <i>Achillea millefolium</i> or <i>Achillea X Lewisii</i> vars. | 5% |
| Sweet Alyssum, <i>Lobularia maritima</i> | 5% |
| English Daisy, <i>Bellis perennis</i> | 5% |

NOTE:

1. Dwarf Perennial Rye and Hard Fescue must make up a combined 70% of mix.

The seed mix must be no less than 98 percent pure and must have a minimum germination rate of 90 percent, and contain less than 1.5 percent inert material. Seed must be tagged with the information required in Section 9-14.2(1).

The Contractor must submit, and receive approval from the Engineer at least 3 Working Days before ordering, all species included in the wildflower mix and the Materialperson's written directions on how to apply the seed mix. Written directions must include rate of application and the incorporation of specific species of grass seed components when appropriate to achieve adequate erosion control protection while maximizing flower display and regeneration.

Noxious weeds (Chapter 16-750 WAC), and invasive species listed by the Washington State Noxious Weed Control Board, will not be allowed.

9-14.3 FERTILIZER

9-14.3(1) GENERAL

Fertilizers must be applied in a form and at a rate recommended by a Certified Agronomist or Soil Scientist, based on soil analysis by an independent accredited laboratory, as specified in Section 9-14.1(A) General Testing and Submittal Requirements.

A minimum of 50 percent of nitrogen fertilizer must be applied in a slow- or controlled-release form; such as sulfur- or polymer-coated urea, IBDU, trinitromethane (Nitroform), or organic forms.

All fertilizers must be furnished in standard sealed and unopened containers with weight, name of plant nutrients and manufacturer's guaranteed statement of analysis clearly marked, all per state and federal law.

The Contractor must submit to the Engineer for approval at least 5 Working Days in advance, an analysis of the proposed fertilizer, a 5 pound sample, and manufacturer's certificate of compliance indicating all Specifications are met.

9-14.3(2) LIME

Lime composition (dolomitic or non-dolomitic) must be determined based on laboratory analysis and recommendations submitted as specified in Sections 9-14.1(4) and 9-14.1(5).

Lime application rate must be determined based on laboratory analysis and recommendations submitted as specified in Sections 9-14.1(4) and 9-14.1(5).

Lime form (prill type or flour) will be determined based on laboratory analysis and recommendations submitted as specified in Sections 9-14.1(4) and 9-14.1(5).

9-14.4 MULCHES AND AMENDMENTS

The following mulches and amendments are shown on the Drawings or specified by the Engineer, according to project needs, and may be subject to testing as specified in other sections:

1. Straw Mulch: Section 9-14.4(1). Generally used as a temporary mulch to cover seed for erosion control seeding.
2. Wood Fiber Mulch: Section 9-14.4(2). Used to protect seed and soil in turf and erosion control hydroseeding applications.
3. Bark Mulch: Section 9-14.4(3). Used in woody plant beds to protect soil, conserve moisture, and provide long-term nutrients.
4. Arborist Wood Chip Mulch: Section 9-14.4(4). Clean recycled wood chip from tree-trimming, composting operations or wood reclamation operations; used as the standard mulch for woody plants.
5. Peat. Section 9-14.4(5): An amendment typically only used for moisture management in potting mixes and container plantings. More widespread use of peat has been replaced with compost and related products.
6. Vermiculite, Perlite and Pumice: Section 9-14.4(6). Specialty materials typically only used to improve moisture management in potting mixes, container plantings, and green roofs.
7. Tackifier. Section 9-14.4(7): An amendment used in hydroseeding mixtures to hold seed and mulch in place.

8. Compost. Section 9-14.4(8): An amendment used in all types of soil mixes to supply organic matter, nutrients, and moisture management properties. Also used in mulches, potting soils, and erosion control applications such as socks and berms. For Project Sites located within the City limits of Seattle; compost must be procured only from approved sources as specified by the City of Seattle, City Purchasing and Contracting Services (<http://www.seattle.gov/city-purchasing-and-contracting/construction-contracting>).

9-14.4(1) STRAW MULCH

All straw mulch Material must be in an air dried condition free of noxious weeds and other materials detrimental to plant life. Straw must be seasoned before baling or loading and must be suitable for spreading with mulch blower equipment.

9-14.4(2) WOOD FIBER MULCH

Wood fiber mulch must be specially processed 100 percent wood fiber in which 30 percent of the fibers must be 0.15 inches long or longer and which must have tackifier added to the mulch during the manufacturing process. Mulch must contain no growth or germination inhibiting ingredients and must be dyed a suitable color to facilitate inspection of placement of the Material. It must be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the Material become uniformly suspended to form a homogenous slurry. When hydraulically sprayed on the ground, the Material must allow the absorption and percolation of moisture.

Each package of cellulose fiber must be marked by the manufacturer to show the air dry weight content.

Tackifier must not be applied at temperatures below 50°F nor in wet or rainy weather. A minimum of 4 to 6 hours of curing time is required for acceptance of the application. See Section 9-14.2(5) for specifications on the addition of tackifier for biofiltration swale seed mix.

Terrain that is steeper than 2 horizontal to 1 vertical, areas that exceed 10,000 square feet, and areas having a vertical drop greater than 15 feet must be treated with a supplemental tackifier as specified in Section 9-14.4(7).

Mulch must be applied at the following rates depending on the slope of the terrain:

1. 35 pounds per 1000 square feet, or 1500 pounds per acre, for areas having zero to 4 horizontal to 1 vertical slope.
2. 50 pounds per 1000 square feet, or 2000 pounds per acre, for areas having between 2 horizontal to 1 vertical and 4 horizontal to 1 vertical slope.
3. 60 pounds per 1000 square feet, or 2500 pounds per acre, for areas having a slope greater than 2 horizontal to 1 vertical.

9-14.4(3) BARK MULCH

Bark mulch must consist of freshwater Douglas fir, pine, or hemlock bark. It must be ground so that on a loose volume basis, a minimum of 95 percent passes a 1-1/2-inch sieve and no more than 55 percent passes a 1/4-inch sieve. The bark mulch must not contain salts, resin, tannin, or any other deleterious material in quantities that would be detrimental to plant life.

Wood chips salvaged from clearing and grubbing activity may be approved as a substitute for bark mulch, if found acceptable by the Engineer prior to application. Arborist wood chip mulch, Section 9-14.4(4), may also be used as a substitute for bark mulch when approved by the Engineer.

9-14.4(4) ARBORIST WOOD CHIP MULCH

Arborist Wood Chip Mulch (AWCM) must be coarse ground wood chips (approximately 1/2 inch to 6 inches along the longest dimension) derived from the mechanical grinding or shredding of the above-ground portions of trees. It may contain wood, wood fiber, bark, branches, and leaves; but may not contain visible amounts of soil. It must be free of weeds and weed seeds including but not limited to plants on the King County Noxious Weed list available at: <http://www.kingcounty.gov/weeds>, and must be free of invasive plant portions capable of resprouting, including but not limited to horsetail, ivy, clematis, and knotweed. It may not contain more than 1/2 percent by weight of manufactured inert material (such as plastic, concrete, ceramics, or metal).

Arborist Wood Chip Mulch, when tested, must meet the following loose volume gradation:

| Sieve Size | Percent Passing | |
|------------|-----------------|---------|
| | Minimum | Maximum |
| 2" | 95 | 100 |
| 1" | 70 | 100 |
| 5/8 | 0 | 50 |
| 1/4" | 0 | 40 |

No particles may be longer than 8 inches.

Prior to delivery, the Contractor must provide the following upon request:

1. The source of the product and species of trees included in it;

- 2. A sieve analysis verifying the product meets the above size gradation requirement;
- 3. A 5 gallon sample of the product, for the Engineer's approval.

9-14.4(5) PEAT

Peat must be derived from 100 percent sphagnum, and must conform to ASTM D 2607 unless otherwise specified in the Contract. Peat must be shredded and granulated to pass a 1/2-inch sieve and conditioned in storage piles for at least 6 months after excavation. The peat must not contain substances harmful to plant life.

9-14.4(6) VERMICULITE / PERLITE / PUMICE

Vermiculite, perlite, and pumice must be horticultural grade and free of any toxic materials.

9-14.4(7) TACKIFIER

Tackifier used to stabilize mulch must provide a liquid soil bonding agent which provides immediate erosion protection and remains effective for a minimum of one full year on an undisturbed site.

9-14.4(8) COMPOST

Procure compost only from suppliers holding an active feedstock processing license from the Washington Department of Ecology per Washington Administrative Code 173-350.

Compost production and quality must comply with Chapter 173-350 WAC, and with the criteria below:

Compost products must be the result of the biological degradation and transformation of feedstocks as specified below, under controlled conditions designed to promote aerobic decomposition, per WAC 173-350-220, which is available at <http://apps.leg.wa.gov/wac/default.aspx?cite=173-350-220>

The Contractor must submit the following information to the Engineer for approval:

- 1. A copy of the Solid Waste Handling permit issued to the Supplier by the Jurisdictional Health Department as per WAC 173-350 (Minimum Functional Standards for Solid Waste Handling).
- 2. The Supplier must verify in writing, and provide lab analyses that the Materials comply with the processes, testing, and standards specified in WAC 173-350 and these Specifications. An independent STA Program certified laboratory must perform the analysis.
- 3. A list of the feedstock by percentage present in the final compost product.
- 4. A copy of the producer's current STA certification as issued by the U.S. Composting Council.
- 5. Acceptance must be based upon a satisfactory Test Report from an independent STA program certified laboratory and the sample submitted to the Engineer.

The compost Supplier must test all compost products within 90 Calendar Days prior to application, at the Suppliers expense. Samples must be collected using the Seal of Testing Assurance (STA) sample collection protocol, available from the U.S. Composting Council, Phone: (631) 737-4931, <http://www.compostingcouncil.org>. The sample must be tested by an independent STA Program certified laboratory. A copy of the approved independent STA Program laboratory test report must be submitted to the Engineer prior to initial application of the compost.

Compost must meet the following size gradations when tested per the U.S. Composting Council Testing Methods for the Examination of Compost and Composting Test Method 02.02-B, Sample Sieving for Aggregate Size Classification:

- a. Fine Compost, typically used for soil amendment, must meet the following gradation by dry weight:

| | Min. | Max. |
|----------------------|------|------|
| Percent passing 2" | 100% | -- |
| Percent passing 1" | 99% | 100% |
| Percent passing 5/8" | 90% | 100% |
| Percent passing 1/4" | 75% | 100% |

- b. Coarse Compost, typically used for erosion control or surface mulching, must meet the following gradation by dry weight:

| | Min. | Max. |
|----------------------|------|------|
| Percent passing 3" | 100% | -- |
| Percent passing 1" | 90% | 100% |
| Percent passing 3/4" | 70% | 100% |
| Percent passing 1/4" | 40% | 60% |

The pH must be between 6.0 and 8.5 when tested per TMECC 04.11-A; "1:5 Slurry pH."

Manufactured inert material (such as concrete, ceramics or metal) must be less than 1.0 percent by weight as determined by TMECC 03.08-A percent dry weight basis. Film plastics must be 0.1 percent or less, by dry weight.

Minimum organic matter content must be 40 percent by dry weight basis as determined by TMECC 05.07A; Loss-On-Ignition Organic Matter Method.

Soluble salt contents must be less than 5.0 mmhos/cm tested per TMECC 04.10-A; 1:5 Slurry Method, Mass Basis.

Maturity must be greater than 80 percent per TMECC 05.05-A; Germination and Vigor. The Engineer may also evaluate compost for maturity using the Solvita Compost Maturity Test at time of delivery. Fine Compost must score a number 6 or above on the Solvita Compost Maturity Test. Coarse Compost must score a 5 or above on the Solvita Compost Maturity Test.

Stability must be 7 or below per TMECC 05.08-B; Carbon Dioxide Evolution Rate.

The compost product must contain a minimum of 65 percent by volume from recycled plant waste as defined in WAC 173-350-100 as yard waste, crop residues, and bulking agents. A maximum of 35 percent by volume of post-consumer food waste as defined in WAC 173-350-100 may be substituted for recycled plant waste. The Engineer may approve compost products containing up to 35 percent biosolids or manure feedstocks for specific projects or soil blends, but these feedstocks are not allowed unless specified, and not allowed in compost used for bioretention soils.

Fine Compost must have a carbon-nitrogen ratio of less than 25:1 as determined using TMECC 04.01 Total Carbon and TMECC 04.02D; Total Kjeldhal Nitrogen. The Engineer may specify a carbon-nitrogen ratio up to 35:1 for projects where the plants selected are entirely Puget Sound native species. Compost may be mixed with fir or hemlock bark as specified in Section 9 14.4(3) to raise the carbon-nitrogen ratio above 25:1. Coarse Compost must have a carbon-nitrogen ratio between 20:1 and 45:1.

9-14.5 MATTING AND STAKES

9-14.5(1) JUTE MATTING

9-14.5(1)A JUTE MATTING FOR NON-STREAM APPLICATIONS

Jute matting must be of a uniform open plain weave of unbleached, single jute yarn treated with a fire retardant chemical. The yarn must be of a loosely twisted construction and must not vary in thickness by more than half of its nominal diameter. Jute matting must be furnished in rolled strips approximately 50 yards in length. Matting width must be 48 inches with an average weight of 0.92 pound per square yard. A tolerance of ± 1 inch in roll width and ± 5 percent in weight per square yard will be allowed.

9-14.5(1)B JUTE MATTING FOR IN-STREAM APPLICATIONS

Jute matting must be of a uniform open plain weave of unbleached 100 percent jute yarn. Plastic or any geosynthetic netting must not be used for stream bank construction or restoration.

The following table specifies acceptable product applications:

| Slope | Minimum Criteria | Test Method |
|-------------------|--|---|
| Slope \geq 1:1 | 25 oz/sy <40% open area | ASTM D-3776 Corp of Engineers COE CW002215 |
| 3:1 < slope < 1:1 | 14 oz/sy <60% open area | ASTM D-3776 Corp of Engineers COE CW002215 |
| 4:1 < slope < 3:1 | 9 oz/sy <65% open area | ASTM D-3776 Corp of Engineers COE CW002215 |
| Slope < 4:1 | No matting required unless otherwise specified in the Contract | |

9-14.5(2) COIR MATTING FOR IN-STREAM APPLICATIONS

Coir matting must be of a uniform open plain weave of unbleached 100 percent coir fabric from coconut husk. Plastic or any geosynthetic netting must not be used for stream bank construction or restoration.

Coir matting must comply with and be installed per the following table:

| Slope | Minimum Criteria | Test Method |
|-------------------|----------------------------|---|
| Slope \geq 1:1 | 25 oz/sy <40% open area | ASTM D-3776 Corp of Engineers COE CW002215 |
| 3:1 < slope < 1:1 | 14 oz/sy | ASTM D-3776 |

| Slope | Minimum Criteria | Test Method |
|-------------------|--|---|
| | <60% open area | Corp of Engineers COE CW002215 |
| 4:1 < slope < 3:1 | 9 oz/sy <65% open area | ASTM D-3776 Corp of Engineers COE CW002215 |
| Slope < 4:1 | No matting required unless otherwise specified in the Contract | |

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9-14.5(3) EXCELSIOR MATTING

Excelsior matting must be a machine produced mat of wood excelsior covered on one side with a biodegradable plastic netting or twisted paper composition. The excelsior matting must have a wood fiber minimum dry weight of 0.8 pound per square yard ± 5 percent, and must be of uniform thickness with the fiber evenly distributed over the entire area of the mat.

The width of a single roll of matting and net must be a minimum 36 inches, and the length of the roll must be approximately 150 feet.

The Contractor must submit to the Engineer for approval at least 10 Working Days in advance of proposed Material application, manufacturer’s certificate of compliance stating that the excelsior matting is environmentally safe and acceptable. This submittal must be accompanied by a sample at least 3 square feet in area.

9-14.5(4) CLEAR AND BLACK PLASTIC COVERING

Plastic covering must comply with the Specifications of the NIST Voluntary Product Standard, PS 17 69, for polyethylene sheeting having a minimum thickness of 6 mil.

9-14.5(5) STAKES FOR EROSION CONTROL MATTING

Stakes may be wire staples, steel pins, steel spikes, or wooden stakes.

Stakes for securing erosion control matting to earth surfaces must be a minimum 12 inches in length, and must have sufficient strength to withstand pounding the stakes into soil flush with the surface.

9-14.6 PLANT MATERIALS

9-14.6(1) DEFINITIONS

Bareroot plants are grown in the ground and harvested without soil or growing medium around their roots. Roots must be protected in transit with moist media such as peat or sawdust

Container plants are grown in pots or flats that prevent root growth beyond the sides and bottom of the container.

Balled and burlapped plants are grown in the ground and harvested with soil around a core of undisturbed roots. This rootball is wrapped in burlap and tied or placed in a wire basket or other supportive structure.

Live cuttings or live stakes are freshly cut stems (sometimes roots) taken from live plant material without a previously developed root system. Cuttings produce clones that are (usually) nearly identical to the source plants. Source plants for cuttings must be vigorous, disease-free specimens. Acceptable sources, lengths, and diameters of cuttings must be as specified on the Drawings or plant schedules.

Rhizomes are a prostrate or subterranean stem, usually rooting at the nodes and becoming erect at the apex. Rhizomes must have a minimum of two growth points. Tubers must be a thickened and short subterranean branch having numerous buds or eyes.

Whips are bareroot trees, generally unbranched, and are sized typically in 1 foot height increments ranging from 2 feet to 6 feet not including the root.

Seedlings are plants propagated from seeds. Seedlings of woody plants demonstrate variability in appearance, size and other growth characteristics that are not acceptable in many landscape situations. Seedling variability is often desirable in native and low-maintenance landscapes where diversity may provide disease resistance.

9-14.6(2) QUALITY

All plant Material furnished by the Contractor must conform to the current issue of American Standard for Nursery Stock (ASNS).

All plant Material must comply with state and federal requirements with respect to plant health and absence of diseases and insect infestation. Inspection certificates required by law must accompany each shipment of plant Material and must be filed with the Engineer prior to planting. All plant Material specified must be first class representatives of their normal species or varieties in healthy growing condition with normal well developed branch system and vigorous root systems. They must be free from disease and insect infestation, disfiguring knots, sun scalds, abrasions of the bark, broken tops, and torn roots.

All plants must be nursery grown stock unless otherwise specified in the Contract.

Plants must not have cuts over 3/4-inch diameter which are not satisfactorily callusing over. Leader must be intact on each plant. Large plants cut back to comply with specified sizes will not be accepted. Trees must be self-supporting, with

1 straight trunks and with single straight leaders. Trees having damaged or missing leader, multiple leaders, or Y crotches will
2 be rejected.

3 Plants furnished in pots or other containers must be acclimated to outside conditions and equal to field grown stock.

4 Collected Plant Material (including cuttings) must come from approved legal locations. Contractor is responsible for
5 securing any required permits and permissions from property owners. Collected plant material must conform in quality, size,
6 and grade to standards for nursery stock and must be listed along with source location (Section 1-06.1) for approval at least 5
7 Working Days in advance of digging by the Supplier or Contractor.

8 Any plant Material that is to be replaced must be of the same species, cultivar, and equal size to the specified plant
9 Material.

10 Root balls must be solidly held together by a fibrous root system and must be composed only of the soil in which the
11 plant has been actually growing. Broken or "Made" balls will not be accepted. The ball must be securely wrapped with
12 nontreated jute burlap or other packing material not injurious to the plant life. Root balls must be free of weed or foreign plant
13 growth.

14 Container grown plants must be plants transplanted into a container and grown in that container sufficiently long for new
15 fibrous roots to have developed so that the root mass keeps its shape and holds together when removed from the container.
16 Plant Material which is rootbound will be rejected. Container sizes for plant Material of a larger grade than provided for in the
17 container-grown Specifications of the American Standard for Nursery Stock (ASNS) must be determined by the volume of the
18 root ball specified in the ASNS for the same size plant Material.

19 All bare root plant Materials must have a heavy fibrous root system. All plants must be dormant at the time of planting.
20 Roots must be protected from drying in transit by wrapping, and stored in moist media in a shaded location if not planted
21 immediately upon receipt. Additional environmental controls may be required to prevent drying or breaking dormancy if plants
22 must be scored more than 48 hours.

23 Average height to spread proportions and branching must be per the applicable sections, illustrations, and accompanying
24 notes of the American Standard for Nursery Stock. Plants, which have suffered damage as the result of girdling of the roots,
25 stem, or a major branch; have deformities of the stem or major branches; have a lack of symmetry; have dead or defoliated
26 tops or branches; or have any defect, injury, or condition which renders the plant unsuitable for its intended use, will be
27 rejected.

28 Trees intended for installation as street trees must have been grown with sufficient spacing to allow for symmetrical
29 branch development which reflects the natural characteristics of the species. Trunks must not be noticeably imperfect in
30 vertical alignment, and there must be no included bark in the crotches between the trunk and side branches.

31 **9-14.6(3) HANDLING AND SHIPPING**

32 Handling and shipping must be done in a manner that is not detrimental to the plants. The root system of all plant
33 Material must not be permitted to dry out at any time.

34 To acclimate plant Materials to Northwest conditions, all plant Materials used on a project must be grown continuously
35 outdoors north of the 42nd Latitude (Oregon California Border) for 60 days prior to delivery.

36 Plant Material must be packed for shipment in accordance with prevailing practice for the type of plant being shipped,
37 and must be protected at all times against drying, sun, wind, heat, freezing, and similar detrimental conditions both during
38 shipment and during related handling. When transported in closed vehicles, plants must receive adequate ventilation. When
39 transported in open vehicles, plants must be protected by tarpaulins or other suitable cover material.

40 Ball and Burlap:

- 41 1. Balled and burlapped plants must be handled by the ball of earth and not the plant. Unless otherwise specified in the
42 Contract, plants may be supplied in suitable containers acceptable to the Engineer should the Contractor so desire.
- 43 2. Balled and burlapped trees must, as a minimum, be installed with all wrapping material, wire cages, twine, burlap and
44 other material reinforcement removed from the top 2/3 of root ball. Unless deemed detrimental to the stability of the
45 rootball and health of the tree all wrappings and support materials must be removed.

46 Containers. All container grown plants must be handled only by the container.

47 **9-14.6(4) RECORDS**

48 The nursery must furnish a notice of shipment in triplicate at the time of shipment of each carload or other lot of plant
49 Material. The original copy must be mailed to the Engineer, the second copy to the consignee and the third copy must
50 accompany the shipment to be furnished to the Engineer at the Project Site. The notice must contain the following information:

- 51 1. Name of shipper.
- 52 2. Date of shipment.
- 53 3. Name of commodity (including all names as specified in the Contract).
- 54 4. Consignee and delivery point.
- 55 5. Owner Contract number.
- 56 6. Point from which shipped.
- 57 7. Quantity contained.

- 1 8. Manufacturer's certificate of compliance of grade (statement that Material conforms to the Specifications).
- 2 9. Size (height, runner length, caliper, as required).
- 3 10. Statement of root pruning (date pruned and size of pruning).
- 4 11. Signature of shipper by authorized representative.
- 5 12. Growing history of plant.
- 6 All plants must have legible labels attached to each individual plant delivered as a separate unit or to each box, bundle,
- 7 bale, or container containing one or more plants. Plant Material with illegible or missing tags will be rejected by the Engineer.
- 8 a. Labels must provide the necessary detailed information as to horticultural name, size, age, caliper, or other data
- 9 required to identify as conforming to Specifications.
- 10 b. When the label is attached to a bundle, box, or container containing more than one plant, information on the label
- 11 must show the quantity together with the other required information. Exception: All trees, whether furnished singly or
- 12 bundled, must be individually tagged with names and size or caliper, needed as shown above. Contractor may refer
- 13 to State of Washington Department of Agriculture, Orders 1229 and 1230, Nursery Stock Standards, regarding
- 14 labeling of plant Material.
- 15 c. All plants that are patented or trademarked must have an individual tag on each plant.
- 16 d. Plant Material tagged in the field (nursery) by the Landscape Architect must be delivered with tags in place.

17 **9-14.6(5) INSPECTION**

18 The Contractor must, as soon as practical, inform the Engineer as to the source of plant Materials for the project as
19 specified in Section 1-06.1.

20 The Contractor must notify the Engineer not less than 48 hours in advance of delivery of plants from the nursery to allow
21 inspection at the nursery before delivery.

22 Pre-Planting Inspection:

- 23 1. All trees will be inspected by the Engineer at the Project Site prior to planting. Plants not complying with these
24 Specifications must be immediately removed from the project and replaced by the Contractor at the Contractor's sole
25 expense.
- 26 2. Root condition of plants furnished in containers must be determined by removal of the plant from the container. Plants
27 not fully rooted through media to create an intact rootball, and rootbound plants with circling roots, must be removed
28 from the Project Site and replaced with acceptable specimens of the same variety.
- 29 3. Plant Material delivered, inspected, and approved for planting must be planted immediately. Plants not immediately
30 planted by the Contractor may be temporarily stored after receiving approval from the Engineer as specified in 9-
31 14.6(7).

32 **9-14.6(6) SUBSTITUTION OF PLANTS**

33 No substitution of plant Material, species or variety, will be permitted unless evidence is submitted in writing to the
34 Engineer that a specified plant cannot be obtained and has been unobtainable since the Award of the Contract. Substitution
35 can be made only with written approval by the Engineer as specified in Section 1-05.3(6). The nearest variety, size, and grade
36 as approved by the Engineer must then be furnished.

37 **9-14.6(7) TEMPORARY STORAGE**

38 Plant Material delivered and accepted must be planted immediately. Plants that cannot be planted within 1 Day after
39 arrival must be heeled in per accepted horticultural practice, as follows:

- 40 1. Bare root plants must be placed in trenches with roots covered with moist earth, sawdust or other acceptable material
41 and be kept moist. All bare root Material supplied in bundles must have the bundle broken and the plants placed in
42 the trenches separately.
- 43 2. Balled and burlapped plants must have the root ball protected by earth, sawdust, or other material acceptable to the
44 Engineer and the material must be kept continuously moist.
- 45 3. Live cuttings may be stored for up to 7 Days, provided they are protected against loss of moisture by a minimum 6-
46 inch thick layer of earth, sawdust, or other acceptable material and be kept moist. Adequate ventilation with an
47 ambient temperature maintained at or near 40 °F must be provided above the cuttings to prevent fungus growth.
48 Cuttings taken in November, December, or January may be stored if wrapped to produce an airtight condition with
49 temperature maintained between 33 °F and 40 °F.

50 The Contractor is responsible for all plants stored under temporary conditions.

51 Plants stored in any location for use on the project must be protected at all times from extreme weather conditions by
52 insulating the root balls with sawdust, soil, or other approved material and by keeping the roots moist at all times.

1 9-14.6(8) SOD

2 Sod must be mature, densely rooted grass; free of weeds and objectionable grasses. All sod must comply with state and
3 federal law, including guaranty, with respect to inspection, plant diseases, and insect infestation. Sod must be cut to a 1-inch
4 mowing height prior to lifting from the field.

5 Sod must be either un-netted, or use biodegradable or degradable plastic netting.

6 Sod must be grown in Western Washington or Oregon. Sod shipments must have a certificate of origin and certification
7 of approved treatment when shipment originates in known infested areas.

8 Turf varieties must include only those ranked "Best" by the 2011 or most current succeeding year's WSU Turfgrass
9 Cultivars Evaluated In Western Washington/Oregon In Recent Years list. (Puyallup.wsu.edu/turf). Alternative varieties may be
10 substituted only if evidence is provided by Contractor that sod made up of these varieties is not available from local sources.

11 Turf type must be determined by the Engineer, depending on the intended turf use:

- 12 1. High Performance – 100 percent perennial rye. 3 or more varieties from approved list.
- 13 2. Ornamental and Passive Recreation. 3 or more varieties from approved list, in a mix meeting the following
14 proportions:

| Approved Turf Types | Proportion |
|-------------------------------|------------|
| Turf-type perennial rye grass | >50% |
| Kentucky bluegrass | <30% |
| Fine fescue | >20% |

16

17 9-14.7 TREE STAKES, GUYS, AND WRAPPING

18 Stakes must be 8-foot long 2-inch diameter pressure treated lodgepole pine wood stakes, with chamfered tops and 6-
19 inch long conical points (see Standard Plan 100a). The Contractor must be prepared to provide No. 5 deformed steel
20 reinforcing bar as a substitute stake for compatibility with tree grates. The stakes must be installed as shown in the Standard
21 Plans unless the Contract indicates otherwise.

22 Guys must be pre manufactured adjustable ties made of plastic Material such as No. 2 Chainlock or approved equal. The
23 guys must be installed as shown in the Standard Plans unless the Contract indicates otherwise. Guys must be adjusted at the
24 end of the first growing season to prevent constriction of growth, bark ringing, or other conditions detrimental to optimal growth
25 of the trees. Guys must be removed one year after planting, except when noted otherwise in the Contract.

26 Wrap. Tree wrap must be as specified in the Contract.

27 9-14.8 SHEAR BOARDS

28 Shear boards must be 2" x 8" x 8' non-treated, rough finished lumber. When conditions require a length less than 8 feet,
29 the Contractor must plan the layout so that no individual length of cut shear board is less than 4 feet.

30 9-14.9 PAVER BLOCKS AND INTERLOCKING CONCRETE PAVERS**31 9-14.9(1) PAVER BLOCKS**

32 Paver blocks must be exposed aggregate concrete of the size shown on the Drawings. Pavers must be made from the
33 following mix:

| Material | Quantity per cubic yard |
|-----------------------|-------------------------|
| gray cement | 564 lbs |
| 5/8 inch minus gravel | 2,400 lbs |
| building sand | 1,030 lbs |

35

36 A sample of exposed aggregate showing the desired amount of exposure is available at the SPU' Materials Laboratory at
37 707 South Plummer Street.

38 Exposed aggregate surface of all concrete paver units must be sealed with a heavy-duty concrete enamel containing a
39 10 percent methylacrylate solution or approved equal. On request by the Engineer, the Contractor must provide a 1 pint
40 sample of sealant for testing. Sealant Material must be approved by the Engineer prior to application.

41 The Contractor must submit two sample paver blocks, which are representative of those to be used in the Project, for the
42 Engineer's approval.

9-14.9(2) INTERLOCKING CONCRETE PAVERS

The manufactured product must comply with the following Specifications in color, materials, physical properties configuration, and tolerances:

1. The color of the unit concrete paver must be natural conforming to samples available from the Engineer.
2. The nominal dimensions must be:

| Dimension | Requirement |
|-----------|-------------|
| length | 9" |
| width | 4-1/2" |
| thickness | 2-3/8" |

3. Shape:

- a. The length sides of the paver must have two projections and two recessions per side. The projection on one side must correspond to a recession on the opposite side. The projections and recessions must be 3/8 inch when measured from the extension of the nominal width lines for the length of the paver.
- b. The width sides of the paver must have one projection and one recession per side. The projection on one side must correspond to a recession on the other side. The projections and recessions must be 3/8 inch when measured from the extension of the nominal length lines for the width of the paver.
- c. The top and bottom surfaces must be flat and parallel. The top side edge must be chamfered 1/4 inch. The sides must be perpendicular to the top and bottom surfaces. Full size edging pavers must have one width side flat. Half size edging pavers must be 1/2 the nominal length with one width side flat.
- d. Length or width of paver unit must not differ by more than 0.059 inches and heights must not differ by more than 0.11 inches from the specified dimensions.

9-14.9(3) CEMENTITIOUS MATERIALS

Materials must conform to the following:

| Material | Standard |
|-----------------|---------------------------|
| Portland Cement | ASTM C 150 |
| Blended Cement | ASTM C 595, Type 1S or 1P |
| Hydrated Lime | ASTM C 207, Type S |
| Pozzolan | ASTM C 618 |

9-14.9(4) AGGREGATES AND OTHER CONSTITUENTS

Aggregates must conform to the following, except that grading requirements may not necessarily apply:

| Weight | Requirement |
|---------------|---|
| Normal weight | ASTM C 33, for Concrete Aggregates |
| Lightweight | ASTM C 331, for Lightweight Aggregates for Concrete Masonry Units |

Air entraining agents, color pigments, integral water repellents, and finely ground silica must be previously established as suitable by the Engineer for use in concrete and must conform to ASTM Standards where applicable, or must be shown by test or experience not be detrimental to concrete.

9-14.9(5) PHYSICAL REQUIREMENTS

At the time of delivery to the Project Site, the average compressive strength of test samples must not be less than 8000 psi with no individual paver unit less than 7200 psi.

The average absorption must not be greater than 5 percent, with no individual unit greater than 7 percent.

The manufacturer must satisfy the Owner by proven field performance of the laboratory freeze thaw test that the paving units have adequate durability when subject to a freeze thaw environment. See freeze thaw test in this Section.

Acceptable field performance is achieved when units similar in composition and produced by the same manufacturing process exhibit no objectionable deterioration for at least 3 years. The paver units used as the basis for proven field performance must have been exposed to the same general type of environment, temperature, range, and traffic volume.

1 When tested per Section 8 of ASTM C 67, specimens must not have breakage or, greater than 1.0 percent loss on dry
 2 weight of any individual paver unit when subjected to 50 cycles of freezing and thawing. This test must be conducted not more
 3 than 12 months prior to delivery of units. When tested per ASTM C 418. Abrasion Resistance of Concrete By Sandblasting
 4 specimens must not have volume loss greater than 0.915 cubic inch per 7.75 square inch. The average thickness loss must
 5 not exceed 1/8 inch.

6 **9-14.9(6) PERMISSIBLE TOLERANCE IN DIMENSIONS**

7 Length or width of paver unit must not differ by more than 0.059 inches and heights must not differ by more than 0.11
 8 inches from the specified dimensions.

9 **9-14.9(7) VISUAL INSPECTION**

10 All paver units must be sounded and free of defects that would interfere with the proper placing of unit; or impair the
 11 strength of the construction. Minor cracks or chips due to the usual method of manufacture and customary method of handling
 12 in shipment and delivery may be allowed subject to the discretion of the Engineer. Paver units identified as unacceptable by
 13 the Engineer must be replaced.

14 **9-14.9(8) SAMPLING AND TESTING**

15 The Contractor must submit 3 samples of the paver unit to the SPU Material Laboratory for approval.
 16 Sample units will be tested per ASTM C 140.

17 **9-14.9(9) BASE COURSE**

18 The base course must be 6 inches in depth, must be as specified in Section 9-03.7(3) Crushed Surfacing, and must
 19 consist of Mineral Aggregate Type 2, 1-1/4 inch minus crushed rock, as describe in Section 9-03. 20 percent "ISOLITE" CG2
 20 must be incorporated into the base course in paver areas extending the width of the sidewalk adjacent to tree pits (an 8' x 7'
 21 surface area per pit).

22 **9-14.9(10) TOP COURSE OR KEYSTONE**

23 The Top Course must be 2 inches in depth and must be as specified in Section 9-03.7(3) Crushed Surfacing and must
 24 consist of Mineral Aggregate Type 1, 5/8 inch minus crushed rock, as describe in Section 9-03. 20 percent "ISOLITE" CG2
 25 must be incorporated into the base course in paver in areas extending the width of the sidewalk adjacent to tree pits (an 8' x 7'
 26 surface area per pit).

27 **9-14.9(11) LEVELING COURSE**

28 The Leveling Course must be as specified in Section 9-03.9, as modified in Section 9-14.9(11).
 29 The Material must be 3/8 inch minus chip rock with the following gradation:

| Sieve Size | Percent Passing |
|------------|-----------------|
| 3/8" | 98 |
| 1/4" | 50-90 |
| No. 4 | 25-55 |
| No. 6 | 0-20 |
| No. 10 | 0-10 |
| No. 40 | 0-5 |
| No. 200 | 0-3 |

31
 32 Material passing the No. 200 sieve size must be brought to the Project Site bagged and dry.

33 **9-14.9(12) BEDDING SAND**

34 The bedding sand must be as specified in Section 9-03.10(6) and must consist of Mineral Aggregate Type 6, washed
 35 sand, as specified in Section 9-03.

36 **9-14.9(13) JOINT FILLING SAND**

37 The joint filling sand must have the following grading:

| Sieve Size | Percent Passing |
|------------|-----------------|
| US No. 8 | 95-100 |
| US No. 16 | 60-70 |
| US No. 30 | 15-25 |

| Sieve Size | Percent Passing |
|------------|-----------------|
| US No. 50 | 0-5 |
| US No. 100 | 0-2 |
| US No. 200 | 0-1 |

1
2 The fracture must be 100 percent. This Material is crushed sand.

3 **9-14.9(14) EDGING**

4 Edging must be installed to separate all unit paver installations from adjacent planting or turf areas. Product must be
5 specified on Drawings and approved by Engineer.

6 **9-14.10 TURF REINFORCEMENT**

7 Turf reinforcement product must be as specified on the Drawings and approved by Engineer.

8 **9-14.11 CEDAR EDGING**

9 Material for edging must be 2" x 4" cedar, construction grade or better with tight knots.

10 **9-14.12 BOLLARDS**

11 **9-14.12(1) WOOD BOLLARDS**

12 Bollards must be nominal 8" x "8, 90 Day stack dry, select Douglas Fir. Bollards must be pressure treated (by closed
13 cylinder method) with Pentachlorophenol after cutting and predrilling. Tops and 4 sides of bollards must be painted (above the
14 notch) with 2 coats of white marine enamel as manufactured by Inter Lux or approved equal applied per manufacturer's
15 recommendations.

16 All metal parts (such bolts, nuts, and washers) must be hot dipped galvanized.

17 **9-14.12(2) CONCRETE BOLLARDS**

18 Concrete bollards must be made of Class 3000 cement concrete as specified in Section 6-02, reinforced with four No. 4
19 deformed steel bars placed 1 inch clear below the concrete surface and held in place with No. 8 gauge wire ties. After forms
20 are removed, concrete must show a smooth dense face. Any surface irregularities showing above grade must be scraped or
21 stoned off; the surface must then be washed and a 1:1 mortar must be brushed on. After the initial set but before the final set,
22 the excess mortar must be rubbed off using burlap sacking or pieces of carpeting. The bollards must then be cured by being
23 kept damp with water for not less than 2 Days.

24 **9-14.12(3) PADLOCKS FOR REMOVABLE BOLLARDS**

25 The padlock must be as manufactured by Best Lock Company, Lock number 2B672 with bronze body, 2-inch stainless
26 steel shackle, and equipped with construction core or approved equal.

27 **9-14.13 BENCHES**

28 Benches must be of the type specified in the Contract.

29 **9-14.14 TREE GRATES**

30 Tree grates must be manufactured in 2 equal sized sections made of gray iron conforming to ASTM A 536, GR80 56 06.
31 Grates must have a 3/4-inch nominal thickness and cover an area not less than 24 square feet. To accommodate tree growth,
32 the grates must have 3 or 4 centrally located concentric break out rings allowing a 12-inch minimum to 30-inch maximum
33 opening in diameter. Break out rings must have no more than 6 points of attachment per grate section and must be scored to
34 allow ease of expansion for tree growth. Grates must be designed to not fail under a wheel load of up to 4000 pounds except
35 at the break out rings.

36 Alternative Material use in the design and manufacturing of tree grates is subject to approval by the Engineer based on a
37 submittal provided by the Contractor providing data on performance standards adequate to meet the public safety,
38 sustainability, functional, and visual objectives of the project. Submittals must include documentation of product use and
39 performance over a minimum of 3 years on installations for public use in areas with comparable climactic conditions typical in
40 the Pacific Northwest.

41 **9-14.15 IN-STREAM LOGS**

42 In-stream logs must consist of tree shoot with or without limb, and tree root and rootwad. In-stream log may include the
43 use of on-site tree identified for removal. The shoot portion of the tree must not contain any root and may have any alignment
44 unless the Contract specifies otherwise. The logs must not be limbed; however, may require trimming of limbs to dimensions
45 as specified in the Contract.

46 In-stream log must be cedar, Douglas fir, or other species tree as specified in the Contract.

1 Logs must be of sound quality, must not be split or cracked, and must be clean and free of insects, rot, decay, soil, rock,
2 and other deleterious material.

3 The Contract will specify log length and diameter, and may specify a range of butt and tip diameters. The root section
4 dimension will contain a minimum and/or maximum diameter and may require trimming approximating a plane.

5 **9-14.16 WATTLES OR COMPOST SOCKS**

6 Wattles must act as a screen or filter and must consist of biodegradable plant material such as any combination of twigs,
7 wicker, bamboo, other withes, straw, coir, and wood shavings, or for Compost Socks, in the shape of cylinders typically
8 ranging from 8-inch to 16-inch diameter and of any length. The wattle must be encased within biodegradable netting. Where
9 not otherwise specified, Compost Socks must be used.

10 **9-14.17 VERTICAL ROOT BARRIER**

11 Root barriers must be an injection molded or extruded modular component made of high density polypropylene or
12 polyethylene plastic with a minimum of 30 percent recycled materials. Panels must have a minimum thickness of 0.080 inches
13 (2 mm). Each panel must have molded vertical ribs (4 minimum) and locking strips, integral male/female sliding locks,
14 intergraded zipper joining system. Vertical root-deflecting ribs or channels must be between 1/2 inch (12.7 mm) and 0.008
15 inches (0.2 mm) high, perpendicular to the panel, and between 5.91 inches (150 mm) to 7.87 inches (200 mm) apart. Panels
16 must be a minimum of 24" wide x 18" or 24" deep, or as shown on Drawings. The Contractor must submit for approval a
17 catalogue cut for the material and installation.

18 **9-14.18 SLOW RELEASE WATERING BAGS**

19 Slow release watering bag must be UV-stabilized polyethylene bag with nylon webbing, black polypro straps, and nylon
20 zippers. Each bag must have at least 2 water release points. Each bag must have a water capacity of at least 15 gallons. For
21 a double bag installation, water capacity must be at least 22.75 gallons. The fill opening must fit up to a 3-inch diameter hose.

22 Slow release watering bags must be Treegator Original, TreeCOVER, Oasis Tree Watering Bags, or approved equal.

23 **SECTION 9-15 IRRIGATION SYSTEM**

24 **9-15.1 PIPE AND FITTINGS**

25 **9-15.1(1) GENERAL**

26 Pipe must be galvanized iron, PVC, or polyethylene, as specified in the Contract.

27 **9-15.1(2) GALVANIZED PIPE AND FITTINGS**

28 Pipe must be standard weight, hot dipped galvanized iron or steel pipe, threaded and coupled. Pipe must comply with
29 ASTM A 120.

30 **9-15.1(3) POLYVINYL CHLORIDE PIPE AND FITTINGS**

31 PVC pipe upstream of the control valves must be schedule 40 and conform to ASTM D 1785.

32 PVC pipe downstream of the control valves must be pressure rated for 200 psi and conform to ASTM D 2241, SDR 21.

33 Fittings must be of the solvent weld type except where risers or valves require threaded transition fittings. Fittings must
34 conform to ASTM D 2466.

35 PVC pipe and fittings must be nontoxic, free from taste and odor, and self-extinguishing.

36 Pipe must be homogenous throughout and free of defects cracks, holes, foreign materials, wrinkles, dents, and blisters.

37 PVC pipe must be continuously and permanently marked with the following information: manufacturer's name, kind of
38 pipe, National Sanitation Foundation (NSF) approval and schedule number.

39 **9-15.1(4) POLYETHYLENE PIPE**

40 Polyethylene pipe must be Class 80, SDR 15, medium density polyethylene pipe, comply with ASTM D 2239, conform to
41 U.S. Commercial Standard CS 255, and be National Sanitation Foundation (NSF) approved.

42 **9-15.2 CONTROL TUBING**

43 Control tubing must be copper refrigerator tubing complying with ASTM B 280 in the size specified on the Drawings.
44 Tubing and fittings must be capable of withstanding a 300 psi operating pressure, and must be of the size shown on the
45 Drawings.

46 **9-15.3 SLEEVE**

47 Pipe sleeves must be PVC schedule 40. Sizes and installation must be as shown on the Drawings and Standard Plan
48 128.

49 Conduit must be as specified in Section 9-34.

9-15.4 IRRIGATION AUTOMATIC CONTROLLERS

Automatic controllers must be installed in electrical controller cabinets on a concrete base as shown on Standard Plan 129. The dimensions and details of the controller cabinet must be as shown on Standard Plan 129 unless otherwise dimensioned and detailed in the Contract. A manufacturer of acceptable irrigation controller cabinets is Skyline Electric and Manufacturing Co., Seattle, Washington.

The controller must be an electrically timed device for automatically opening and closing control valves for predetermined periods of time and mounted so that all normal adjustments are conveniently located for use by the operator. Controllers must be enclosed in a weatherproof metal enclosure. The Contractor must submit a Shop Drawing of the padlock secured enclosure sized adequately to hold all specified equipment. The enclosure must include a modified free standing shelf measuring 12" x 12" x 15" high to hold the Controller, and one GFCI outlet with 15 amp circuit breaker (10,000 amp AIC) located in the upper right hand corner. All 120 volt wiring must be behind a dead front panel. The controller must be solid state and capable of operating the irrigation system as designed and constructed and must include these operating features:

1. Each controller station must be adjustable for setting to remain open for any desired period of time - from 5 minutes or less to at least 1 hour.
2. Adjustments must be provided whereby any number of Days may be omitted and whereby any one or more positions on the controller can be skipped. When adjustments are made, they must continue automatically within a 14 Day cycle until the operator desires to make new adjustments.
3. Controls must allow any position to be operated manually either on or off whenever desired.
4. Controls must provide for resetting the start of the irrigation cycle at any time and advancing from one position to another.
5. Controllers must contain an on-off switch and fuse assembly.
6. Controller adjustments must be such that the open cycle may be doubled or repeated not less than 3 times during the complete watering cycle.
7. Controller must have a power failure cutout.
8. Controller must be UL approved and marked accordingly.

Contractor must provide an outdoor rated padlock by Best Manufacturing Company with a removable blue core.

9-15.5 SPRINKLER HEADS

Sprinkler heads must be of the type, pattern, and coverage shown on the Drawings at rated operating pressure specified, discharging not more than the amount of gallons per minute specified.

Sprinkler heads must be designed so that spray adjustments can be made by either an adjustment screw or interchangeable nozzles. Watering cores must be easily removed without removing the housing from the pipe.

All turn heads must be designed with turf flanges having 2 gripping holes to facilitate removal of the head.

When the Contract does not specify irrigation system spacing, or does not specify irrigation head make or model, then the Contractor must submit the missing information to the Engineer for approval at least 10 Working Days in advance of ordering materials. Approval, and request for approval of substitution, of sprinkler heads will be based on compatibility of materials with other Owner systems at the Project Site as specified in 1-02.4(1) and 1-05.3(6). The Contractor must design the layout of such systems incorporating efficient and adequate coverage without overspray.

9-15.6 ELECTRICAL WIRE

Wire from controller to valves must be #14 UF direct burial (UL approved), red or black for the hot side, white for neutral (solid copper). The auxiliary wires, where required, must be any third color (except green). UF and UL designations must be clearly marked on the insulation jacket of all wires.

9-15.7 IRRIGATION VALVES**9-15.7(1) GATE VALVES**

Gate valves, when called for on the Drawings, must be heavy-duty bronze conforming to the Specifications of ASTM B 62. Valves must be of the same size as the pipes on which they are placed and must have union or flange connections. Service rating (for non-shock cold water) must be 300 psi. Valves must be of the double disk, taper seat type, with rising stem, union bonnet, and handwheel. Manufacturer's name, type of valve and size must be cast on the valve.

9-15.7(2) CONTROL VALVES**9-15.7(2)A MANUAL CONTROL VALVES**

Manual valves must be bronze or brass, angle type with hex brass union. Service rating must be not less than 150 psi nonshock cold water. Valves must be designed for underground installation with suitable cross wheel for operation with a standard key. The Contractor must furnish 3 suitable operating keys per Contract. Valves must have removable bonnet and stem assembly with adjustable packing gland and must house long acme threaded stem to ensure full opening and closing. Valve discs must be full floating with replaceable seat washers.

1 9-15.7(2)B AUTOMATIC CONTROL VALVES

2 Automatic remote control valves must be globe pattern with flanged or screwed connections as required. The valve must
3 be constructed so as to allow all internal parts to be removable from the top of the valve without disturbing the valve
4 installation. Screwed valves must be provided with union connections.

5 Valves must be of a "normally closed" design and must be electric solenoid operated, having maximum rating of 6.5
6 watts utilizing 24 volts AC power. Solenoids must be directly attached to the valve bonnets or body with all control parts and
7 ports completely internal. Valves must be of 150 psi brass or bronze, or iron body bronze mounted combination. The time
8 interval for valve closing operation must be a minimum of 5 seconds for complete closure at constant rate of closing and a
9 minimum of 3 seconds to completely open at a constant rate of opening. A manual control bleed cock must be included on the
10 valve to operate the valve without electric current. A manual shutoff stem with cross handle for wrench operation is required for
11 manual adjustment from fully closed to wide open. Once the manual adjustment is set, the valve can be operated
12 automatically in the adjusted position. Water flow must be completely stopped when the control valve is closed either manually
13 or automatically. Automatic control valves and automatic controllers need not be of the same manufacturer.

14 All automatic control valves must be pressure reducing valves unless otherwise specified in the Contract.

15 9-15.7(2)C AUTOMATIC CONTROL VALVES WITH PRESSURE REGULATOR

16 The automatic control valve with pressure regulator must be similar to the automatic control valve and must also reduce
17 the inlet pressure to a constant lower pressure regardless of supply fluctuations. The regulator must be fully adjustable.

18 9-15.7(3) QUICK COUPLER VALVES

19 Quick coupler valves must have a service rating not less than 125 psi for nonshock cold water. The body of the valves
20 must be of cast leaded semi red brass alloy No. C84400 conforming to ASTM B 584. The base of the valve must have
21 standard female pipe threads. The design of the valve must be such that it opens only upon inserting a coupler key and closes
22 as the coupler is removed from the valve. Leakage of water between the coupler and valve body when in operation will not be
23 accepted. The valve body receiving the coupler must be designed with double worm slots to allow smooth action in opening
24 and closing of the valve with a minimum of effort. Slots must be notched at the base to hold the coupler firmly in the open
25 position. Couplers must be of the same material as the valve body with stainless steel double guide lugs to fit the worm slots.
26 Couplers must be of one piece construction with steel reinforced side handles attached. All couplers must have standard male
27 pipe threads at the top. Couplers must be furnished with all quick coupler valves unless otherwise specified in Contract. See
28 Standard Plan 121.

29 9-15.7(4) DRAIN VALVES

30 The Contractor must install a 3/4-inch male automatic ball check drain valve at the low point in the system. The drain
31 valve must be drained to a pocket containing a minimum of 1/2 cubic yard of Mineral Aggregate Type 4. See Standard Plan
32 122.

33 9-15.7(5) CHECK VALVES

34 Check valves must be heavy-duty bronze or steel. The valves must function by means of a hinged disc suspended from
35 the body and able to close of its own weight. Valves must be of the size as the pipes on which they are placed, unless
36 otherwise specified in the Contract, and must have union or flanged connections. Service rating (for nonshock cold water)
37 must be 300 psi. Manufacturer's name, type of valve and size must be cast on the valve.

38 9-15.7(6) PRESSURE REDUCING VALVES

39 Pressure reducing valves must have a minimum of 150 psi working pressure with an adjustable outlet range of 20 to 70
40 psi. The valves must be factory set as shown on the Drawings.

41 Pressure reducing valves must be rated for safe operation at 175 psi non-shock cold water.

42 9-15.7(7) THREE WAY VALVES

43 Three way valves must be tight closing, three port, ball or plug type, constructed to permit straight through and 90 degree
44 flow only. The valve must be of bronze or approved corrosion resistant body Materials and must have a minimum of 150 psi
45 working pressure. The head of the valve, or handle when applicable, must be permanently marked to indicate port position.
46 Whenever handles are included as an integral part of the valve, the Contractor must remove the handles and submit them to
47 the Engineer for ultimate distribution to the Maintenance Division.

48 9-15.7(8) FLOW CONTROL VALVES

49 Valve body materials must be plastic or metal. Internal parts must be stainless steel. Valves must be factory set to design
50 flows. Valves must have no external adjustment and be tamper proof when installed. 1/4-inch and smaller flow control valves
51 must have a minimum pressure absorption range of 2 to 32 psi. 1-1/2-inch and larger flow control valves must have a
52 minimum pressure absorption range of 3 to 50 psi.

53 Flow must be controlled to 5 percent of design volumes.

9-15.7(9) AIR RELIEF VALVE

The air relief valve must automatically relieve air and break a vacuum in the serviced pipe. Body Materials must be installed exactly at all high points.

9-15.8 VALVE BOXES

All automatic control valves, flow control valves, and pressure reducing valves must be provided with valve boxes. Valve boxes must be sized as appropriate to allow efficient access to components and must be approved by the Engineer prior to installation. Valve boxes must be extendable to obtain the depth required. Where 1-inch diameter Schedule 80 PVC braces are required for quick coupler valves as shown on Standard Plan 121, the box must have holes adequately sized to securely snug fit the brace. All manual drain valves and manual control valves must be equipped with a protective sleeve and cap as shown in the Standard Plans.

9-15.9 BACKFLOW PREVENTION ASSEMBLIES

Backflow prevention assemblies must be as specified in Section 9-30.13.

9-15.10 HOSE BIBS

Hose bibs must be constructed of bronze or brass, angle type threaded to accommodate a 3/4-inch hose connection, and must be key operated. Design must be such as to prevent operation by wrench or pliers.

9-15.11 DETECTABLE MARKING TAPE

Detectable marking tape must consist of inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents, and solvents likely to be encountered in the soil, with a metallic foil core to provide the most positive detection and pipeline locators.

The tape must be color coded and must be imprinted continuously over its entire length in permanent black ink. The message must convey the type of line buried below and must also have the word "Caution" prominently shown. Color coding of the tape must be as follows:

| Utility | Tape Color |
|--------------------------------------|------------|
| Water | Blue |
| Sewer | Green |
| Electrical | Red |
| Gas-Oil | Yellow |
| Telephone-CATV | Orange |
| Non-Potable Water | Purple |
| Irrigation, Potable Water Source | Blue |
| Irrigation, Non-Potable Water Source | Purple |

The width of the tape must be as recommended by the manufacture for the depth of installation.

SECTION 9-16 FENCE AND GUARDRAIL

9-16.1 CHAIN LINK FENCE AND GATES

9-16.1(1) GENERAL

All material used in the construction of chain link fence and gates must be new. Iron or steel Material must be galvanized; however, exceptions to galvanizing are listed in various Standard Plans and other Standard Specifications. Imperfectly galvanized Material or Material upon which serious abrasions of galvanizing occur will not be acceptable.

The base material for the manufacture of steel pipes used for posts, braces, top rails, and gate frames must conform to the Specifications of ASTM F 1083. The base material for the manufacture of steel H columns must comply with the Specifications of ASTM A 663 or ASTM A 675.

Roll formed posts, braces, and rails must be made from sheet steel and must conform with the details as shown on the Drawings or Standard Plan 450b. The Material for end, corner, and pull posts must have a minimum yield strength of 35,000 psi. The minimum yield strength for Alternate A roll formed line posts must be 40,000 psi and for Alternate B roll formed line posts 45,000 psi. Top rail and braces to be used with Alternate A or B line posts must conform to the minimum yield strength as required for either post respectively.

All posts, braces, top rails, and gate frames must be hot dip galvanized. They must have a minimum average of 1.8 ounces zinc coating per square foot of surface area with no individual test being below 1.6 ounces zinc coating per square foot of surface area. In the case of members made from pipe, this area is defined as the total area inside and outside. A sample for

1 computing the average weight of coating is defined as a 12-inch piece cut from each end of the galvanized member. Fittings
2 must be galvanized per ASTM F 626. Other Materials must be galvanized per ASTM A 153.

3 **9-16.1(2) POSTS**

4 All posts for chain link fence must be of the shape, size, and weight per foot shown on Standard Plan 450b. Roll formed
5 end, corner, and pull posts must be made from 0.1345-inch minimum thickness sheet steel and must have integral fastening
6 loops to connect to the fabric for the full length of each post. Roll formed line posts must be made from 0.110-inch minimum
7 thickness sheet steel for Type 3 and Type 4 fences and must be made from 0.120-inch minimum thickness sheet steel for
8 Type 1 and Type 6 fences.

9 An acceptance tolerance for posts for chain link fence allows for deviation from the weight per linear foot specified in the
10 Standard Plans. This tolerance must be applied on an individual post basis and must be ± 5 percent for tubular and H section
11 posts and ± 6 percent for roll form sections. Materials that exceed the weight per foot or wall thickness Specification may be
12 accepted, providing they do not interfere with the proper construction of the fence.

13 **9-16.1(3) TOP RAIL, BRACES, AND TRUSSES**

14 Top rail and compression braces must be of the type and size shown on Standard Plan 450b. Tension truss rods must be
15 3/8-inch round galvanized rods with drop forged turnbuckles, or other approved type of adjustment. Couplings for tubular
16 sections must be outside sleeve type and at least 6 inches long. Roll formed top and brace rails must be made from 0.0747-
17 inch thick sheet steel and must be an open rectangular section with internal flanges. The acceptable thickness tolerance for
18 sheet steel members must be ± 0.006 inch.

19 **9-16.1(4) TENSION WIRE AND ATTACHMENTS**

20 Top and bottom wire must be 7 gage coil spring steel wire of good commercial quality and must have a zinc coating
21 averaging 0.8 ounce per square foot of surface area. All tension wire attachments must be hot dip galvanized steel. Eye bolts
22 must be 3/8-inch diameter and of sufficient length to fasten to the type of posts used.

23 **9-16.1(5) FITTINGS**

24 All fittings and miscellaneous hardware must be malleable cast iron or pressed steel. Fittings must be galvanized per
25 ASTM F 626. Galvanizing of miscellaneous hardware not covered by ASTM F 626 must be in conformance with ASTM A 153.
26 Fittings for any particular fence must be those furnished by the manufacturer of the fence.

27 **9-16.1(6) CHAIN LINK FENCE FABRIC**

28 Chain link fabric must consist of 11 gage wire (0.120-inch diameter) for Types 3, 4, and 6 fence; and 9 gage wire (0.148-
29 inch diameter) for Type 1 fence. The fabric wire may be one of the following Materials provided that only one type must be
30 selected for use in any one Contract:

- 31 1. Galvanized steel wire conforming to ASTM A 392.
- 32 2. Galvanizing must be Class I performed by the hot dip process.
- 33 3. Aluminum coated steel wire conforming to ASTM A 491.
- 34 4. Class II aluminum wire conforming to 6061 T94 alloy.

35 The wire must be woven into approximately 2-inch diamond mesh. The width and top and bottom finish of the fabric must
36 be as shown in Standard Plans 450a and 450c.

37 **9-16.1(7) FABRIC BANDS AND STRETCHER BARS**

38 Fabric bands must be 1/8" x 1" nominal and stretcher bars 3/16" x 3/4" nominal. Nominal must be construed to be the
39 area of the cross-section of the shape obtained by multiplying the specified width by thickness. A variation of ± 5 percent from
40 this theoretical area must be construed as "nominal" size. Both must be hot dip galvanized to comply with the Specifications of
41 ASTM F 626.

42 **9-16.1(8) TIE WIRE**

43 Tie wire must be 9 gage aluminum wire complying with the ASTM B 211 or 9 gage galvanized wire complying with the
44 Specifications of AASHTO M 279. Galvanizing must be Class 1. Hog rings must comply with the Specifications of AASHTO M
45 279. Galvanizing must be Class 1.

46 **9-16.1(9) CHAIN LINK GATES**

47 Gate frames must be constructed of not less than 1-1/2 inch inside diameter hot dip galvanized pipe with nominal weight
48 of 2.72 pounds per linear foot. The corners of the gate frame must be fastened together and reinforced with a malleable iron or
49 pressed steel fitting designed for the purpose, or they may be welded. Welding must be as specified in Section 6-03.3(25). All
50 welds must be ground smooth and painted with a high zinc dust content paint per MIL P 21035. The paint must be applied in
51 one or more coats to provide a dry film thickness of 3.5 mil minimum.

52 Cross trussing must be 3/8-inch galvanized steel adjustable rods.

53 Chain link gate fence fabric Material must be the same as used for the chain link fence as specified in 9-16.1(6).

Each gate must be furnished complete with necessary hinges, latch, and drop bar locking device designed for the type of gate posts and gate used on the Project. Gates must have positive type latching devices with provisions for padlocking.

Gate frames constructed of steel sections, except pipe, that are fabricated in such a manner as to form a gate of equal or better rigidity may be used provided they are approved by the Engineer.

9-16.1(10) MISCELLANEOUS

All concrete must be Class 3000 as specified in Section 6-02.3 and Gates

9-16.2 WIRE FENCE AND GATES

9-16.2(1) GENERAL

All materials used in the construction of the wire fence must be new. All iron or steel material must be galvanized. Imperfectly galvanized material or material upon which serious abrasions of galvanizing occur must not be used.

9-16.2(2) STEEL FENCE POSTS AND BRACES

All posts for chain link fence must be of the shape, size, and weight per foot shown in Standard Plan 450b. Roll formed end, corner, and pull posts must be made from 0.1345-inch minimum thickness sheet steel and must have integral fastening loops to connect to the fabric for the full length of each post. Roll formed line posts must be made from 0.110-inch minimum thickness sheet steel for Type 3 and Type 4 fences and must be made from 0.120-inch minimum thickness sheet steel for Type 1 and Type 6 fences.

Line posts may be channel, T, U, Y, or other approved shape, manufactured solely for use as fence posts. One type of line post must be used throughout the Project. Line posts must be studded, slotted, or properly adapted for attaching either wire or mesh in a manner that does not damage the galvanizing of posts, wire, or mesh during the fastening. Line posts must have a minimum weight of 1.33 pounds per linear foot and must be provided with a tapered steel anchor plate attached securely having a minimum weight of 0.67 pounds and having a surface area of 20 square inches ± 2 square inches.

End, corner, gate, and pull posts must comply with the Specifications for line posts, except that the posts must have a minimum weight of 3.1 pounds per linear foot and anchor plates and special studs, slots, or adapters for the attachment of wires will not be required.

Braces must have a minimum weight of 3.1 pounds per linear foot.

All posts, braces, anchor plates, and hardware not covered by ASTM F 626 must be galvanized per ASTM A 123, or ASTM A 153.

A tolerance of minus 5 percent on the weight of individual posts, braces, or anchor plates will be permitted.

9-16.2(3) WOOD FENCE POSTS AND BRACES

Douglas fir, Western red cedar, hemlock, or larch must be used in the construction of wood fence posts and braces. The material must be of good quality and approved by the Engineer before use. Peeler cores must not be used for round posts. Wood fencing materials must have sufficient sapwood in the outer periphery to obtain the specified penetration of preservative. Western red cedar will not require preservative treatment. Fencing materials must be cut to the correct length before pressure treatment.

Line posts must be 3-inch minimum diameter round posts or nominal 3" x 3" square sawed posts. If the posts are to be pointed for driving, they must be pointed before treatment. Line posts must be at least 7 feet in length.

Pull posts and brace posts must be 6-inch diameter round posts or nominal 6" x 6" material not less than 7 feet in length.

End, gate, and corner posts, and posts at an intersecting fence must be 6-inch diameter round posts or nominal 6" x 6" material not less than 7'-10" in length.

All sawed posts and timbers must comply with the requirements in the tables in Section 9-09.2.

The preservatives used to pressure treat wood fencing materials must be as specified in Section 9-09.3.

The retention and penetration of the preservative must be as follows:

Minimum Retention in Pounds per Cubic Foot

| Preservative | Sawed Posts | Round Posts |
|--------------|-------------|-------------|
| ACA | 0.40 | 0.40 |
| ACZA | 0.40 | 0.40 |

Minimum Penetration

| Material Size | Minimum Penetration |
|---------------|--------------------------------------|
| 5" or less | 0.40" penetration and 90% of sapwood |
| 5" or greater | 0.50" penetration and 90% of sapwood |

9-16.2(4) BRACE WIRE

Brace wire must be 9 gage galvanized wire complying with the Specifications of ASTM A 116, galvanizing Class 3.

9-16.2(5) STAPLES AND WIRE CLAMPS

The staples used to attach the wire fencing to wood posts must be galvanized 9 gage, 1-1/2 inches long complying with the Specifications of AASHTO M 279, galvanizing Class 1.

The wire clamps used to attach the wire fencing to steel posts must be galvanized 11 gage wire complying with the Specifications of AASHTO M 279, galvanizing Class 1.

9-16.2(6) BARBED WIRE

Barbed wire must conform to the Specifications of AASHTO M 280, and must consist of two strands of 12-1/2 gage wire, twisted with 4 point 14 gage barbs with the barbs spaced an average of 5 inches apart. Galvanizing must be Class 3.

9-16.2(7) WIRE MESH

Wire mesh must conform to the Specifications of AASHTO M 279, and must consist of 7 horizontal wires with vertical stays spaced 6 inches apart. The top and bottom wires must be 10 gage, and the intermediate wires and vertical stays must be 12-1/2 gage. The mesh must have a total width of 26 inches (Design No. 726-6-12-1/2). Galvanizing must be Class 3. The zinc coated wire as represented by the test specimens must be capable of being wrapped in a close helix at a rate not exceeding 15 turns/minute around a cylindrical steel mandrel having a diameter the same as the specimen being tested, without cracking or flaking the zinc coating to such an extent that any zinc can be removed by rubbing with the bare fingers.

9-16.2(8) VERTICAL CINCH STAYS

Vertical cinch stays must be 9-1/2 gage galvanized wire complying with the Specifications of AASHTO M 279, except that the minimum weight of zinc coating must be 0.3 ounce per square foot of uncoated wire surface.

9-16.2(9) WIRE GATES

Gate frames must be constructed of galvanized standard weight pipe with a nominal diameter of not less than 1 inch. The pipe must conform to the Specifications of ASTM A 53. Wire gates must be not less than 48 inches in height and must be designed to fit openings of the widths called for in the Contract. Each gate must be provided with two upright braces of the same material as the frame, spaced at 1/3 points in the gate. All gates must be provided with adjustable 3/8-inch diameter diagonal truss rods from corner to corner.

The gate frame must be provided with wire mesh as specified in Section 9-16.2(7), except that it must consist of 10 horizontal wires and have a total width of 47 inches (Design No. 1047-6-12-1/2).

Each gate must be furnished complete with necessary hinges and latch designed for use with the type of gate posts used on the Project. The hinges must be so designed as to be securely attached to the gate post and to enable the gate to be swung back against the fence.

Double gates must be hinged in the same manner as single gates and must be provided with an approved drop bar locking device.

9-16.2(10) MISCELLANEOUS

Bolts, nuts, and hinges used in the construction of fence and gates must be galvanized per AASHTO M 232.

All concrete must be Class 3000 as specified in Section 6-02.3.

9-16.3 NON-WEATHERING STEEL BEAM GUARDRAIL**9-16.3(1) RAIL ELEMENT**

The W beam or thrie beam rail elements, backup plates, reducer sections, and end sections must conform to "A Guide to Standardized Highway Barrier Hardware" published by AASHTO, AGC, and ARTBA. All rail elements must be formed from 12 gage steel except for thrie beam used for bridge rail retrofit and Design F end sections that must be formed from 10 gage steel.

The rail splices must have a minimum total ultimate strength of 80,000 pounds at each joint.

The 6-inch channel rails and splice plates must conform to ASTM A 36. All fabrication must be complete before galvanizing.

1 The holes in the plate must be slotted to facilitate erection and to permit expansion and contraction. The edges of the rail
2 must be rolled or rounded so they present no sharp edges. Where the rail is on a curve, the plates at the splice must make
3 contact throughout the area of splice. When the radius of curvature is less than 150 feet, the rail must be shaped in the shop.

4 **9-16.3(2) POSTS AND BLOCKS**

5 Posts and blocks may be of ammoniacal copper arsenate (ACA), or ammoniacal copper zinc arsenate (ACZA), treated
6 timber or galvanized steel; except only treated timber posts and blocks may be used for weathering steel beam guardrail.
7 Blocks made from alternate materials that comply with the NCHRP Report 350 criteria may be used per the manufacturer's
8 recommendations. Except for terminal or anchor assemblies, all posts for any one project must be of the same type (wood or
9 steel). Posts and blocks must be of the size and length shown on the Drawings and complying with these Specifications. Posts
10 and blocks may be S4S or rough sawn.

11 Timber posts and blocks must conform to the grade specified in Section 9-09.2, except pine lumber No. 1 grade may be
12 used for the blocks. Timber posts and blocks must be fabricated as specified in the Drawings before being treated. Timber
13 posts and blocks must be treated by the empty cell process to provide a minimum retention, depending on the treatment used,
14 according to the following:

- 15 1. ACA 0.50 lbs. pcf.
- 16 2. ACZA 0.50 lbs. pcf.

17 Treatment must be as specified in Section 9-09.3.

18 Steel posts, blocks, and base plates, where used, must conform to either ASTM A 36 or ASTM A 992, and must be
19 galvanized per AASHTO M 111. Welding must conform to Section 6-03.3(25). All fabrication must be completed prior to
20 galvanizing.

21 **9-16.3(3) GALVANIZING**

22 Beam rail elements and terminal sections must be galvanized per AASHTO M 180, Class A, Type 2, except that the rail
23 must be galvanized after fabrication, with fabrication to include forming, cutting, shearing, punching, drilling, bending, welding,
24 and riveting. In addition, the minimum average weight of zinc coating must be 2 ounces per square foot of surface (not sheet),
25 the average to be determined on the basis of 3 individual tests, no one of which may be less than 1.8 ounces per square foot
26 of surface (not sheet). The aluminum content of the zinc bath during actual galvanizing operations must not exceed 0.01
27 percent. Channel rails, splice plates, WF steel posts, and base plates must be galvanized per ASTM A 123. Anchor cables
28 must be galvanized per Federal Specification RR W 410, Table II, galvanized at finished size. Bolts, nuts, washers, plates,
29 rods, and other hardware must be galvanized per ASTM A 153.

30 **9-16.3(4) HARDWARE**

31 Bolts, unless otherwise specified in other Standard Specifications or in the Standard Plans, must comply with ASTM A
32 307, Grade A Specifications. High strength bolts must conform to the Specifications of AASHTO M 164. Nuts must comply with
33 ASTM A 563, Grade A Specifications. Washers, unless specified or shown otherwise, must comply with ASTM F 844
34 Specifications. The Contractor must submit a manufacturer's certificate of compliance for the bolts, nuts, and washers prior to
35 installing any of the hardware.

36 **9-16.3(5) ANCHORS**

37 Welding must conform to Section 6-03.3(25).

38 All welding must be at least equal in strength to the parent metal.

39 All fabrication must be complete and ready for assembly before galvanizing. No punching, drilling, cutting, or welding will
40 be permitted after galvanizing unless authorized by the Engineer.

41 Foundation tubes must be fabricated from steel conforming to the Specifications of ASTM A 500, Grade B, or ASTM A
42 501.

43 The anchor plate assembly must develop a minimum tensile strength of 40,000 pounds.

44 The anchor plate, W200 x 27 and metal plates must be fabricated of steel conforming to ASTM A 36.

45 Anchor cable must be 3/4-inch preformed, 6 x 19 wire strand core or independent wire rope core (IWRC), galvanized,
46 right regular lay manufactured of improved plow steel with a minimum breaking strength of 42,800 pounds. Two certified
47 copies of mill test reports of the cable used must be furnished to the Engineer.

48 Swaged cable fittings must develop 100 percent of the specified breaking strength of the cable. One swaged fitting
49 attached to 3 feet of cable must be furnished to the Engineer for testing.

50 The swaged fitting and stud assembly must be of steel conforming to the requirements of American Iron and Steel
51 Institute C 1035 and must be annealed and galvanized suitable for cold swaging.

52 Welded wire fabric for Type 1 anchor must conform to ASTM A 185.

53 All metal components of the anchor and cable assembly and not less than the top 14 inches of the W8 x 17 for the Type
54 2 anchor must be hot dip galvanized as specified in Section 9-16.4(3).

55 Cement concrete of the class specified, must be as specified in Section 6-02.3.

1 Cement grout must consist of one part Portland cement and two parts sand.

2 **9-16.3(6) INSPECTION AND ACCEPTANCE**

3 The Contractor must provide at least 3 Working Days advance notice to the Engineer before the rail elements are
4 fabricated in order that inspections may be provided. The Contractor must arrange for all facilities necessary for the inspection
5 of material and workmanship at the point of fabrication of the rail element, and inspectors must be allowed free access to
6 necessary parts of the premises.

7 The inspector must have the authority to reject materials or workmanship which do not fulfill conform to these
8 Specifications. In cases of dispute, the Contractor may appeal to the Engineer, whose decision will be final.

9 The inspector may accept a mill test report certifying that the steel used in fabricating the rail element complies with the
10 Specifications. The Owner reserves the right, however, to require the Contractor to furnish samples of the steel proposed for
11 use and to determine to its satisfaction that the steel complies with the Specifications. Steel rail elements, fittings, terminal
12 section hardware, and bolts may be accepted by the Engineer based on the Manufacturer's Certification of Compliance.

13 **9-16.4 WIRE MESH SLOPE PROTECTION**

14 **9-16.4(1) GENERAL**

15 All metal material used in the construction of wire mesh slope protection must be new and galvanized. Imperfectly
16 galvanized material or material upon which serious abrasion of galvanizing occurs will not be acceptable.

17 **9-16.4(2) WIRE MESH**

18 The galvanized wire mesh must consist of No. 9 gage (0.148-inch diameter) commercial quality zinc coated steel wire, 3-
19 1/2" x 5-1/2" diamond mesh chain link conforming to the Specifications of AASHTO M 181. Galvanizing must conform to the
20 Specifications of ASTM A 392 except the weight of zinc coating must be 0.80 ounce per square foot minimum, of uncoated
21 wire surface. Galvanizing must be done before weaving.

22 The wire mesh fabric must have knuckled selvages.

23 Alternate wire mesh for slope protection must be double twisted mesh. The mesh must be of nonraveling construction
24 and consist of a uniform double twisted hexagonal mesh of hot-dip galvanized steel wire having a diameter of 0.120 inches
25 after galvanization. The wire must be galvanized prior to weaving into the mesh and must conform to ASTM A 641, Class 3,
26 Finish 5, Soft temper. The minimum tensile strength must be 60,000 psi when tested per ASTM A 370. Openings must be
27 hexagonal in shape and uniform in size measuring not more than 3-1/4" x 4-1/2", approximately 9 square inches. Lacing wire
28 must use the same Specifications as the wire used in the wire mesh except that its diameter must be 0.0866 inches after
29 galvanization.

30 Edges must be mechanically selvaged in such a manner as to prevent unraveling, and must develop the full strength of
31 the mesh. The wire used for the selvaage must have a nominal diameter of 0.1535 inch.

32 **9-16.4(3) WIRE ROPE**

33 Wire rope must be 5/8-inch diameter zinc coated steel structural wire rope per ASTM A 603, Class A.

34 **9-16.4(4) HARDWARE**

35 All rings must be drop forged steel, heat treated after forging. Lightweight wire rope thimbles weighing approximately
36 13.8 pounds per hundred must be used with the 1/2-inch diameter wire rope. Wire rope clips may be drop forged steel or cast
37 steel for use with 1/2-inch wire rope. All rings, thimbles, wire rope clips, and U bolts must be galvanized per AASHTO M 232,
38 Class C, except castings must be Class A, and forgings must be Class B.

39 **9-16.4(5) HOG RINGS AND TIE WIRE**

40 Hog ring fasteners and tie wire must be manufactured of 9 gauge steel wire complying with Federal Specification QQ W
41 461 (AISI numbers 1010 and 1015) finish 5; medium hardness and tensile strength; Class 3 coating.

42 **9-16.4(6) GROUT**

43 When required, grout for anchors must consist of 1 part Portland cement and 3 parts of clean sand. The Portland cement
44 must be as specified in Section 9-01.2(1).

45 **9-16.4(7) ANCHOR RODS**

46 Anchor rods must be of good quality steel. The eye may be drop forged or formed with a full penetration weld and must
47 develop 100 percent of the rod strength. The anchor rod must be galvanized per ASTM A 153.

48 **9-16.5 GLARE SCREEN**

49 **9-16.5(1) GENERAL**

50 All material used in the construction of the fence must be new. Iron or steel material must be galvanized or aluminum
51 coated as specified. Imperfectly galvanized or aluminum coated material, or material upon which serious abrasions of
52 galvanizing or aluminum coating occur, will not be acceptable.

1 9-16.5(2) GLARE SCREEN FABRIC

2 Glare screen fabric must consist of diamond woven wire mesh. The fabric wire may be 0.148-inch diameter aluminum
3 alloy complying with the Aluminum Association requirements for alloy 6061T94, or it may be 0.148-inch diameter (9 gage) iron
4 or steel wire that complies with ASTM A 392 galvanized or A 491 for aluminum coated, except that galvanizing of Type 2 glare
5 screen fabric must be not less than 0.8 ounce per square foot and must be done before weaving. Aluminum coating must be
6 Class II.

7 Type 1 glare screen mesh size must be approximately a 1-inch diamond. Type 2 glare screen mesh size must be a
8 maximum of 3-1/2-inch vertical and 5-1/2-inch horizontal. The design must permit the slats to be installed in a vertical position
9 as shown in WSDOT Standard Plans without distortion of the slats.

10 9-16.5(3) POSTS

11 Line posts for Type 1 glare screen must be 1-1/2 inches by 1-7/8 inches hot dip galvanized steel H column with a
12 minimum weight of 2-4/5 pounds per linear foot. Line posts for Type 2 glare screen must be 1-19/20 inches by 2-1/4 inches hot
13 dip galvanized steel H column with a minimum weight of 4.0 pounds per linear foot, or 2-inch inside diameter hot dip
14 galvanized steel pipe with a nominal weight of 3-13/20 pounds per linear foot provided only one type must be used on any one
15 Project.

16 End, corner, brace, and pull posts must be 2-inch inside diameter hot dip galvanized steel pipe with nominal weight of
17 3.65 pounds per linear foot. Intermediate pull posts (braced line posts) must be H column as specified for line posts. Brace
18 post sleeves must be 2-1/2-inch inside diameter hot dip galvanized steel pipe with nominal weight of 5.79 pounds per linear
19 foot.

20 The base material for the manufacture of steel pipes used for posts must conform to ASTM A 53, except the weight
21 tolerance on tubular posts must be applied as follows. The base material for the manufacture of steel H columns must comply
22 with ASTM A 675.

23 Posts provided for glare screen will have an acceptance tolerance on the weight per linear foot, as specified, equal to ± 5
24 percent for tubular and H section posts. This tolerance applies to each individual post.

25 All posts, braces, and top rails must be hot dip galvanized. They must have a minimum average of 1.8 ounces zinc
26 coating per square foot of surface area with no individual test being below 1.6 ounces zinc coating per square foot of surface
27 area. In the case of members made from pipe, this area is defined as the total area inside and outside. A sample for
28 computing the average of weight of coating is defined as a 12-inch piece cut from each end of the galvanized member.

29 9-16.5(4) TENSION WIRE

30 Top and bottom tension wire must be 7 gage coil spring steel wire of good commercial quality and must have a zinc
31 coating averaging 0.8 ounces per square foot of surface area.

32 9-16.5(5) CABLE

33 The tension cable must be 1/4-inch diameter aluminum coated or hot dip galvanized, 7 wire strand steel cable
34 conforming to ASTM A 474 for aluminum coated or ASTM A 475 for galvanized, High Strength Grade. Galvanizing must be
35 Class A.

36 9-16.5(6) CABLE AND TENSION WIRE ATTACHMENTS

37 All tension wire and cable attachments must be hot dip galvanized steel conforming to AASHTO M 232 unless otherwise
38 specified in the Contract. Eye bolts must have either a shoulder or a backup nut on the eye end and be provided with an eye
39 nut where needed or standard hex nut and lock washer and be 5/8-inch diameter for tension cable and 3/8-inch diameter for
40 tension wire and of sufficient length to fasten to the type of posts used. Where the eye bolt is to be installed through a pipe
41 section, two lead washers and one steel washer must also be provided. Turnbuckles must be of the shackle end type, 1/2-inch
42 diameter, with standard takeup of 6 inches and provided with 3/8-inch diameter pins. Thimbles must be light weight wire rope
43 thimbles for use with 1/4-inch diameter cable. Wire rope clips must have a U bolt diameter of 5/16 inch for use with 1/4-inch
44 diameter cable. Anchor shackles must be 3/8-inch diameter with a minimum distance between eyes of 1-1/16 inch and a pin
45 diameter of 7/16 inch. Seizing must be 0.032-inch diameter galvanized annealed iron wire.

46 9-16.5(7) SLATS**47 9-16.5(7)A WOOD SLATS**

48 Wood slats must be 3/8" x 2-3/8" by the height designation of the fence. Material must be finished and treated cedar or
49 redwood and must be free from loose knots, cracks, and other imperfections. A dimensional tolerance of $\pm 1/16$ inch in width
50 or thickness is allowed provided that the maximum space between slats does not exceed 3/4 inch.

51 9-16.5(7)B PLASTIC SLATS

52 Plastic slats must be 3/8" x 2-3/8" by the height designation of the fence. They must be manufactured from tubular
53 polyethylene color pigmented material consisting of high density virgin polyethylene and color pigments, designed to retard
54 ultraviolet penetration. The material must have a minimum wall thickness of 0.0030 inches \pm 0.0003 inches and must remain

1 flexible without distortion and without becoming brittle through a temperature range of -70 °F to + 250 °F. Tensile strength
2 must be at least 3600 psi and the melt index must not exceed 0.25.

3 Plastic slats must be kept in place by means of U shaped retainer members at the bottom and top of the fence. Retainer
4 members must be of the same material as the slats.

5 The color for plastic slats will be approved by the Engineer from samples submitted by the Contractor.

6 **9-16.5(8) FITTINGS**

7 Fittings must be malleable cast iron or pressed steel and galvanized per AASHTO M 232.

8 Fittings for any particular fence must be those furnished by the manufacturer of the fence.

9 **9-16.5(9) FABRIC BANDS AND STRETCHER BARS**

10 Fabric bands must be 1/8" x 1" nominal and stretcher bars 3/16" x 3/4" nominal. Nominal must be construed to be the
11 area of the cross-section of the shape obtained by multiplying the specified width by thickness. A variation of minus 5 percent
12 from this theoretical area must be construed as "nominal" size. Both must be hot dip galvanized to comply with ASTM F 626.

13 **9-16.5(10) TIE WIRE**

14 Tie wire must be 9 gage aluminum wire complying with the ASTM B 211 for alloy 1100 H14 or 9 gage galvanized wire
15 complying with AASHTO M 279. Galvanizing must be Class 1.

16 **9-16.6 WEATHERING STEEL BEAM GUARDRAIL**

17 **9-16.6(1) RAIL AND HARDWARE**

18 Steel for rail elements and terminal sections must conform to ASTM A 606 or ASTM A 607. Bolts, nuts, and washers for
19 installation of the weathering steel must be manufactured from steel conforming to ASTM A 242M and must not be galvanized.
20 If required, 6-inch channels and fittings must conform to ASTM A 242. In addition, all steel for the guardrail components must
21 conform to one of the following chemical compositions, percent (ladle):

22
23

Composition

| | C | Mn | P | S | Si | Cu | Cr | Ni | Zr |
|-------|--------------|-----------|--------------|--------------|-----------|-----------|-----------|--------------|--------------|
| No. 1 | 0.12 Max. | 0.20-0.50 | 0.07-0.15 | 0.05 Max. | 0.25-0.75 | 0.25-0.55 | 0.30-1.25 | 0.65 Max. | -- |
| No. 2 | 0.12 Max. | 0.50-1.00 | 0.12 Max. | 0.05 Max. | 0.20-0.90 | 0.50 Max | 0.40-1.00 | 1.00 Max. | 0.10 Max. |

24

25 Blast cleaning or pickling to remove mill scale will not be required. All fabricated steel parts must be handled with care to
26 avoid gouges, scratches, and dents. The steel must be kept clean of all foreign material, such as paint, grease, oil, chalk
27 marks, crayon marks, concrete spatter, or other deleterious substances. Natural oxidation of the steel will not be considered
28 foreign material. Storage in transit, in open cars and trucks, for an extended period will not be permitted. Steel parts stored
29 outside in yards or at Job Sites must be positioned to allow free drainage and air circulation.

30 **9-16.6(2) ANCHORS**

31 Guardrail anchors may either be furnished as provided in Section 9-16.4(5) or they may be nongalvanized and fabricated
32 from steel conforming to ASTM A 242 with the exception that all Type 1 anchors must have galvanized cable and fittings as
33 specified in Section 9-16.4(5).

34 **9-16.6(3) POSTS AND BLOCKS**

35 Posts and blocks for weathering steel beam guardrail must be as specified in Section 9-16.4(2).

36 **SECTION 9-17 FLEXIBLE GUIDE POSTS**

37 **9-17.1 GENERAL**

38 See Section 8-10 for flexible delineator posts.

39 Flexible guide posts must be made of a flexible, nonwarping, nonmetallic, durable plastic material; must be resistant to
40 damage due to impact, ultraviolet light, ozone, hydrocarbons, and other effects of atmospheric weathering; must resist
41 stiffening with age; and must be designed for a minimum life equaling 60 months of outdoor service.

42 The post system must be designed for permanent installation to resist overturning, twisting, and displacement from wind
43 and impact forces.

44 Each flexible guide post must be permanently identified with the manufacturer's name, the month and year of fabrication
45 and a mark indicating the recommended burial depth. The letters must be solvent resistant, a minimum of 1/4 inch in height,

1 and permanently affixed to the post unless otherwise specified in the Contract, the color of the guide post must be white or
2 brown as shown on the Drawings. Guide post length must be as specified in Section 8-10.3.

3 The reflective panel on a flat or elliptical guide post must have a minimum width of 3 inches facing traffic. The reflective
4 sheeting must have a minimum area of 24 square inches (3 inches by 8 inches). The reflective panel on a round guide post
5 must have a 9-inch minimum band of reflective sheeting visible for 360 degrees.

6 **9-17.2 LABORATORY TESTS**

7 Ten guide posts of each model must be conditioned in an oven for two hours at 120 °F ± 3 F°. After conditioning, the
8 guide post must be bent backwards at 90 degrees from the vertical to simulate a field impact. The guide post must, without
9 cracking, recover to within 10 degrees of its original position within 5 minutes. Color must remain unchanged. Any appreciable
10 change in color, cracking on more than one face, or not returning to within 10 degrees of vertical, is considered a failure. At
11 least 70 percent of the posts must pass to be considered for preapproval.

12 The same 10 guide posts tested for heat resistance must be tested for cold resistance. The guide posts must be
13 conditioned for 24 hours at -20 °F, ± 3 °F, then subjected to the same testing as for heat resistance. The guide posts must
14 conform to the same cracking, color, and recovery standards as for heat resistance. At least 70 percent of the posts must pass
15 to be considered for preapproval.

16 3 guide posts of each model must be subjected to deflection testing. The guide posts must be fixed near the base in such
17 a way that 4 feet of the post is cantilevered. The guide posts must then be loaded 1/2 inch from the free end until collapse is
18 observed. (Collapse is defined as the point at which the guide post can no longer resist any further loading.) The stress at
19 collapse must be calculated as follows:

$$20 \quad P = K(Q / b)$$

21 Where:

22 P = the equivalent stress in pounds per square foot.

23 Q = the load at collapse in pounds.

24 b = the post width (diameter of major axis) in inches.

25 K = is constant equal to 6 inches per square foot.

26
27 The value of P must be no less than 3.43 pounds per square foot for round guide posts and 5.30 pounds per square foot
28 for flat or elliptical guide posts. Any load below these values or cracking of more than one face, of any of the guide posts is
29 considered a failure.

30 The 3 guide posts subjected to deflection testing must be subjected to cyclic loading with an amplitude of 2 inches at the
31 tip, with a cycle testing machine. Each guide post must be cycled 30,000 times at 60 cycles per minute. When the cyclic tests
32 are completed, the 3 guide posts must again be subjected to deflection testing. The average load of the posts after cyclic
33 loading must be a minimum of 80 percent of the average load of the posts tested before cyclic loading. A value below this limit
34 is considered a failure.

35 3 guide posts of each model must be subjected to a 5.5 pound deflection test. The guide posts must be fixed near the
36 base in such a way that 4 feet of the post is cantilevered. The guide post must then be loaded 1/2 inch from the free end with a
37 5.5 pound weight. A deflection greater than 29 inches is considered a failure.

38 A 9-inch specimen from the un-reflectorized portion of each of 3 guide posts must be prepared. The specimens must be
39 cycled at 1000 hours in a weatherometer per ASTM G 53 (3 hr. 60C UV, 3 hr. 50C CON). The specimens must show no signs
40 of delamination, distress, or discoloration. Physical properties of tensile strength and rigidity must be maintained within 80
41 percent of the unconditioned values.

42 **9-17.3 FIELD TESTS**

43 Ten guide posts of each model, supplied as specified in Section 9-17.4, must be installed by the manufacturer's
44 representative at the SPU Materials Laboratory designated test site. Anchoring Materials must be driven such that the anchor
45 is flush with, or below, the ground level. The test temperature must be at or below 50 °F.

46 The 10 guide posts must be struck 7 times at 35 mph, then two times at 55 mph, by a car or equivalent hood and bumper
47 device with an 18-inch height. After each impact, the delineators must be inspected for the following criteria:

- 48 1. A minimum of 50 percent of the reflective sheeting must be kept undamaged. An area of damage greater than 50
49 percent is considered a failure.
- 50 2. If the guide post leans more than 10 degrees from vertical it is considered a failure.
- 51 3. Any cracking, except surface cracking evident on only one face of the post, is considered a failure.
- 52 4. Pullout in excess of 3 inches is considered a failure.

53 If an individual guide post fails any one of the above criteria in the 35 mph series of impacts, the product is unacceptable.
54 At least 70 percent of the guide posts must pass each criteria in the 55 mph series of impacts to be acceptable.

1 9-17.4 APPROVAL

2 The Contractor must submit a manufacturer's certificate of compliance stating all materials meet or exceed Contract
3 requirements. See Section 1-06.3.

4 SECTION 9-18 PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB**5 9-18.1 PRECAST TRAFFIC CURB****6 9-18.1(1) AGGREGATES AND PROPORTIONING**

7 The cement, fine and coarse aggregate, and reinforcing steel to be used in the manufacture of precast concrete traffic
8 curb must comply with the following requirements and be submitted to the SPU Materials Laboratory for approval:

- 9 1. Aggregates must be as specified in Section 9-03 except that they must be uniformly graded up to a maximum size of
10 3/8 inch and must contain sufficient fine fractions to permit securing the type of surface finish specified here. The
11 aggregate must be approved by the SPU Materials Laboratory before it is used.
- 12 2. Reinforcing steel must be as specified in Section 9-07.
- 13 3. The cement concrete mix must be composed of not less than 1 part Portland cement to approximately 2 parts of fine
14 concrete aggregate and 3-1/4 parts of coarse concrete aggregate adjusted to secure proper workability. The
15 Contractor will be allowed to use a different concrete mix if approved by the Engineer, provided that it develops not
16 less than 4,000 psi compressive strength when tested at the age of 28 Days.

17 9-18.1(2) MIXING

18 The mixers must be kept in good repair and must be equipped with an automatic timing device, and a positive device for
19 regulating the quantity of water added to each batch. The latter device must be approved by the Engineer before use.

20 After all Materials, including water, have been placed in the mixer, the Materials must be mixed for a period of not less
21 than 1-3/4 minutes, or as long as necessary to produce a uniform concrete mix. No water must be added to any batch after
22 completion of the mixing period. Each batch of concrete must be completely emptied from the mixer before placing more
23 Materials in it. Do not use a batch that has not been placed within 30 minutes from the time water was first added.

24 The amount of water in the concrete must be kept to a minimum, consistent with the manufacture of a dense mix, free
25 from air bubbles and surface defects in excess of the tolerance limits specified.

26 9-18.1(3) FORMS

27 Forms for precast traffic curbs must be steel or special concrete mold. The use of forms or molds made of plaster of
28 paris, wood, or other absorptive material will not be permitted.

29 Bulkheads must be tight fitting so that there is no leakage of mortar between the bulkhead and form.

30 The Materials and methods used for lubricating the forms must be such that they do not result in discoloration of the curb
31 at any time. A minimum quantity of lubricant must be used and all excess lubricant must be removed.

32 9-18.1(4) PLACING CONCRETE

33 The concrete must be consolidated by external vibration, or by other means if approved by the Engineer, to produce a
34 dense concrete throughout, having a minimum of air bubbles and honeycombing.

35 Reinforcing steel must be placed and maintained in its proper position as shown in the Standard Plans.

36 Curb or buttons must not be manufactured in an atmospheric temperature of less than 50 °F.

37 9-18.1(5) REMOVAL OF FORMS

38 The curb must be removed from the molds or forms with instructions, or by some other identified method, acceptable to
39 the Engineer.

40 The loosening of the curb from the molds must be carefully performed to avoid excessive shock and straining of the curb.
41 When, in the opinion of the Engineer, undue shock is required to remove the curb from the molds, the stripping operation must
42 be deferred until such time as the curb may be removed without breakage.

43 9-18.1(6) CURING CONCRETE

44 Immediately after the concrete has been placed and consolidated in the mold, each unit must be placed in a curing room
45 fitted with water sprays and maintained at a relative humidity of not less than 90 percent and a temperature of not less than 60
46 °F, nor more than 100 °F. Each unit must remain in the curing room for a period of not less than 10 Days, except that if Type III
47 cement is used, the period in the curing room may be reduced to 5 Days.

48 9-18.1(7) FINISH

49 The curb must have a smooth, glassy finish on all exposed surfaces.

1 Excess honeycombing in the back of the curb may be cause for rejection of the curb. Honeycombing areas in the back of
2 the curb which, in the opinion of the Engineer, are not detrimental to the curb need not be patched. The workmanship of the
3 bottom finish must be such that no mechanical interlocking of the mortar bed and the curb bottom or anchor groove occurs.

4 **9-18.1(8) SURFACE TREATMENT**

5 As soon as the units have been taken out of the curing room and thoroughly surface dried to a depth of at least 1/4 inch,
6 brush apply two coats of a water repellent compound as specified in Section 9-18.3. When the first coat has dried, the second
7 coat of water repellent compound must be applied.

8 **9-18.1(9) DIMENSIONS AND SHAPE**

9 The curb must conform to the dimensions and shape shown on the Standard Plans within a tolerance of 1/4 inch in
10 length and 1/8 inch in alignment.

11 **9-18.1(10) CURB LENGTHS AND ANCHOR HOLES**

12 413a and 413b curb must be made in 3'-0" maximum length sections. Circular curbing must be made only for such radii
13 as called for in the details on the Drawings.

14 Each 413b curb section must have two 1-inch diameter holes as shown in Standard Plan 413a.

15 **9-18.1(11) DEFECTIVE CURB**

16 Not more than 2 percent of the top area in any one piece of curb must be defective, and not more than 5 percent of the
17 total length of the top corners of reflecting faces in any one piece of curb must be broken or rounded. There must be not more
18 than 30 air holes in any linear foot of curb, nor more than 50 air holes in any 3 linear feet of curb. All curb having defects in
19 excess of any of the listed defects in this Section will be considered defective as specified in Section 1-05.7. Failure to reject
20 such curb at the time of form removal may be waived if and only if 90 percent of the curb laid has less than 10 percent of the
21 maximum allowable number of each type defect specified in this paragraph; however, all defects must be immediately
22 repaired. The Contractor agrees that its refusal to repair defects is grounds for the Engineer to declare the curb defective.

23 An air hole must be defined as any hole 1/8 inch or larger in diameter or depth.

24 The sum of the length of the lines of discoloration caused by a cracked mold in any one piece of curb must not exceed 50
25 percent of the length of the curb, and the maximum length of any single line of discoloration must not exceed 18 inches. 75
26 percent of the curb laid must be entirely free from lines of discoloration. The employment of heat to obliterate lines of
27 discoloration will not be permitted. The process used to obliterate lines of discoloration is subject to the approval of the
28 Engineer.

29 The repairing of molds which are chipped or broken must be done in a manner that the broken or chipped areas are not
30 apparent on the curb made in those molds.

31 All curb in which surface checking develops during the first 5 Days after manufacture will be rejected.

32 Hidden air holes at or immediately below the exposed surface of the curb which are in excess of the limits specified and
33 are disclosed by testing the surface by means of a rubber hammer, will be considered defective as specified in Section 1-05.7.

34 All curb in which cracking is in evidence immediately after removal from the molds will be considered defective. A crack is
35 defined as any continuous separation of the concrete greater than 3 inches in length.

36 All curb which varies in dimensions, alignment, or surface contour in excess of the tolerance specified will be considered
37 defective.

38 **9-18.1(12) REPAIRING CURB**

39 Curb having defects which are not sufficient cause for its rejection must be neatly repaired immediately after removal
40 from the molds as subject to the approval of the Engineer. However, no patching or other repairs must be made without the
41 permission of the Engineer. Patches must be undercut if, in the opinion of the Engineer, this operation is necessary to achieve
42 an acceptable patch.

43 All holes larger than 1/16-inch diameter in the exposed surface of acceptable curb or buttons must be filled with cement
44 mortar.

45 **9-18.1(13) IDENTIFICATION MARKING**

46 The date of manufacture, the length, and identification number corresponding to the detail layout must be marked in
47 black paint on the back or end of each piece of curb.

48 Rejected curb must be marked on the back or end surfaces in a practical and semi-permanent manner to identify each
49 cause of rejection.

50 **9-18.1(14) SHIPPING**

51 No unit of curb must be shipped from the manufacturing facility prior to 21 Days after manufacture, except that if Type III
52 cement has been used, the units may be shipped 14 Days after manufacture.

1 9-18.1(15) SAMPLING AND INSPECTION

2 The Contractor must submit, for the approval of the Engineer, an advance sample of curb which must be at least
3 equivalent in color, surface texture, and bottom finish to the standard as set forth in these Specifications. No repairing of any
4 kind must be done on the advance sample. Upon approval, the advance sample must be stored at the facility or site of
5 manufacture in a location readily accessible to the inspector where there is adequate daylight for examination. The advance
6 sample must be protected from damage and discoloration and must be used as a standard of comparison for color, surface
7 texture, and bottom finish for all curb manufactured. All curb furnished must be equivalent to the sample.

8 The inspection at the facility will be made just prior to shipment, at which time examination will be made of the alignment,
9 contour, color, cracks, surface damage or discoloration, broken corners or edges, and any other defects which may have
10 developed, and to check the laboratory test reports for strength. However, intermediate inspections may be made to determine
11 surface checking and hidden air holes if it is impractical to examine for these defects at the final inspection.

12 9-18.2 BLOCK TRAFFIC CURB

13 Block traffic curb must be as shown on Standard Plan 413b.

14 The curb units must be made from Portland cement and high quality sand and gravel, the proportions of which must be
15 left to the discretion of the producer as long as the unit develops a minimum compressive strength of 1,600 psi at 28 Days
16 when tested for end loading.

17 The proportions of sand, gravel, and cement, the type of forms used, and the method of compacting the concrete in the
18 forms must all be such that as dense, smooth, and uniform a surface as is practicable for a concrete masonry unit is obtained
19 on the finished curb units. The faces that are to be exposed must be free from chips, air holes, honeycomb, or other
20 imperfections, and cracks must be tight, with the following exceptions: not more than 5 percent of each curb unit contains
21 cracks, contains small chips which are not larger than 1/4 inch in any dimension, and air holes which are not larger than 1/4
22 inch in diameter or depth. The units used in any contiguous line of curb must have approximately the same color and surface
23 characteristics.

24 9-18.3 WATER REPELLENT COMPOUND

25 The water repellent compound must be a clear, penetrating type, silicone resin base compound containing no filler or
26 other material that leaves a film on the surface of the masonry after it is applied, and bonds securely to the masonry. It must
27 be of such consistency that it can be applied readily by brush or spray to the masonry at atmospheric temperature down to
28 minus 20°F.

29 The average absorption of 3 test specimens treated with the water repellent compound, when tested per the methods
30 used in the Laboratory must not exceed 2 percent after being partially immersed in water for 72 hours immediately after curing.

31 The average moisture vapor transpiration (breathing) of 3 test specimens, when tested per the methods used in the
32 Laboratory, must be not less than 50 percent at 7 Days.

33 The water repellent compound must be approved by the Laboratory before it is used.

34 9-18.4 SODIUM METASILICATE

35 Sodium metasilicate must comply with ASTM D 537.

36 SECTION 9-19 PRESTRESSED CONCRETE GIRDERS**37 9-19.1 CONCRETE AGGREGATES AND PROPORTIONING**

38 The concrete for prestressed girders must have the minimum compressive strengths as specified on the Drawings.
39 Aggregates used in the mix must conform to the following:

- 40 1. Coarse aggregate must be as specified in Section 9-03.1(3).
- 41 2. Fine aggregate must be as specified in Section 9-03.1(2), Class 1 or Class 2.
- 42 3. The manufacturer may change the grading of the coarse aggregate provided that the concrete mix design is qualified
43 with the modified gradation. An alternative combined gradation conforming to Section 9-03.1(4) may also be used.

44 The Contractor must submit for review a proposed mix design for each design strength. Included must be evidence
45 acceptable to the Engineer that the proposed mix design complies with design requirements. The mix design review will not
46 preclude any requirements for the concrete placed in the girders.

47 The concrete mix must be prepared and placed as specified in Section 6-02.

48 Water used in mixing the concrete must be as specified in Section 9-25.1.

49 Portland cement and hydraulic cement must be as specified in Section 9-01.

50 Chemical admixtures and pozzolans must be as specified in Section 9-23.4.

51 The total chloride ion (C1-) content of the mixed concrete, expressed as a percent by mass of cement, must not exceed
52 0.06 percent.

1 **9-19.2 REINFORCEMENT**

2 Reinforcement must be as specified in Section 9-07 and must be placed as specified in Section 6-02.3(24).

3 **SECTION 9-20 CONCRETE PATCHING MATERIAL, GROUT AND MORTAR FOR STRUCTURES**

4 **9-20.1 PATCHING MATERIAL**

5 Concrete patching material will be prepackaged mortar extended with aggregate. The amount of aggregate for extension
6 must conform to the manufacturer's recommendation.

7 **9-20.2 SPECIFICATIONS**

8 Patching mortar and patching mortar extended with aggregate must contain cementitious material and be as specified in
9 Sections 9-20.2(1) and 9-20.2(2). The Manufacturer must use the services of an independent laboratory that has an
10 equipment calibration verification system and a technician training and evaluation process per AASHTO R-18 to perform all
11 tests specified in Section 9-20.

12 **9-20.2(1) PATCHING MORTAR**

13 Patching mortar must conform to the following requirements:

| | ASTM Test Method | Specification |
|--|---|------------------------------|
| Compressive Strength | | |
| at 3 hours | C 39 | Minimum 3,000 psi |
| at 24 hours | C 39 | Minimum 5,000 psi |
| Length Change | | |
| at 28 Days | C 157 | 0.15 percent maximum |
| Total Chloride Ion Content | C 1218 | 1 lb/yd ³ maximum |
| Bond Strength | | |
| at 24 hours | C 882 (As modified by C 928, Section 8.5) | Minimum 1,000 psi |
| Scaling Resistance (at 25 cycles of freezing and thawing) | C 672 (As modified by C 928, Section 8.4) | 1 lb/ft ² maximum |

15
16 **9-20.2(2) PATCHING MORTAR EXTENDED WITH AGGREGATE**

17 Patching mortar extended with aggregate must comply with the following:

| | ASTM Test Method | Specification |
|--|---|---|
| Compressive Strength | | |
| at 3 hours | C 39 | Minimum 3,000 psi |
| at 24 hours | C 39 | Minimum 5,000 psi |
| Length Change | | |
| at 28 Days | C 157 | 0.15 percent maximum |
| Bond Strength | | |
| at 24 hours | C 882 (As modified by C 928, Section 8.5) | Minimum 1,000 psi |
| Scaling Resistance (at 25 cycles of freezing and thawing) | C 672 | 2 Maximum Visual Rating |
| Freeze thaw | C 666 | Maximum expansion 0.10% Minimum durability 90.0% |

19

1 **9-20.2(3) AGGREGATE**

2 Aggregate used to extend the patching mortar must be as specified in Section 9-03.1(3) and be AASHTO Grading No. 8.
3 A Manufacturers certificate of compliance must be required showing the aggregate source and the gradation.

4 **9-20.2(4) WATER**

5 Water must be as specified in Section 9-25.1. The quantity of water must be within the limits recommended by the
6 manufacturer

7 **9-20.3 GROUT**

8 Grout is a mixture of Portland or blended hydraulic cement and water with or without aggregates and with or without
9 admixtures. Grout may also contain pozzolans and/or concrete admixtures. Grout may be a Contractor's submitted mix design
10 or a Manufacturer's prepackaged grout product.

11 All prepackaged grouts must be used per the manufacturer's recommendations, including but not limited to, shelf life,
12 mixing, surface preparation, and curing.

13 Where required, all 2-inch cube specimens fabricated in the field must be made per WSDOT TM-813. All 2-inch cube
14 specimens fabricated in a laboratory must be made per AASHTO T-106. All 2-inch cube specimens must be tested per
15 AASHTO T-106.

16 When coarse aggregate is used, specimens must be fabricated per AASHTO T-23 and tested per AASHTO T-22.

17 **9-20.3(1) GROUT TYPE 1 FOR POST-TENSIONING APPLICATIONS**

18 Grout Type 1 must be a Class C prepackaged, pumpable, nonbleed, nonshrink, and high-strength material conforming to
19 AASHTO LRFD Bridge Construction Specifications, Section 10.9.3. The water-cement ratio must not exceed 0.45:1.

20 **9-20.3(2) GROUT TYPE 2 FOR NONSHRINK APPLICATIONS**

21 Grout Type 2 must be a nonshrink, prepackaged material complying with ASTM C-1107. The minimum compressive
22 strength must be 4000 psi at 7 Days.

23 **9-20.3(3) GROUT TYPE 3 FOR UNCONFINED BEARING PAD APPLICATIONS**

24 Grout Type 3 must be a prepackaged material complying with ASTM C 928 – Table 1, R2 concrete or mortar.

25 **9-20.3(4) GROUT TYPE 4 FOR MULTIPURPOSE APPLICATIONS**

26 Grout Type 4 must be a multipurpose grout material for structural and nonstructural applications. The grout must be
27 produced using Portland cement Type I/II. The water-cementitious material ratio must not exceed 0.45:1 and water-reducing
28 admixtures may be used. Multipurpose grout may be extended up to 3 parts fine aggregate to 1 part cement. The minimum
29 compressive strength must be 4000 psi at 7 Days. Substitution of fly ash for cement is allowed up to 20 percent.

30 **9-20.4 MORTAR**

31 Mortar must be material made from Portland or blended hydraulic cement, water, and fine aggregate.

32 **9-20.4(1) FINE AGGREGATE FOR MORTAR**

33 Fine Aggregate for mortar must be per ASTM C 144.

34 **9-20.4(2) MORTAR TYPE 1 FOR CONCRETE SURFACE FINISH**

35 Mortar Type 1 for concrete surface finishing must be either prepackaged or a Contractor-recommended blend of Portland
36 cement Type I/II and fine aggregate conforming to Section 9-20.4(1). If the Class 1 concrete surface finishing mortar is a
37 Contractor-recommended blend, it must conform to the sand-to-cement ratios specified in Section 6-02.3(14)A.

38 **9-20.4(3) MORTAR TYPE 2 FOR MASONRY APPLICATIONS**

39 Mortar Type 2 for masonry must be either prepackaged or a Contractor-recommended blend of Portland cement Type I/II
40 and fine aggregate conforming to 9-20.4(1).

41 **9-20.4(4) MORTAR TYPE 3 FOR CONCRETE REPAIR**

42 Mortar Type 3 must be a prepackaged material that does not include expansive admixtures. Aggregate extension and
43 mixing procedures must be per the manufacturer's recommendation. The minimum compressive strength must be 4000-psi at
44 7 Days.

1 **SECTION 9-21 PLASTIC TRAFFIC BUTTONS AND LANE MARKERS**

2 **9-21.1 PLASTIC TRAFFIC BUTTON AND LANE MARKER TYPE 1**

3 **9-21.1(1) GENERAL**

4 Plastic Traffic Button and Lane Marker Type 1 must be composed of thermosetting resins, pigments, and inert
5 ingredients and must be of uniform composition throughout. The color must be yellow or white to correspond to the delineation
6 line color.

7 **9-21.1(2) PHYSICAL AND CHEMICAL PROPERTIES**

8 The traffic buttons and lane markers must be of uniform composition and free from surface irregularities, cracks, checks,
9 chipping, peeling, spalling, crazing, and other physical defects impairing their appearance, application, or durability.

10 The molding process must be such that coarse aggregate particles on the curved surface are covered by not less than
11 1/16 inch of pigmented Material.

12 The lane marker Type 1 must comply with the following (see Standard Plan 700):

13

| Lane Marker/Traffic Button (Description) | Lane Marker Type 1 |
|--|--------------------|
| Diameter | 3-7/8" to 4-1/8" |
| Weight (lbs) | 0.275 min. |
| State Reflectance | 80% min. |
| Impact Resistance (in-lbs) | 15 min. |
| Planeness of Base: | |
| Concavity (in) | 0.02 max. |
| Convexity (in) | 0.05 max. |
| Titanium Dioxide (% by weight) | 21 min. |
| Resin Content (% by weight) | 20 min. |

14

15 **9-21.1(3) TEST METHODS**

16 Test methods must be as follows:

- 17 1. Reflectance: Reflectance will be measured with a photovolt Reflectance Meter or its equivalent by comparing the
18 buttons to a 75 percent brightness standard.
- 19 2. Impact Resistance: Impact resistance will be measured by allowing a 1 pound steel ball to fall 15 inches (free fall)
20 onto the lane marker, supported by, but not bonded to, a steel base plate.
- 21 3. Titanium Dioxide Content: The titanium dioxide content will be determined by ashing representative portions of the
22 lane marker, treating the ash with a boiling (NH4)2SO4•H2SO4 solution, filtering, and measuring the absorbance of
23 the filtrate at about 410 millimicrons. Calibration must be with known samples per ASTM D 921.
- 24 4. Resin Content: Resin content will be determined by ashing and igniting representative portions of the marker.

25 Additional information on the test methods is available from the SPU' Materials Laboratory.

26 **9-21.2 LANE MARKERS TYPE 2A AND TYPE 2B**

27 The markers must consist of an acrylic plastic shell filled with a tightly adhering potting compound. The shell must contain
28 prismatic reflective faces as shown in Standard Plan 700 to reflect incident light from opposite directions.

29 **9-21.2(1) PHYSICAL PROPERTIES**

30 The shell must be molded of methyl methacrylate or acrylonitrile butadiene styrene (ABS).

31 Filler must be a potting compound selected for strength, resilience, and adhesion adequate to pass physical
32 requirements as outlined here.

33 The outer surface of the shell must be smooth except for purposes of identification and must contain methyl methacrylate
34 reflective faces in the color specified. As an option, thin untempered glass may be bonded to the prismatic reflective faces to
35 provide an abrasion resistant surface.

36 The base of the marker must be substantially free from gloss or substances that may reduce its bond to adhesive. This
37 must be done by embedding sand or inert granules on the surface of the potting compound prior to its curing.

38 The markers must be fabricated as follows:

39

| Lane Marker (Description) | Lane Marker Type 2A | Lane Marker Type 2B |
|---------------------------------|--|---------------------|
| Dimensions of Plastic Shells | 4" x 4" x 0.65" or octagonal w/4 inch across flats | 4.7" x 2.3" x 0.52" |
| Slope of Reflecting Face | 20-30 deg. | 20-30 deg. |
| Area of Each Reflecting Surface | 3.0-3.25 square in | 1.87 square in |

1

2 **9-21.2(2) OPTICAL REQUIREMENTS**

3 Definitions:

4 Horizontal entrance angle means the angle in the horizontal plane between the direction of incident light and the normal
5 to the leading edge of the marker.6 Observation angle means the angle at the reflector between observer's line of sight and direction of the light incident on
7 the reflector.8 Specific intensity (S.I.) means candlepower of the returned light at the chosen observation and entrance angles for each
9 foot candle of illumination at the reflector on a plane perpendicular to the incident light.10 Optical Requirements: The S.I. of each crystal reflecting surface at 0.2 degrees observation angle must be at least the
11 following when the incident light is parallel to the base of the marker:

12

| Horizontal Entrance Angle | S.I. |
|---------------------------|------|
| 0 degrees | 3.0 |
| 20 degrees | 1.2 |

13

14 Yellow reflectors must be at least 60 percent and red reflectors at least 25 percent of the above values.

15 Optical Testing Procedure: A random lot of markers will be tested. The markers to be tested must be located with the
16 center of the reflecting face at a distance of 5 feet from a uniformly bright light source having an effective diameter of 0.2 inch.17 The photocell width must be 0.05 inch. It must be shielded to eliminate stray light. The distance from light source center
18 to the photocell center must be 0.21 inch. If a test distance other than 5 feet is used, the source and receiver dimensions and
19 the distance between source and receiver must be modified in the same proportion as the test distance.

20 Failure of more than 4 percent of the samples is cause for rejection of the lot.

21 **9-21.2(3) STRENGTH REQUIREMENTS**

22 Markers must support a load of 2,000 pounds as applied in the following manner:

- 23 1. A marker must be centered over the open end of a vertically positioned hollow metal cylinder. The cylinder must be 1
24 inch high with an internal diameter of 3 inches and wall thickness of 1/4 inch. The load must be slowly applied to the
25 top of the marker through a 1-inch diameter by 1 inch high metal plug centered on the top of the marker.
- 26 2. Failure occurs with either a breakage or a significant deformation of the marker at any load of less than 2,000
27 pounds.

28 **SECTION 9-22 MONUMENT FRAMES AND COVERS**29 **9-22.1 GENERAL**30 Monument castings must conform to ASTM A 48, Class 30 and must be free of porosity, shrink cavities, cold shuts or
31 cracks, or any surface defects which would impair serviceability. Repair of defects by welding, or by the use of smooth on or
32 similar material, will not be permitted. The manufacturer must certify that the product conforms to these Specifications.33 Monument castings must be machine finished or ground on seating surfaces to assure non-rocking fit in any position,
34 and interchangeability. The foundry must make standard frames and covers available to the Engineer to test fit and seating.35 **SECTION 9-23 CONCRETE CURING MATERIALS, POZZOLANS AND ADMIXTURES**36 **9-23.1 SHEET MATERIALS FOR CURING CONCRETE**37 Sheet materials for curing concrete must comply with AASHTO M 171, Sheet Materials for Curing Concrete, except that
38 only white reflective type must be used.39 **9-23.2 LIQUID MEMBRANE FORMING CONCRETE CURING COMPOUNDS**40 Liquid membrane-forming compounds for curing concrete must be per AASHTO M 148 (ASTM C 309) Type 1D or 2,
41 Class A or B.

1 Each lot of liquid membrane-forming curing compound must be sampled at the Project Site and tested for acceptance.
2 Liquid membrane-forming curing compound must not be used in the absence of satisfactory test results.

3 **9-23.3 BURLAP CLOTH**

4 Burlap cloth must comply with AASHTO M 182, Class 4.

5 **9-23.4 CHEMICAL ADMIXTURES FOR CONCRETE**

6 Acceptance of chemical admixtures will be based on manufacturer's certificate of compliance. If required by the
7 Engineer, admixtures must be sampled and tested before they are used. A 1 pint (500-mL) sample of the admixture must be
8 submitted to the SPU Materials Laboratory for testing 10 Days prior to use. Chemical Admixtures must contain less than 1
9 percent chloride ion (Cl-) by weight of admixture.

10 **9-23.4(1) AIR-ENTRAINING ADMIXTURES**

11 Air-Entraining admixtures must be per AASHTO M 154 or ASTM C 260.

12 **9-23.4(2) TYPE A WATER-REDUCING ADMIXTURES**

13 Type A Water-Reducing admixtures must be per AASHTO M 194 Type A or ASTM C 494 Type A.

14 **9-23.4(3) TYPE B RETARDING ADMIXTURES**

15 Type B Retarding admixtures must be per AASHTO M 194 Type B or ASTM C 494 Type B.

16 **9-23.4(4) TYPE C ACCELERATING ADMIXTURES**

17 Type C Accelerating admixtures must be per AASHTO M 194 Type C or ASTM C 494 Type C, and only nonchloride
18 accelerating non-corrosive admixtures must be used.

19 **9-23.4(5) TYPE D WATER-REDUCING AND RETARDING ADMIXTURES**

20 Type D Water-Reducing and Retarding admixtures must be per AASHTO M 194 TYPE D OR ASTM C 494 TYPE D.

21 **9-23.4(6) TYPE E WATER-REDUCING AND ACCELERATING ADMIXTURES**

22 Type E Water-Reducing and Accelerating admixtures must be per AASHTO M 194 Type E or ASTM C 494 Type E, and
23 only nonchloride accelerating admixtures must be used.

24 **9-23.4(7) TYPE F WATER-REDUCING, HIGH RANGE ADMIXTURES**

25 Type F Water-Reducing, High Range admixtures must be per AASHTO M 194 Type F or ASTM C 494 Type F.

26 **9-23.4(8) TYPE G WATER-REDUCING, HIGH RANGE, AND RETARDING ADMIXTURES**

27 Type G Water-Reducing, High Range, and Retarding admixtures must be per AASHTO M 194 Type G or ASTM C 494
28 Type G.

29 **9-23.4(9) TYPE S SPECIFIC PERFORMANCE ADMIXTURES**

30 Type S Specific Performance admixtures must be per ASTM C 494 Type S. When a Type S admixture is used, a report
31 on the performance characteristics of the Type S admixture must be submitted along with the concrete mix design. The report
32 must describe the performance characteristics and provide data substantiating the specific characteristics of the Type S
33 admixture per ASTM C 494.

34 **9-23.5 WATERPROOFING**

35 Concrete made with waterproofing admixtures must have a percent absorption after immersion and boiling of less than
36 5.0 percent at 7 days and a volume of permeable voids less than 11.0 percent at 7 days per ASTM C 642. The Contractor
37 must submit evidence in the form of test results showing compliance with these Specifications, when they submit their
38 concrete mix design.

39 If the concrete requires air entrainment, the Contractor must also submit evidence to the Engineer that the admixture will
40 not adversely affect the air void system of the hardened concrete. Test results complying with ASTM C 457 must be provided
41 as evidence to satisfy this requirement.

42 **9-23.6 FLY ASH**

43 Fly ash must be per AASHTO M 295 Class C or F including optional chemical requirements as set forth in Table 2 and
44 with a further limitation that the loss on ignition must be a maximum of 1.5 percent.

45 **9-23.7 GROUND GRANULATED BLAST FURNACE SLAG (GGBFS)**

46 Ground granulated blast furnace slag must be per AASHTO M 302, Grade 100 or Grade 120. The grade of the ground
47 granulated blast furnace slag, the source, and type of manufacturing facility must be certified on the cement mill test certificate.

1 9-23.8 MICROSILICA FUME

2 Microsilica Fume must be per AASHTO M 307. The optional physical requirement for Reactivity with Cement Alkalies set
3 forth in Table 3 will be required when Microsilica Fume is being used as an ASR mitigation measure.

4 9-23.9 METAKAOLIN

5 Metakaolin must be per AASHTO M 295 Class N, including optional chemical requirements as set forth in Table 2 and
6 with a further limitation that the loss on ignition must be a maximum of 1.5 percent.

7 9-23.10 LIMESTONE

8 Limestone for Type IL or Type IT blended hydraulic cement must comply with the specifications of ASTM C 595.

9 SECTION 9-24 PLASTIC WATERSTOP**10 9-24.1 MATERIAL**

11 Waterstops must be fabricated from a plastic compound, the basic resin of which must be polyvinyl chloride. The
12 compound must contain such additional resins, plasticizers, inhibitors, or other material that when the Material is compounded,
13 it must comply with the performance requirements in this Specification.

14 Single pass reworked Material of the same composition generated from the fabricator's waterstop production may be
15 used. No reclaimed polyvinyl chloride must be used.

16 All waterstops must be molded or extruded in such a manner that any cross-section is dense, homogeneous, and free
17 from porosity and other imperfections.

18 Waterstops must be symmetrical in shape, nominally 4" x 3/16", and have a minimum of 4 ribs on each side of the bulb.
19 The bulb thickness and diameter must be as noted on the Drawings.

20 9-24.1(1) TESTS OF MATERIAL

21 The waterstops must meet all of the physical and other test requirements of this material as defined in the Corps of
22 Engineers Specifications for Polyvinyl Chloride Water Stop CRD C572, except that the tear resistance of the material must be
23 not less than 160 pounds per inch. The Contractor must furnish such sample material as required by the Engineer for the
24 purpose of making tests.

25 SECTION 9-25 WATER**26 9-25.1 WATER FOR CONCRETE**

27 Water for mortar or concrete, grout, and mortar must be clear, apparently clean, and suitable for human consumption
28 (potable). As determined by the Engineer, if the water contains substances that cause discoloration, unusual or objectionable
29 smell or taste, or other suspicious content, the Engineer may require the Contractor to provide test results documenting that
30 the water meets the physical test requirements and chemical limits described ASTM C1602 for nonpotable water.

31 Water from mixer washout operations may be used in concrete provided it meets or exceeds the above criteria as well as
32 the following additional requirements:

- 33 1. Concrete with water from mixer washout operations must not be used in bridge roadway deck slabs, flat slab bridge
34 superstructures, modified concrete overlays, or prestressed concrete,
- 35 2. Specific gravity must not exceed 1.07,
- 36 3. Alkalies, expressed as $[\text{Na}_2\text{O} + 0.658 \text{K}_2\text{O}]$ must not exceed 600 ppm,
- 37 4. Free of coloring agents,
- 38 5. If the wash water contains admixtures from different manufacturers, the Contractor must provide evidence that the
39 combination of admixtures are compatible and do not adversely affect the air void system of the hardened concrete
40 as per Section 6-02.3(3), and
- 41 6. All tests to verify that the physical and chemical requirements are met, must be conducted on the following schedule:
 - 42 a. The physical requirements must be tested on weekly intervals for 4 weeks and thereafter on monthly intervals,
 - 43 b. The chemical requirements must be conducted on monthly intervals, and
 - 44 c. The specific gravity must be determined daily per ASTM D 1429, Test Method D.

45 The Contractor must use the services of a laboratory that has equipment calibration/verification system, and a technician
46 training and evaluation process per AASHTO R-18 to conduct all tests. The laboratory must use testing equipment that has
47 been calibrated / verified at least once within the past 12 months to meet the requirements of each test procedure per the
48 appropriate section of AASHTO R-18. Records of tester qualifications and equipment verification documents must be
49 maintained and be available for review by the Engineer upon written notice. The Engineer's review of the laboratory facility,
50 testing equipment personnel, and all qualification, calibration, and verification documents will be conducted at the Engineer's
51 discretion.

1 **9-25.2 WATER FOR IRRIGATION**

2 Water for irrigation must not contain dissolved or suspended matter which is harmful to the plant Material on which it is to
3 be used.

4 **SECTION 9-26 EPOXY RESINS**

5 **9-26.1 EPOXY BONDING AGENTS**

6 **9-26.1(1) GENERAL**

7 Epoxy bonding agents must be 2-component epoxy resin-base systems per ASTM C 881; must be furnished in the type,
8 grade, and class specified; and must be as specified in this Section. When not specified, an appropriate grade and class must
9 be selected for the particular application. Epoxy bonding agents for patching external concrete must be concrete-gray in color.

10 **9-26.1(1)A TYPE I AND TYPE IV**

11 Epoxy bonding agents used for bonding hardened concrete to hardened concrete and other materials must be Type I for
12 non-load bearing applications and Type IV for load bearing applications.

13 **9-26.1(1)B TYPE II AND TYPE V**

14 Epoxy bonding agents used for bonding freshly mixed concrete to hardened concrete must be Type II for non-load
15 bearing applications and Type V for load bearing applications.

16 **9-26.1(1)C TYPE III**

17 Epoxy bonding agents used for bonding skid-resistant materials to hardened concrete and as a binder in epoxy mortars
18 and epoxy concretes used on traffic bearing surfaces must be Type III.

19 **9-26.1(2) PACKAGING AND MARKING**

20 The components of the epoxy system furnished under these Specifications must be supplied in separate containers that
21 are non-reactive with the materials contained. The contents of each container must be such that when the container contents
22 are combined, a properly proportioned final mixture results.

23 Containers must be identified as "Component A" (Contains the Epoxy Resin) and "Component B" (Contains the Curing
24 Agent) and must show the type, grade, class, and mixing directions as defined by these Specifications. Each container must
25 be marked with the name of the manufacturer, the lot or batch number, the date of packaging, and the quantity contained in
26 pounds or gallons.

27 Potential hazards must be so stated on the package per the Federal Hazardous Products Labeling Act and State of
28 Washington, Department of Labor and Industries Regulations for Shipment of Hazardous Products.

29 **9-26.1(3) CERTIFICATION**

30 If requested by the Owner, the manufacturer of the epoxy system must certify that components A and B comply with this
31 Specification before a sample will be accepted for testing by the Owner. The manufacturer's certificate of compliance must be
32 furnished as specified in Section 1-06.3.

33 **9-26.1(4) REJECTION**

34 Except as noted otherwise, the entire lot of both components may be rejected if samples submitted for test fail to comply
35 with this Specification.

36 **9-26.1(5) ACCEPTANCE**

37 Acceptance of the Epoxy Bonding Agents for use on the project must be based on a passing test report from the
38 Materials Laboratory.

39 **9-26.2 EPOXY ADHESIVE FOR LANE MARKERS**

40 **9-26.2(1) GENERAL**

41 Epoxy adhesives for lane markers must comply with AASHTO M 237 for Type II - Standard Setting, High Viscosity,
42 Epoxy Adhesive. In lieu of the square base test specimen molds for the Slant Shear Strength test specified in AASHTO M 237,
43 cylindrical molds per ASTM C 882 may be used.

44 **9-26.2(2) PACKAGING AND MARKING**

45 Packaging and Marking of Epoxy Adhesive for Lane Markers must be as specified in Section 9-26.1(2).

46 **9-26.2(3) CERTIFICATION**

47 Certification of Epoxy Adhesive for Lane Markers must be as specified in Section 9-26.1(3).

1 9-26.2(4) REJECTION

2 Rejection of Epoxy Adhesive for Lane Markers must be as specified in Section 9-26.1(4).

3 9-26.2(5) ACCEPTANCE

4 Acceptance of each lot of the Epoxy Adhesive for Lane Markers for use on the project must be based on a
5 manufacturer's certificate of compliance.

6 9-26.3 EPOXY GROUT/MORTAR/CONCRETE**7 9-26.3(1) GENERAL**

8 This Specification must apply to epoxy grout, epoxy mortar and epoxy concrete for traffic and non-traffic bearing
9 applications. Epoxy grout/mortar/concrete must consist of an epoxy bonding agent and an aggregate component.

10 Prepackaged epoxy grout/mortar/concrete must be prepared from a ready-to-mix epoxy bonding agent/aggregate system
11 supplied by a manufacturer in kit form.

12 Non-prepackaged epoxy grout/mortar/concrete must be prepared from an epoxy bonding agent and an aggregate
13 component that is clean, surface dry and inert and that is of a quality and gradation suitable for Portland cement mortar or
14 concrete. Aggregate as specified in Section 9-03.1(2) will be satisfactory. Epoxy grout/mortar/concrete for patching external
15 concrete must be concrete-gray in color.

16 9-26.3(1)A TRAFFIC BEARING APPLICATIONS

17 Epoxy grout/mortar/concrete for traffic bearing applications must have a 7-day compressive strength of not less than
18 4000 psi when tested per ASTM C579. Epoxy bonding agent must be Type III as described in Section 9-26.1(1)C.

19 9-26.3(1)B NON-TRAFFIC BEARING APPLICATIONS

20 Epoxy grout/mortar/concrete for non-traffic bearing applications must have a 7-day compressive strength of not less than
21 4000 psi when tested per ASTM C579. Epoxy bonding agent must be Type I, II, IV, or V as appropriate for intended use as
22 described in Section 9-26.1(1)A and Section 9-26.1(1)B.

23 9-26.3(2) PACKAGING AND MARKING

24 Packaging and Marking of the epoxy bonding agent component of epoxy grout/mortar/concrete must be as specified in
25 Section 9-26.1(2).

26 9-26.3(3) CERTIFICATION

27 Certification of the epoxy bonding agent component of epoxy grout/mortar/concrete must be as specified in Section 9-
28 26.1(3).

29 9-26.3(4) REJECTION

30 Rejection of the epoxy bonding agent component of epoxy grout/mortar/concrete must be as specified in Section 9-
31 26.1(4).

32 9-26.3(5) ACCEPTANCE

33 Acceptance of the epoxy grout/mortar/concrete material for use on the project must be based on a passing test report
34 from the Materials Laboratory.

35 SECTION 9-27 CRIBBING**36 9-27.1 GABION CRIBBING****37 9-27.1(1) GABION FABRIC**

38 Gabions may be fabricated from either hexagonal twisted wire mesh or from welded wire mesh. Only one type of mesh
39 and protective coating must be used throughout a structure.

40 Baskets must be furnished in the required dimensions with a dimensional tolerance of ± 5 percent.

41 Wire for construction of gabions must be either galvanized steel wire conforming to ASTM A 641, Class 3, Soft Temper,
42 or aluminized steel wire conforming to ASTM A 809, Soft Temper. The wire must have a minimum tensile strength of 60,000
43 psi when tested per ASTM A 370.

44 9-27.1(2) GABION BASKETS

45 Gabion baskets 1 foot or greater in the vertical dimension must have mesh openings with nominal dimensions not to
46 exceed 4-1/2 inches and the maximum area of any mesh opening must not exceed 10 square inches.

47 1. Hexagon Twisted Wire Mesh:

48 a. Wire for galvanized or aluminized hexagonal twisted wire mesh must be nominal sized 0.120-inch galvanized
49 steel wire or aluminized steel wire.

- 1 b. Hexagonal wire mesh be formed from galvanized or aluminized wire in a uniform hexagonal pattern with
 2 nonraveling double twist. The perimeter edges of the mesh for each panel must be tied to a selvage wire of the
 3 same composition as the body mesh and have a minimum diameter of 0.150 inches so that the selvage is at least
 4 the same strength as the body of the mesh.

5 2. Welded Wire Mesh:

- 6 a. Welded wire mesh must be fabricated from galvanized steel wire having a diameter of 0.106 inches. Wire must be
 7 galvanized prior to fabrication.
 8 b. Welded wire mesh must be formed in a uniform square pattern with openings 3 inches by 3 inches with a
 9 resistance weld at each connection per ASTM A 185.
 10 c. If required, a PVC coating must be fusion bonded onto the welded wire mesh to provide a nominal coating
 11 thickness of 0.0216 inches per side with a minimum of 0.0150 inches.

12 3. PVC Coating (for welded wire mesh only):

13 Acceptance of PVC coating material must be by certified test reports of an independent laboratory. The initial
 14 properties of PVC coating material must have a demonstrated ability to conform to the following requirements:

- 15 a. Specific Gravity — In the range of 1.2 to 1.4, when tested according to ASTM D 792.
 16 b. Tensile Strength — Not less than 2,275 psi, when tested according to ASTM D 638.
 17 c. Modulus of Elasticity — Not less than 1,980 psi at 100 Strain, when testing according to ASTM D 638.
 18 d. Hardness — Shore “A” not less than 75 when tested according to ASTM D 2240.
 19 e. Brittleness Temperature — Not higher than 15°F when tested according to ASTM D 746.
 20 f. Resistance to Abrasion — The percentage of the mass loss must be less than 12 percent when tested according
 21 to ASTM D 1242, Method B at 200 cycles, CSI-A Abrader Tape, 80 Grit.
 22 g. Salt Spray Exposure and Ultraviolet Light Exposure — The PVC must show no effect after 3,000 hours of salt
 23 spray exposure according to ASTM B 117. The PVC must show no effect of exposure to ultraviolet light with test
 24 exposure of 3,000 hours using apparatus Type E and 63°C, when tested according to Practice D 1499 and
 25 Practice G 23. After the salt spray test and exposure to ultraviolet light as specified above, the PVC coating must
 26 not show cracks, blister, split, nor show a noticeable change of color. In addition, the specific gravity, tensile
 27 strength, modulus of elasticity, and resistance to abrasion must not change more than 6, 25, 25, and 10 percent
 28 respectively from their initial values.

29 **9-27.1(3) GABION MATTRESSES**

30 Gabion baskets less than 1 foot in the vertical dimension must have mesh openings with nominal dimensions not to
 31 exceed 3.3 inches, and the maximum area of any mesh opening must not exceed 6 square inches.

32 1. Hexagonal Twisted Wire Mesh:

- 33 a. Wire for galvanized or aluminized hexagonal twisted wire mesh must be nominal sized 0.086-inch galvanized
 34 steel wire or aluminized steel wire.
 35 b. Hexagonal wire mesh must be formed from galvanized or aluminized wire in a uniform hexagonal pattern with
 36 nonraveling double twisted. The perimeter edges of the mesh for each panel must be tied to a selvage wire of the
 37 same composition as the body mesh and have a minimum diameter of 0.1062 inches so that the selvage is at
 38 least the same strength as the body of the mesh.

39 2. Welded Wire Mesh:

- 40 a. Welded wire mesh must be fabricated from galvanized steel wire having a diameter of 0.080 inches. Wire must be
 41 galvanized prior to fabrication.
 42 b. Welded wire mesh must be formed in a uniform rectangular pattern with openings 1-1/2” x 3” with a resistance
 43 weld at each connection per ASTM A 185.
 44 c. If required, a PVC coating must be fusion bonded onto the welded wire mesh to provide a nominal coating
 45 thickness of 0.0216 inches per side with a minimum of 0.0150 inches. The PVC coating must be in conformance
 46 with Section 9-27.1(2).

47 **9-27.1(4) FASTENERS FOR BASKET ASSEMBLY**

48 The lacing wire must be a nominal sized 0.0866-inch galvanized steel wire or aluminized steel wire. Lacing wire must
 49 have the same coating as the basket mesh.

50 Spiral binders, if used for joining welded wire panels must be formed from 0.106-inch nominal diameter steel wire with a
 51 3-inch pitch having the same Specifications and coating as the wire mesh. Lacing wire may be used in lieu of spiral binders.

52 Alternate fasteners for basket assembly must remain closed when subjected to a 600 pound tensile force when confining
 53 the maximum number of wires to be confined. Installation procedures and test results for alternate fasteners must be
 54 submitted for approval.

55 Internal connecting wires must be the same as required for lacing wire. Alternate stiffeners acceptable to the gabion
 56 manufacturer may be used if found acceptable to the Engineer.

1 9-27.1(5) NONRAVELING CONSTRUCTION

2 The wire mesh must be fabricated as to be nonraveling. This is defined as the ability to resist pulling apart at any of the
3 connections forming the mesh when a single strand in a section of mesh is cut.

4 9-27.1(6) STONE

5 Stone for filling gabions must have a Degradation Factor of at least 30. The stone must be dense enough to pass the unit
6 weight test specified in Section 6-09.3(6)F. Stone must meet the following requirements for gradation:

| Sieve Size | Percent Passing |
|------------|-----------------|
| 8" square | 100 |
| 6" square | 75-90 |
| 4" square | 0-10 |
| % Fracture | 75 min. |

8

9 SECTION 9-28 SIGNING MATERIALS AND FABRICATION**10 9-28.1 SIGNS****11 9-28.1(1) GENERAL**

12 Signs to be mounted on wood utility poles (except Seattle City Light poles) and signs installed overhead must be
13 aluminum. Other signs must be either High Density Overlay plywood or sheet aluminum.

14 Parking and pedestrian control signs must be non-reflectorized. All other traffic signs must be reflectorized.

15 STOP and YIELD sign backs and edges must be painted with one coat of red enamel to match the red on the sign face.

16 Regulatory and warning signs must have rounded corners with the exception of STOP signs. All other signs must have
17 square cut corners. Borders for signs having square cut corners must have a corner radius approximately 1/8 of the lesser
18 side dimension of the sign up to a maximum radius of 12 inches. For signs with rounded corners, the borders must be
19 concentric with the rounded corners.

20 9-28.1(2) PLYWOOD

21 Plywood signs must be constructed of High Density Overlay plywood, complying with the requirements of Products
22 Standard PS 1 83 for Softwood Plywood, Construction and Industrial published by the Product Standards Section of the U.S.
23 Department of Commerce. The plywood must be free of contaminants which would adversely affect the application or life of
24 the sheeting to be applied. Face veneers must be Grade B or better.

25 Core and crossband veneers must be solid. Core veneers must be jointed, and core gaps must not exceed 1/8 inch in
26 width. The entire area of each contacting veneer surface must be bonded with a waterproof adhesive that complies with U.S.
27 Department of Commerce Specifications for exterior type plywood.

28 The overlay must be of the high density type. It must have a minimum weight of 60 pounds per thousand square feet of
29 surface and must be at least 0.012 inches thick before pressing. The overlay must have a sufficient resin content to bond itself
30 to the plywood, with a minimum resin content of 45 percent based on the dry weight of the impregnated fiber.

31 Thickness Single Panel Plywood Signs:

32

| Sign Size | Thickness |
|--|-----------|
| Up to 18 inches inclusive in width | 3/8" |
| Over 18 inches to 36 inches inclusive in width | 5/8" |
| Over 36 inches in width | 3/4" |
| Overhead signs | 3/4" |

33

34 Street designation signs and signs mounted on span wires or mast arms must have the sign back and edges primed with
35 1 coat of white exterior enamel undercoat and finished with 1 coat of International Green (Forest Green) exterior enamel. All
36 other plywood signs must have only the edges primed with 1 coat of white exterior enamel undercoat and finished with 1 coat
37 of white exterior enamel. The primer must be as recommended by the Supplier of the finish coat. The finish enamel must
38 comply with Federal Specification TT E 489.

39 9-28.1(3) SHEET ALUMINUM SIGNS

40 Sheet aluminum signs must be constructed of Material conforming to ASTM B209, alloy 6061T6, or alloy 5052-H36 or
41 H38. Alloy 50D5-H34 may be used for sign refacing.

1 After the aluminum sheet panel has been fabricated, the surface of each panel must be protected from corrosion. The
 2 corrosion protection must comply with ASTM B-449 Class II Specification for Chromates on Aluminum. Aluminum signs over
 3 12' wide x 5' high must be comprised of vertical panels in increments of 2, 3, or 4 feet wide. No more than one 2-foot and/or 3-
 4 foot panel may be used per sign. The Contractor must use the widest panels possible. All parts necessary for assembly must
 5 be constructed of aluminum, galvanized steel, or stainless steel as shown on the Drawings. Sheet thickness must be as
 6 follows:

| Maximum Horizontal Dimension | Sheet Aluminum Thickness |
|-----------------------------------|--------------------------|
| Overlay panels | 0.050" |
| Up to 20 inches | 0.063" |
| 20 inches to 36 inches, inclusive | 0.080" |
| Over 36 inches (Permanent Signs) | 0.125" |

8 The side dimension for a diamond shaped warning sign is considered to be the maximum horizontal dimension.

9 Before placing aluminum in contact with untreated steel, the steel surfaces must be protected by proper cleaning and
 10 painting with one coat of paint conforming to Section 9-08.2 Item 3 Formula A-9-73 and two coats of aluminum paint.

11 Metal must be handled by device or clean canvas gloves between all cleaning and etching operations and the application
 12 of reflective sheeting.

13 Sheet aluminum edges must be filed smooth to eliminate sharp edges and burrs.

14 **9-28.1(4) REFLECTIVE SIGN FACE SHEETING**

15 Reflective sheeting must consist of spherical lens elements embedded within a transparent plastic or adhered to a
 16 synthetic resin and encapsulated by a transparent plastic. The sheeting must have a flat, smooth outer surface, be weather
 17 resistant, and have a precoated adhesive backing with a protective liner.

18 The sheeting must have the following minimum brightness values expressed as average candle power per foot candle
 19 per square foot of Material. Measurements must be conducted per standard testing procedures for reflex reflectors in Federal
 20 Specification L-S-300.

21 The brightness of the reflective sheeting, totally wet by rain, must be not less than 90 percent of the above values. Wet
 22 performance measurements must be conducted in conformance with the Standard Rainfall Test specified in Federal
 23 Specification L-S-300C.

24 The diffuse day color of the reflective sheeting must be visually evaluated by comparison with the applicable Highway
 25 Color Tolerance Chart. Color comparisons must be made under north daylight or a scientific daylight having a color
 26 temperature of from 6500 K to 7500 K. Color must be illuminated at 45 degrees and viewed at 90 degrees.

27 The sheeting surface must be smooth and facilitate cleaning and wet performance and exhibit 85 degree glossmeter
 28 rating of not less than 50 (ASTM D 523). The sheeting surface must be readily processed and compatible with transparent and
 29 opaque process colors and show no loss of the color coat with normal handling, cutting, and application. The sheeting must
 30 permit cutting and color processing at temperatures of 60 °F to 100 °F and 20 to 80 percent relative humidity.

31 The sheeting surface must be solvent resistant such that it may be cleaned with gasoline, VM&P Naptha, mineral spirits,
 32 turpentine, methanol, or xylol.

33 The embedded lens sheeting, when applied according to manufacturer's recommendations to cleaned and etched 0.020"
 34 x 2" x 8" aluminum, conditioned 24 hours, and tested at 72 °F and 50 percent relative humidity, must be sufficiently flexible to
 35 show no cracking when bent around a 3/4-inch diameter mandrel.

36 Conditioned for 48 hours, the tensile strength of the embedded lens sheeting must be 5 to 20 pounds per inch width
 37 when tested per ASTM D 828. Following liner removal, the sheeting must not shrink more than 1/32 inch in 10 minutes nor
 38 more than 1/8 inch in 24 hours in any dimension per 9-inch square at 75 °F and 50 percent relative humidity.

39 The encapsulated lens sheeting, with liner removed, conditioned for 24 hours at 72 °F and 50 percent relative humidity,
 40 must be sufficiently flexible to show no cracking when bent around a 1/8-inch diameter mandrel with adhesive side contacting
 41 the mandrel.

42 The protective liner attached to the adhesive must be easily removable by peeling without soaking in water or other
 43 solvents.

44 The pre coated adhesive backing must be a tack free heat activated type or a pressure sensitive type, either of which
 45 must adhere to the sheeting without the necessity of additional coats of adhesive.

46 The adhesive must form a durable bond to smooth the corrosion-resistant and weather resistant surfaces and permit the
 47 reflective sheeting to adhere securely 48 hours after application at temperatures of 30°F to 200°F. The adhesive bond must be
 48 sufficient to render the applied sheeting vandal resistant and prevent its shocking off when jabbed with a spatula at 10°F. The
 49 sheeting must resist peeling from the application surface when a 5 pounds per inch width force is applied as outlined in ASTM
 50 D 903.

| With Embedded Lens Elements: | | | | | | | | | |
|------------------------------|------------------------|----------------|-----------------|------------------------|----------------|----------------|----------------|-----------------|----------------|
| | Div. Ang. | | | Div. Ang. | | | Div. Ang. | | |
| | 0.2 degrees | 0.5 degrees | 1.50 degrees | 0.2 degrees | 0.5 degrees | 1.5 degrees | 0.2 degrees | 0.50 degrees | 1.5 degrees |
| Inc. Ang. | Silver White #1 | | | Silver White #2 | | | Yellow | | |
| -4 degree | 70.0 | 30.0 | 4.0 | 80.0 | 41.0 | 4.0 | 50.0 | 25.0 | 5.0 |
| 40 degree | 14.5 | 8.5 | 1.5 | 16.5 | 9.5 | 2.0 | 11.5 | 7.0 | 1.5 |
| Inc. Ang. | Red | | | Blue | | | Green | | |
| -4 degrees | 14.5 | 7.5 | 1.0 | 4.0 | 2.0 | 0.6 | 9.0 | 4.5 | 1.0 |
| 40 degrees | 3.0 | 1.5 | 0.3 | 0.9 | 0.4 | 0.08 | 1.8 | 1.5 | 0.2 |
| Inc. Ang. | Orange | | | Brown | | | -- | | |
| -4 degrees | 25.0 | 13.5 | 1.5 | 1.0 | 0.35 | 0.1 | | | |
| 40 degrees | 1.0 | 0.8 | 0.1 | 0.2 | 0.1 | 0.01 | | | |

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| With Encapsulated Lens Elements: | | | | | | |
|----------------------------------|---------------------|----------------|----------------|----------------|----------------|----------------|
| | Div. Ang. | | | Div. Ang. | | |
| | 0.2 degrees | 0.5 degrees | 1.5 degrees | 0.2 degrees | 0.5 degrees | 1.5 degrees |
| Inc. Ang. | Silver White | | | Yellow | | |
| -4 degrees | 250.0 | 95.0 | 4.0 | 170.0 | 62.0 | 3.0 |
| 40 degrees | 120.0 | 54.0 | 2.0 | 80.0 | 35.0 | 1.5 |
| Inc. Ang. | Orange | | | Green | | |
| -4 degrees | 70.0 | 25.0 | 1.1 | 30.0 | 12.0 | 0.5 |
| 40 degrees | 33.0 | 14.0 | 0.5 | 14.0 | 6.8 | 0.2 |
| Inc. Ang. | Red | | | -- | | |
| -4 degrees | 35.0 | 13.0 | 0.7 | | | |
| 40 degrees | 16.0 | 7.4 | 0.3 | | | |

2

3 9-28.1(5) NON REFLECTIVE SIGN FACE SHEETING

4 The nonreflective sheeting must consist of a white plastic film having a smooth, flat outer surface. The sheeting must be
5 weather resistant and have a protected pre coated adhesive backing.

6 9-28.1(6) SHEETING APPLICATION

7 Plywood sign faces must be cleaned with lacquer thinner, heptane, benzene, or solvent recommended by the sheeting
8 manufacturer. The surface must be sanded with light sandpaper or steel wool and wiped dry and clean with clean cloth.
9 Aluminum sign faces must be cleaned with a solvent recommended by the sheeting manufacturer.

10 Sign face sheeting must be applied by a vacuum applicator recommended by the sheeting manufacturer, or by a
11 continuous roll applicator.

12 Heat activated adhesive backed sheeting must be applied by the vacuum method. The adhesive on the back of the
13 sheeting must be activated by a minimum temperature of 185 °F and with a minimum vacuum pressure of 25 inches of
14 mercury. This operation must be in effect for a minimum of 3 minutes on plywood and 5 minutes on metal. After aging for 48
15 hours at 75 °F, the adhesive must form a bond equal to or greater than the strength of the sheeting.

16 Pressure sensitive adhesive backed sheeting must be applied by a continuous roll applicator. The process must be in
17 conformance with the recommendation of the sheeting manufacturer.

18 Edges and splices of sign face sheeting must be coated with an edge sealer recommended by the sheeting
19 manufacturer.

20 9-28.1(7) LETTERS, ARROWS, AND SYMBOLS

21 Letters, arrows, and symbols must be of the type, size, and color specified on the Drawings, in the Specifications or
22 WSDOT Sign Fabrication Manual, and the "Standard Highway Signs" by United States Department of Transportation.

23 Letters, arrows, and symbols must be of Material compatible with the sign surface Material, as recommended by the sign
24 surface manufacturer or approved by the Engineer.

1 **9-28.1(8) HARDWARE**

2 Bolts, nuts, and washers must be of the same Material for each attachment. All parts necessary for assembly must be
 3 constructed of the following Materials:

| Hardware | Specification |
|----------------------------|-------------------------------|
| Bolts | ASTM B 209, 2024 T4 Aluminum |
| | ASTM A 307 Steel |
| | ASTM F 593 Stainless Steel |
| Washers | ASTM B 209, 2024 T4 Aluminum |
| | ASTM A 36 Steel |
| | ASTM A 240 Stainless Steel |
| Nuts | ASTM B 209, 6061 T6 Aluminum |
| | ASTM A 307 Steel |
| | ASTM F 594 Stainless Steel |
| Locknuts | ASTM B 211, 2017 T4 Aluminum |
| | ASTM A 307 Steel |
| | ASTM F 594 Stainless Steel |
| Rivets | ASTM B 209, 6061 T6 Aluminum |
| | ASTM B 316, 6053 T61 Aluminum |
| Post Clips | ASTM B 179, 356 T6 Aluminum |
| Wind Beams | ASTM B 209, 6061 T6 Aluminum |
| Angle and Z Bar | ASTM B 209, 6061 T6 Aluminum |
| | ASTM A 36 Steel |
| Strap and Mounting Bracket | ASTM A 276 Stainless Steel |

5
 6 All steel parts must be galvanized per ASTM A 123. Steel bolts and related connecting hardware must be galvanized per
 7 ASTM A 153.

8 **9-28.2 POSTS**

9 **9-28.2(1) Parking Meter Post**

10 **9-28.2(1)A GENERAL**

11 Parking meter post mounted with a parking meter and with no sign attached to the post must have a 2-1/2-inch nominal
 12 ASTM A 53, Schedule 40 galvanized standard steel pipe sleeve fitted loosely over the exposed meter post full length. On the
 13 bottom, the sleeve must make contact with the canopy for surface mounted posts or with the finished grade for direct burial
 14 posts. On the top, the sleeve must make contact with the parking meter base. Standard Plan 629 shows the sleeve on a direct
 15 burial post. Direct burial and surface mounted meter posts not used for a parking meter and used only for parking sign or other
 16 type sign, must have a 2-3/8-inch galvanized steel cap securely fitted over the top of the post as shown on Standard Plans 627
 17 and 628.

18 **9-28.2(1)B DIRECT BURIAL PARKING METER POST**

19 See Standard Plan 629. Direct burial parking meter post must be fabricated from 2-inch nominal diameter standard
 20 ASTM A 53, schedule 40 galvanized pipe, 46 inches in length, and with the bottom 3 inches flattened. Two 1/4-inch weep
 21 holes are required. The buried post base must be backfilled, and mounded for drainage, with very quick setting and very
 22 strong cement grout, such as jet-set cement, having the following properties:

| Property | Standard | Performance |
|----------------------|-------------|-----------------------------|
| Compressive Strength | ASTM C 109 | 8,000 psi. min. in 28 days |
| Bond Strength | ASTM C 1042 | 500 psi. min. in 1 day |
| Shrinkage | ASTM C 596 | Less than 0.10% |
| Set-time | ASTM C 191 | Initial set in 8-10 minutes |
| | | Final set in 15-20 minutes |

1
2 Cement grout meeting these requirements is jet-set cement and can be obtained from Jet Set Northwest Inc., Seattle,
3 WA, or approved equal.

4 **9-28.2(1)C SURFACE MOUNTED PARKING METER POSTS**

5 Bolted down parking meter and parking sign posts must be fabricated from 2-inch nominal diameter standard ASTM A
6 53, schedule 40 galvanized steel pipe, 40 inches in length, with 5/16" x 5" x 5" ASTM A 36 steel base plate. The meter post
7 base canopy, also known as collar, must be made of 0.062-inch 2-5-0 aluminum as shown on Standard Plan 627.

8 **9-28.2(2) TELES PAR QWIK-PUNCH SIGN POST AND POST ANCHOR**

9 Unless otherwise specified, Sign Posts must be Telespar Qwik-Punch® or approved equal, Tube Size 2" x 2", Gauge 14.
10 Unless otherwise specified, the length of the post must be specified in the Standard Plans with a length tolerance of ± 0.25
11 inch. The finished members must be straight and have a smooth uniform finish. Post must be in-line galvanized per AASHTO
12 M-120.

13 Unless otherwise specified, light duty and heavy-duty post anchors must be Telespar Qwik-Punch® or approved equal,
14 one size larger than the sign post, with gauge and length as specified on Standard Plan 621b.

15 Surface-mounted post anchors must be gauge 12 Telespar Qwik-Punch® or approved equal, galvanized tube welded to a
16 1/4-inch thick, 7" x 7" steel base plate. Four, 3/4-inch holes must be drilled in the base plate, one at each corner centered 1.06
17 inches from each edge of the plate; centered 4.88 inches apart. The tube length as specified on Standard Plan 621b, one size
18 larger than the sign post. The tube must be tube centered on the plate as shown on Standard Plan 621b and fillet welded on
19 all 4 sides where the tube meets the plate. All welds must develop the full strength of the parent metal. After fabrication, the
20 base plate and welds of the anchors must be hot-dip galvanized per AASHTO M111 or ASTM 123. The tube portion of the
21 anchors must not be hot-dipped as not to impede the insertion of the sign post.

22 Telespar Qwik-Punch® or approved equal Sign Post and Post Anchor must have 7/16-inch prepunched holes on 1-inch
23 centers.

24 Corner bolts, nuts, and washer for attaching post to anchors must be Telespar Qwik-Punch® or approved equal
25 recommended. Surface mounting bolts must be as shown on Standard Plan 621b.

26 **9-28.2(3) STREET NAME SIGN POST**

27 Street name sign post must be 2-1/2 inches inside diameter x 10'-6" standard weight galvanized steel pipe, with the
28 bottom 6-inch end section flattened to form a wedge. For details, see Standard Plan 622.

29 **SECTION 9-29 PAVEMENT MARKING**

30 **9-29.1 GENERAL**

31 Pavement marking materials in this Section consist of paint, plastic, tape or raised pavement markers as described in
32 Section 8-22 and Section 8-23 as listed below:

- 33 1. Low VOC Solvent Based Paint
- 34 2. Low VOC Waterborne Paint Temporary Pavement Marking Paint
- 35 3. Type A – Liquid Hot Applied Thermoplastic
- 36 4. Type B – Pre-formed Fused Thermoplastic
- 37 5. Type C – Cold Applied Pre-formed Tape
- 38 6. Type D – Liquid Cold Applied Methyl Methacrylate Glass Beads
- 39 7. Temporary Pavement Marking Tape
- 40 8. Temporary Raised Pavement Markings

41 **9-29.2 PAINT**

42 White and yellow paint must comply with the Specifications for low VOC (volatile organic compound) solvent-based paint
43 or low VOC waterborne paint. Blue paint for "Access Parking Space Symbol with Background" and black paint for contrast
44 markings must be chosen from a WSDOT QPL-listed manufacturer for white and yellow paint.

45 Blue and black paint must comply with the Specifications for yellow paint in Section 9-29.2(3) and Section 9-24.2(5), with
46 the exception that blue and black paints do not need to meet the requirements for titanium dioxide, directional reflectance, and
47 contrast ratio.

48 **9-29.2(1) COLOR**

49 Paint draw-downs must be prepared according to ASTM D 82. For white, the color must closely match Federal Standard
50 595, color number 37875. For yellow, the color must closely match Federal Standard 595, color number 33538. For blue, the
51 color must closely match Federal Standard 595, color number 35180. For black, the color must closely match Federal
52 Standard 595, color number 37038.

9-29.2(2) PROHIBITED MATERIALS

Traffic paint must not contain mercury, lead, chromium, toluene, chlorinated solvents, hydrolysable chlorine derivatives, ethylene-based glycol ethers and their acetates, nor any other EPA hazardous waste material over the regulatory levels per CFR 40 Part 261.24.

9-29.2(3) LOW VOC SOLVENT BASED PAINT

| Paint Properties | Test Method | Low VOC Solvent-Based Paint | | | |
|---|--------------------------|---|------|--------|------|
| | | White | | Yellow | |
| | | Min. | Max. | Min. | Max. |
| Density of Paint (lb/gal) | ASTM D 1475 | 11.8 | -- | 11.8 | -- |
| Viscosity, KU | ASTM D 562 | -- | -- | -- | -- |
| @35 °F | -- | -- | -- | -- | -- |
| @50 °F | -- | -- | 105 | -- | 105 |
| @77 °F | -- | 75 | 85 | 75 | 85 |
| @90 °F | -- | -- | -- | -- | -- |
| @120 °F | -- | 65 | -- | 65 | -- |
| Nonvolatile Content, % by weight | ASTM D 2369 | 65 | -- | 65 | -- |
| Pigment Content, % by weight | ASTM D 2698 | -- | 53 | -- | 53 |
| Titanium Dioxide Content (lb/gal), Rutile Type II | ASTM D 5381 | 1.0 | -- | -- | 0.2 |
| Volatile Organic Content (VOC) lbs/gal | ASTM D 3960 | -- | 1.25 | -- | 1.25 |
| Directional Reflectance %, @ 15 mils wet | WSDOT T 314 | 80 | -- | 50 | -- |
| Package Stability | ASTM D 1849 | 6 | -- | 6 | -- |
| Bleeding, % | ASTM D 868 ¹ | 90 | -- | 90 | -- |
| Flexibility | ASTM D 522 ² | No cracking, flaking, or loss of adhesion | | | |
| Settling Properties during Storage, Inch | ASTM D 1309 ³ | -- | 8 | -- | 8 |
| Skinning | ASTM D 154 | The paint must not skin within 48 hours in a 3/4 filled, tightly closed container | | | |

NOTES:

- The reflectance of the paint over asphalt paper must be a minimum of 90 percent of the reflectance measurement of the paint over a taped (nonbleeding) surface.
- The paint must be applied at a wet film thickness of 6 mils to a 3" x 5" panel that has been solvent cleaned and lightly buffed with steel wool. With the panel kept in a horizontal position, the paint must be allowed to dry for 18 hours at 77 °F ± 2 °F, and then baked for 3 hours at 140 °F ± 2 °F. The panel must be cooled to 77 °F ± 2 °F for at least 30 minutes, bent over a 0.25-inch mandrel, and then examined without magnification. The paint must show no cracking, flaking, or loss of adhesion.
- The sample must show no more than 0.5 inches of clear material over the opaque portion of the paint and there must be no settling below a rating of 8.

9-29.2(4) LOW VOC WATERBORNE PAINT

| Paint Properties | Test Method | Standard Waterborne Paint | | | | High-Build Waterborne Paint | | | | Cold Weather Waterborne Paint | | | |
|---------------------------|-------------|--------------------------------------|-----|--------|-----|--------------------------------------|-----|--------|-----|-------------------------------|-----|--------|-----|
| | | White | | Yellow | | White | | Yellow | | White | | Yellow | |
| | | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| Density of Paint (lb/gal) | ASTM D 1475 | Within ± 0.3 of qualification sample | | | | Within ± 0.3 of qualification sample | | | | 12.5 | -- | 12.5 | -- |
| Viscosity, KU | ASTM D 562 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| @35 °F | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 95 | -- | 95 |
| @77 °F | -- | 80 | 95 | 80 | 95 | 80 | 95 | 80 | 95 | -- | 87 | -- | 87 |
| @90 °F | -- | -- | -- | -- | -- | -- | -- | -- | -- | 60 | -- | 60 | -- |

| Paint Properties | Test Method | Standard Waterborne Paint | | | | High-Build Waterborne Paint | | | | Cold Weather Waterborne Paint | | | |
|--|---|---|------|--------|------|---|------|--------|------|--|------|--------|------|
| | | White | | Yellow | | White | | Yellow | | White | | Yellow | |
| | | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| Nonvolatile Content, % by weight | ASTM D 2369 | 75 | -- | 75 | -- | 77 | -- | 77 | -- | 70 | -- | 70 | -- |
| Pigment Content, % by weight | ASTM D 3723 | -- | 68 | -- | 68 | 62 | -- | 62 | -- | 50 | -- | 50 | -- |
| Nonvolatile Vehicle (NVV), % by weight | ASTM D 2369 ASTM D 3723 ¹ | 40 | -- | 40 | -- | 43 | -- | 43 | -- | 40 | -- | 40 | -- |
| Volatile Organic Content (VOC) lbs/gal | ASTM D 3960 | -- | 1.25 | -- | 1.25 | -- | 1.25 | -- | 1.25 | -- | 1.25 | -- | 1.25 |
| Fineness of Grind, (Hegman Scale) | ASTM D 1210 | 3 | -- | 3 | -- | -- | -- | -- | -- | 3 | -- | 3 | -- |
| Contrast Ratio, @ 15 mils wet | WSDOT T 314 | 0.98 | -- | 0.96 | -- | 0.98 | -- | 0.96 | -- | 0.99 | -- | 0.98 | -- |
| Flash Point, °F | ASTM D 93 | 100° | -- | 100° | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| pH | ASTM E 70 | 9.5 | -- | 9.5 | -- | 9.5 | -- | 9.5 | -- | 9.5 | -- | 9.5 | -- |
| Laboratory Dry Time (Minutes) | ASTM D 711 | -- | 10 | -- | 10 | -- | -- | -- | -- | -- | 10 | -- | 10 |
| Vehicle Composition | ASTM D 2621 | 100% acrylic emulsion or approved equal | | | | 100% acrylic emulsion or approved equal | | | | 100% acrylic emulsion or approved equal | | | |
| Freeze-Thaw Stability, KU | ASTM D 2243 and D 562 | @ 5 cycles show no coagulation or change in viscosity greater than ± 5 KU | | | | @ 5 cycles show no coagulation or change in viscosity greater than ± 5 KU | | | | @ 3 cycles show no coagulation or change in viscosity greater than ± 10 KU | | | |
| Heat Stability | ASTM D 562 ² | ± 10 KU from the initial viscosity | | | | ± 10 KU from the initial viscosity | | | | ± 10 KU from the initial viscosity | | | |
| Low Temperature Film Formation | ASTM D 2805 ³ | -- | -- | -- | -- | -- | -- | -- | -- | No Cracks | | | |

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NOTES:

- Use the following formula for calculating nonvolatile in vehicle (NVV): $NV V = \frac{N - P}{100 - P} \times 100$. Where: N = percent of nonvolatile content as determined by ASTM D 2369 and P = percent of pigment content as determined by ASTM D 3723.
- Put approximately 15 fluid ounces of paint in a 1 pint lined container, close the container, seal it with tape and put it in an oven maintained at $140\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$ for 7 days. Equilibrate the paint at $77\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$ and mix thoroughly with gentle stirring. Perform consistency test as specified in ASTM D 562. Consistency must not vary by ± 10 KU from the initial viscosity.
- Apply paint at 15 mils wet per ASTM D 2805 over a 2A Leneta Chart. Immediately and carefully lay the applied film horizontally in a refrigerator that maintains a temperature of $35\text{ }^{\circ}\text{F}$. After 24 hours, remove the applied film and inspect. Paint film must show no cracks when held at arm's length and observed by the naked eye.

1 9-29.2(5) TEMPORARY PAVEMENT MARKING PAINT

2 Paint used for temporary pavement marking must be as specified in Section 9-29.2.

3 9-29.3 PLASTIC

4 White and yellow plastic pavement marking materials must comply with the Specifications for:

- 5 1. Type A – Liquid hot applied thermoplastic
- 6 2. Type B – Pre-formed fused thermoplastic
- 7 3. Type C – Cold applied pre-formed tape
- 8 4. Type D – Liquid cold applied methyl methacrylate

9 For black, the color must closely match Federal Standard 595, color number 37038, and must be chosen from a WSDOT
10 QPL-listed manufacturer for white or yellow plastic. Black plastic must comply with Sections 9-29.3(2), 9-29.3(3), and 9-29.3(4)
11 for yellow, except for retroreflectance.

12 9-29.3(1) TYPE A – LIQUID HOT APPLIED THERMOPLASTIC

13 Type A material consists of a mixture of pigment, fillers, resins, and glass beads that is applied to the pavement in the
14 molten state by extrusion or by spraying. The material can be applied at a continuously uniform thickness or it can be applied
15 with a profiled pattern. Glass beads, intermixed and top dress, must conform to the manufacturer's recommendations
16 necessary to meet the retroreflectance requirements. Type A material must conform to AASHTO M 249 and the following:

- 17 1. Resin – The resin must be alkyd or hydrocarbon.
- 18 2. Retroreflectance – ASTM E 1710

19 Newly applied pavement markings must have a minimum initial coefficient of retroreflective luminance of $250 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$ for white and $175 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$ for yellow per ASTM E 1710 when measured with a 30-meter retroreflectometer.
20 Retroreflectivity will be measured for compliance with a Delta LTL-X retroreflectometer.

- 21 3. Skid Resistance – ASTM E 303
- 22 45 BPN units minimum

23 The material will have a thickness of 125 mils. A thickness tolerance not exceeding 10 percent will be allowed.

25 9-29.3(2) TYPE B – PRE-FORMED FUSED THERMOPLASTIC

26 Type B material consists of a mixture of pigment, fillers, resins, and glass beads that is factory produced in sheet form.
27 The material is applied by heating the pavement and top heating the material. The material must contain intermixed glass
28 beads. The material must conform to AASHTO M 249, with the exception of the relevant differences for the materials being
29 applied in the pre-formed state and the following:

- 30 1. Resin – The resin must be alkyd or hydrocarbon.

31 The sample material submitted for approval must be fused to a suitable substrate prior to performing the following
32 tests.

- 33 2. Retroreflectance – ASTM E 1710

34 The fused samples must have a minimum initial coefficient of retroreflective luminance of $250 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$ for white
35 and $175 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$ for yellow per ASTM E 1710 when measured with a 30-meter retroreflectometer. Retroreflectivity
36 will be measured for compliance with a Delta LTL-X retroreflectometer.

- 37 3. Skid Resistance – ASTM E 303
- 38 60 BPN units minimum

39 The blue color must match Federal Standard 595, color number 35180, and the tolerance of variation must match that
40 shown in the FHWA Highway Blue Color Tolerance Chart.

41 The red color must match Federal Standard 595, color number 11136, and the tolerance of variation must match that
42 shown in the FHWA Highway Red Color Tolerance Chart.

43 All Type B material pavement markings must have a thickness of 125 mil and include heat indicators. Heat indicators
44 must be included on the top surface of the material (bead side) and must have regularly spaced indents. These indents will act
45 as indicators for determining the correct amount of heat application and will close upon application when heated to the proper
46 molten state. Type B material must be slip resistant. The approved Type B Material Supplier is PreMark® material with
47 ViziGrip®, manufactured by Ennis-Flint, 115 Todd Court, Thomasville, NC 27360.

48 9-29.3(3) TYPE C – COLD APPLIED PRE-FORMED TAPE

49 Type C material consists of plastic pre-formed tape that is applied cold to the pavement. The tape must be capable of
50 adhering to new and existing hot mix asphalt or cement concrete pavement. If the tape manufacturer recommends the use of a
51 surface primer or adhesive, use a type approved by the pavement marking manufacturer. The tape must also be capable of
52 being inlaid into fresh hot mix asphalt during the final rolling process. The material is identified by the following designations:

53 Type C-1 tape has a surface pattern with retroreflective elements exposed on the raised areas and faces and intermixed
54 within its body and must conform to ASTM D 4505, Reflectivity Level I, Class 2 or 3, Skid Resistance Level A.

1 Type C-2 tape has retroreflective elements exposed on its surface and intermixed within its body and must conform to
2 ASTM D 4505, Reflectivity Level II, Class 2 or 3, Skid Resistance Level A.

3 9-29.3(4) TYPE D - LIQUID COLD APPLIED METHYL METHACRYLATE

4 Type D material consists of a two part mixture of methyl methacrylate and a catalyst that is applied cold to the pavement.
5 The material can be applied at a continuously uniform thickness or it can be applied with profiles (bumps). The material is
6 classified by Type designation, depending upon the method of application. Type D-1 material is to be applied by hand
7 operated extrusion device, pouring or hand troweling. Type D-2 and D-5 material must be applied by spraying. Type D-3 and
8 D-4 material must be applied by machine extrusion.

9 Glass beads must conform to the manufacturer's recommendations necessary to meet the retroreflectance requirements.
10 Type D-1, D-2, D-3, D-4, and D-6 material must have intermixed glass beads in the material prior to application. Type D-5
11 material must have glass beads injected into the material at application and a second coating of top dressing beads applied
12 immediately after material application.

13 Type D materials must conform to the following:
14

| Type D – Liquid Cold Applied Methyl Methacrylate Properties | | | | | |
|---|-------------------------|--------------------------|------|--------------------------|------|
| Property | Test Method | White | | Yellow | |
| | | Min. | Max. | Min. | Max. |
| Adhesion to PCC or HMA, psi | ASTM D4541 ¹ | 200 or substrate failure | -- | 200 or substrate failure | -- |
| Chemical Resistance | 2 | No Effect | | No Effect | |
| Hardness | ASTM D2240 ³ | 50 | -- | 50 | -- |
| No Track Time | ASTM D711 ⁴ | -- | 30 | -- | 30 |
| Skid Resistance, BPN | ASTM E303 | 45 | -- | 45 | -- |
| Tensile Strength, psi | ASTM D638 | 125 | -- | 125 | -- |

15 NOTES:

- 16 1. Part A and B mixed, applied at 60 mils thickness.
- 17 2. Cured markings must be resistant to calcium chloride, sodium chloride, fuels, oils, and UV effects. Cure 3 days for
18 motor oil, gas, diesel, ATF, salt, and anti-freeze.
- 19 3. Shore Durometer Type D and measurement made after 24 hours.
- 20 4. Sample applied at 40 mils.

21
22 Type D liquid cold-applied methyl methacrylate must comply with the following formulations:

- 23 1. 4:1 Formulation Type D – Liquid Cold Applied Methyl Methacrylate
 - 24 a. Type D-1 – 1 gallon of methyl methacrylate and 3 fluid ounces of benzoyl peroxide powder (by weight).
 - 25 b. Type D-2, D-3, D-4, and D-5 – 4 parts methyl methacrylate and 1 part liquid benzoyl peroxide (by volume).
- 26 2. 98:2 Formulation Type D – Liquid Cold Applied Methyl Methacrylate
 - 27 a. Type D-1 – 1 gallon of methyl methacrylate and 3 fluid ounces of benzoyl peroxide powder (by weight).
 - 28 b. Type D-2, D-3, D-4, D-5, and D-6 – 98 parts methyl methacrylate and 2 parts liquid benzoyl peroxide (by volume).

29
30 Type D liquid cold applied methyl methacrylate must meet the following requirements for viscosity:
31

| 4:1 Formulations Type D – Liquid Cold Applied Methyl Methacrylate | | | | | | | | | | | | | |
|---|-------------------------------|--------|--------|--------|--------|--------|--------|-------|--------|-----------|-------|------------|--------|
| Property | Test Method | D-1 | | D-2 | | D-3 | | D-4 | | D-5 White | | D-5 Yellow | |
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| Viscosity cP @ 77°F, 50-rpm, spindle #7 | ASTM D2196 Method B, LV Model | 11,000 | 15,000 | 26,000 | 28,000 | 17,000 | 21,000 | -- | -- | -- | -- | -- | -- |
| Viscosity cP @ 77°F, 50-rpm, spindle #4 | ASTM D2196 Method B, LV Model | -- | -- | -- | -- | -- | -- | 8,000 | 10,000 | 5,000 | 8,000 | 7,000 | 11,000 |

| 98:2 Formulations Type D – Liquid Cold Applied Methyl Methacrylate | | | | | | | | | | | | | |
|--|-------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Property | Test Method | D-1 | | D-2 | | D-3 | | D-4 | | D-5 | | D-6 | |
| | | Min. | Max. |
| Viscosity Daniel Scale | Daniel Method ¹ | 12 | 14 | 6 | 12 | 12 | 14 | 13 | 15 | -- | -- | -- | -- |
| Viscosity cP @ 77°F, 50-rpm, spindle #4 | ASTM D2196 Method B, LV Model | -- | -- | -- | -- | -- | -- | -- | -- | 100 | 118 | -- | -- |

NOTE:

1. Follow Daniel Gauge method; measure flow at 60-seconds.

9-29.4 GLASS BEADS FOR PAVEMENT MARKING MATERIALS

Glass beads for traffic marking paint must be coated with silicone for moisture resistance and a silane to promote adhesion. The beads must be transparent, clean, colorless glass; smooth and spherically shaped; and free from milkiness, pits, or excessive air bubbles.

Glass beads used with plastic traffic markings must be per the manufacturer's recommendations.

The glass beads for paint and plastic traffic markings must not contain any metals in excess of the following established total concentration limits when tested per the listed test methodology:

| Metal Concentration Limits | | |
|----------------------------|-----------------|------------------------|
| Element | Test Method | Max. Parts Per Million |
| Arsenic | EPA SW846 6010C | 5.0 |
| Barium | EPA SW846 6010C | 100.0 |
| Cadmium | EPA SW846 6010C | 1.0 |
| Chromium | EPA SW846 6010C | 5.0 |
| Lead | EPA SW846 6010C | 50.0 |
| Selenium | EPA SW846 6020A | 1.0 |
| Silver | EPA SW846 6010C | 5.0 |
| Mercury | EPA SW846 7471B | 0.20 |

Glass beads for pavement marking materials must meet the following requirements for quality:

| Glass Bead Property | Test Method | Type A | | Type B ¹ | |
|--------------------------------|----------------------------|-----------------------|------|--|------|
| | | Min. | Max. | Min. | Max. |
| Refractive Index @ 77 ± 9 °F | AASHTO M 247 Section 5.2.3 | 1.50 | 1.55 | 1.50 | 1.55 |
| Moisture Resistances | AASHTO M 247 Section 5.3.2 | Flow Without Stopping | | Flow Without Stopping | |
| Adherence | AASHTO M 247 Section 5.3.4 | Pass | | Pass | |
| Roundness, % | ASTM D1155 | 70 | -- | 80 ² | -- |
| | FLHT 520 | -- | -- | 80 ³ | -- |
| Appearance | TT-B-1325D Section 4.3.1 | -- | -- | Beads must be transparent, clean, dry, and free from bubbles and foreign matter. | |
| Resistance to Acid | TT-B-1325D Section 4.3.6 | -- | -- | Beads must not develop any surface haze or dulling. | |
| Resistance to Calcium Chloride | TT-B-1325D Section 4.3.7 | -- | -- | Beads must not develop any surface haze or dulling. | |

| Glass Bead Property | Test Method | Type A | | Type B ¹ | |
|------------------------------|-----------------------------|--------|------|--|------|
| | | Min. | Max. | Min. | Max. |
| Resistance to Sodium Sulfide | TT-B-1325D Section 4.3.8 | -- | -- | Sodium sulfide must not darken the beads. | |
| Water Resistance | TT-B-1325D Section 4.3.9 | -- | -- | Water must not produce haze or dulling of the beads. | |

NOTES:

1. WSDOT Type B Glass Beads are high-performance glass beads for improved retroreflectivity and durability for high-performance pavement markings. A minimum of 50 percent of the glass beads must be made from the direct-melt molten kiln process.
2. Roundness will be determined on material < No. 30 sieve.
3. Roundness will be determined on material ≥ No. 30 sieve.

Glass beads for pavement marking materials must meet the following grading requirements when tested per ASTM D1214:

| Sieve Size | Percent Passing | | | |
|------------|---------------------|------|--------|------|
| | Type A ¹ | | Type B | |
| | Min. | Max. | Min. | Max. |
| No. 14 | | | 100 | |
| No. 16 | 100 | | | |
| No. 18 | | | 65 | 80 |
| No. 20 | 95 | 100 | | |
| No. 30 | 75 | 95 | 30 | 50 |
| No. 50 | 15 | 35 | 0 | 5 |
| No. 100 | 0 | 5 | | |

NOTE:

1. Same gradation as AASHTO M 247 Type 1.

9-29.5 TEMPORARY PAVEMENT MARKING TAPE

Temporary pavement marking tape must be pressure sensitive, reflective type, conforming to ASTM D 4592, designed for application on asphalt or concrete pavement. Biodegradable tape with paper backing must not be allowed. Surface preparation and application must be in conformance with all the manufacturer's recommendations.

9-29.6 TEMPORARY RAISED PAVEMENT MARKERS

Temporary flexible raised pavement markers must consist of an L shaped body with retroreflective tape on the top of one face for one-way traffic and reflective tape on the top of both faces for two-way traffic. The marker body must be made from 0.060-inch minimum thick polyurethane. The top of the vertical leg must be between 1.75 and 2.0 inches high and must be approximately 4 inches wide. The base width must be approximately 1.125 inches wide. The base must have a pressure sensitive adhesive material, a minimum of 0.125 inches thick with release paper. The reflective tape must be a minimum of 0.25" x 4" wide. The reflective tape must have a minimum reflectance of 3.5 candlepower per foot-candle for white and 2.5 candlepower per foot-candle for yellow measured at 0.2-degree observation angle and 0-degree entrance angle.

Temporary raised pavement markers except temporary flexible raised pavement markers must be as specified in Section 8-08.2.

9-29.7 FIELD TESTING**9-29.7(1) REQUIREMENTS**

Field performance evaluation is required for low VOC solvent-based paint per Section 9-29.2(3), standard waterborne paint and high-build water borne paint per Section 9-29.2(4), Type A – liquid hot applied thermoplastic per Section 9-29.3(1),

1 Type B – preformed fused thermoplastic per Section 9-29.3(2), Type C – cold applied preformed tape per Section 9-29.3(3),
2 and Type D – liquid applied methyl methacrylate per Section 9-29.3(4).

3 Testing on a northern AASHTO National Transportation Product Evaluation Program (NTPEP) pavement marking test
4 deck is recommended. Test decks conducted by other public entities may be considered provided they produce data similar to
5 a northern NTPEP test deck. Retroreflectivity, Durability, and Auto No-Track must conform to the following requirements after
6 being installed on a northern NTPEP test deck for a minimum of 12 months.

7 Successful use of a product in 5 other States may be considered in lieu of the field test requirement.

8 Cold weather waterborne traffic paint per Section 9-29.2(4) will be accepted based solely on the laboratory testing.

9 **9-29.7(1)A RETROREFLECTIVITY**

10 Retroreflectivity is measured as a coefficient of retroreflective luminance (RL) per ASTM E 1710 for 30-meter geometry.
11 The minimum initial retroreflectivity is 250 mcd·m⁻²·lx⁻¹ for white and 175 mcd·m⁻²·lx⁻¹ for yellow, except Type C preformed
12 tape must meet the minimum initial values in ASTM D 4505. The minimum retroreflectivity after 12 months is 150 mcd·m⁻²·lx⁻¹
13 for white and 100 mcd·m⁻²·lx⁻¹ for yellow, when measured in the skip line area. However, the Engineer will review the results
14 of each test deck to determine the minimum value in effect for that deck, in order to approve only the better-performing
15 materials.

16 **9-29.7(1)B DURABILITY**

17 Durability rating must be a minimum of 7 in the skip line area and 6 in the wheel paths after 12 months. The rating
18 system used will be as indicated by NTPEP procedures. However, the Engineer will review the results for each test deck to
19 determine the minimum value in effect for that deck, in order to approve only the better-performing materials.

20 **9-29.7(1)C AUTO NO-TRACK TIME**

21 Auto No-Track Time will only be required for low VOC solvent-based paint per Section 9-29.2(3), and standard
22 waterborne paint and high-build water borne paint per Section 9-29.2(4).

23 No-track time must be determined per NTPEP procedures by passing over an applied test line with a standard size
24 passenger car without tracking of the line when viewed from a distance of 50 feet. Standard paint must have a no-track time of
25 90 seconds or less when applied at a wet film thickness of 15 ± 1 mL, with glass beads applied at a minimum rate of 6 pounds
26 per gallon of paint. High-build paint must have a no-track time of 120 seconds or less when applied at a wet film thickness of
27 20 to 30 mL, with glass beads applied at a minimum rate of 10 pounds per gallon of paint. The maximum no-track time must
28 not be exceeded when the pavement temperature is between 50 °F and 120 °F, with relative humidity less than 85 percent,
29 and the pavement is dry.

30 **9-29.7(1)D APPROVAL**

31 The Engineer will evaluate the results of laboratory and test deck data. This information will be reviewed for each
32 material by color and roadway surface to determine compliance with this Specification. Approved product formulas will remain
33 active for a period of approximately 5 years after completion of the NTPEP evaluation; afterwards, the product will need to be
34 reevaluated.

35 **SECTION 9-30 WATER DISTRIBUTION AND TRANSMISSION MATERIALS**

36 **9-30.0 GENERAL**

37 All Materials for water distribution and transmission must be new. Materials used for temporary Water Main and for
38 temporary service connection purposes may be either new or previously used materials and is subject to SPU's Water
39 Operations inspection and approval prior to installation.

40 Prior to ordering any pipe to be used in a potable water supply, the Contractor must submit the Material source as
41 required by Section 1-06.1 and must obtain the Engineer's approval.

42 All direct and indirect drinking water system components which come in contact with potable water must have National
43 Sanitation Foundation certification.

44 **9-30.1 PIPE**

45 All pipe and fittings must be clearly marked with the manufacturer's name, type, class, and thickness as applicable and
46 must be marked on the component at the place of manufacture. Marking must be legible and permanent under normal
47 conditions of handling and storage.

48 **9-30.1(1) DUCTILE IRON PIPE**

49 1. Ductile iron pipe must be centrifugally cast in 18 or 20-foot nominal lengths and must be marked conforming to
50 AWWA C151. Ductile iron pipe must have a double thick cement-mortar lining conforming to AWWA C104. Ductile
51 iron pipe must be Standard Thickness Class 52.

52 Flanged ductile iron pipe must be CL 53 per AWWA C115.

53 Thicker Classes are acceptable.

- 1 2. Non-restrained joints must be rubber gasket, push-on type, or mechanical joint conforming to AWWA C111.
- 2 3. Restrained joints must be as specified in Section 9-30.2(6).
- 3 4. Special coatings must be as specified in Section 9-30.1(4).
- 4 5. Ductile Iron pipe must meet SPU's taste and odor test requirements.

5 **9-30.1(2) STEEL PIPE**

6 **9-30.1(2)A STEEL PIPE LESS THAN 4 INCHES DIAMETER**

7 Steel pipe less than 4 inches in diameter must conform to ASTM A 53, schedule 40 and must be hot dip galvanized
8 inside and out, including the couplings. The pipe sections must be coupled by malleable iron screw coupling per ANSI
9 Specification B16.3.

10 **9-30.1(2)B STEEL PIPE 4 INCH DIAMETER AND LARGER**

11 Steel pipe 4 inches in diameter and larger must conform to AWWA C200. The type of protective coating and lining and
12 other supplementary information required by AWWA C204 will be included in the Contract.

13 **9-30.1(3) PLASTIC PIPE AND ASBESTOS CEMENT PIPE**

14 PVC, polyethylene, polybutylene, and asbestos cement material pipe must not be used as Water Main to convey potable
15 water.

16 **9-30.1(4) PIPE COATINGS**

17 **9-30.1(4)A SPECIAL PIPE COATINGS**

18 Special pipe coatings must be as specified in the Contract.

19 **9-30.1(4)B MULTI LAYERED POLYETHYLENE TAPE COATING (MULTI-LAYERED POLYETHYLENE**
20 **ENCASEMENT)**

21 See Section 9-30.1(4)D for polyethylene (film wrap) encasement.

22 Acceptable Suppliers of multi layered polyethylene tape coating must be Polyken YGIII as manufactured by Seal For Life
23 Industries, or Tapecoat CT 10/40 W as manufactured by Tapecoat Company, or approved equal. The multi layered
24 polyethylene tape coating must conform to AWWA C214, and must comply with the following:

- 25 1. The multi layered polyethylene tape coating system must consist of the following components:
 - 26 a. One layer of pipeline coating primer and 20 mil inner wrap.
 - 27 b. One layer of pipeline wrap coating, 30 mils minimum thickness.
 - 28 c. One additional layer of outer wrap coating, 30 mils minimum thickness.
- 29 2. The primer must be fast drying and must form an instantaneous, firm bond when the adhesive on the tape coating
30 comes in contact with the primed pipe surface. Coating primer must be compatible with the adhesive and must be
31 from the same manufacturer.
- 32 3. The inner wrap coating must consist of polyethylene backing with a butyl-based adhesive laminated to one side of the
33 backing. The polyethylene backing and adhesive must be made by the calendaring process in order to ensure the
34 maximum bonding of the adhesive to the backing. The adhesive must be formulated so that it forms a firm bond upon
35 contact with the primed pipe surface.
- 36 4. The pressure sensitive adhesive outer wrap must consist of a polyethylene backing with a butyl-adhesive laminated
37 to one side of the backing. The pressure sensitive adhesive on the outer wrap must form a firm continuous bond to
38 the backing of the tape coating.
- 39 5. Cutbacks on the spigot end must be 6 inches or less and must be made with a cutting device that is guided from the
40 end of the pipe to ensure a straight, uniform cutback. Cutbacks must not be made on the bell end of the pipe.
- 41 6. Following the application of the outer wrap, the coating must be electrically tested for holidays with a pulse tape
42 holiday detector. The detector voltage range for this coating is 7000-9800 volts. The testing must conform to NACE
43 RP-02-74.
44 All defects electrically detected must be repaired by priming and patching with a suitable primer and tape as specified
45 by the manufacturer and approved by the Engineer.
- 46 7. Accessory Tape. Accessory tape for fittings and specials must be YG III as manufactured by Seal For Life Industries,
47 or approved equal. The accessory tape must conform to AWWA C209, and must comply with the following:
 - 48 a. One layer of pipeline coating primer and 50 mil inner wrap.
 - 49 b. One layer of 35 mil outer wrap.

50 The primer must be fast drying and must form an instantaneous, firm bond when the adhesive on the tape coating comes
51 in contact with the primed pipe surface.

1 The pressure sensitive adhesive outer wrap must consist of a polyethylene backing with a butyl adhesive laminated to
 2 one side of the backing. The pressure sensitive adhesive on the outer wrap must form a firm continuous bond to the backing of
 3 the tape coating.

4 **9-30.1(4)C THERMOPLASTIC POWDER COATING**

5 **9-30.1(4)C1 GENERAL**

6 The powdered thermoplastic Material must consist of acid modified polyolefin elastomer to which any stabilizers,
 7 pigments, or other additives necessary to comply with this Specification have been added by extrusion compounding. The
 8 thermoplastic powder must be suitable for factory application by fluid bed dipping, and or elastic/flock deposition method. For
 9 on-site application, other application methods such as controlled flame spraying are acceptable if carried out by an approved
 10 applicator. When applied to a substrate per the guidelines agreed by the manufacturers and approved applicators, the powder
 11 must form a coating that meets or exceeds this Specification.

12 **9-30.1(4)C2 QUALITY OF DUCTILE IRON PIPE**

13 Surface preparation, application, and curing of powder coating, and testing and touch up of coating must be performed
 14 by an experienced applicator. An experienced applicator is defined as having working knowledge of and experience with:

- 15 1. Surface preparation/blasting of a ductile iron pipe.
- 16 2. Application and curing of thermoplastic powder coating.
- 17 3. Quality assurance testing including:
 - 18 a. Mil thickness measurement,
 - 19 b. Profile measurement,
 - 20 c. Anchor and adhesion testing,
 - 21 d. Holiday testing, and
 - 22 e. Temperature monitoring, and
- 23 4. Manufacturer approved touch-up repairs.

24 **9-30.1(4)C3 SURFACE PREPARATION**

25 The pipe and fittings must be prepared for coating by blasting the pipe surface to remove impurities and imperfections.
 26 The existing pipe surface profile must not change by more than 2 to 3 mils. Preparation must consist of the following:

- 27 1. Before blast cleaning, remove all visible grease, asphalt coating, oil, slag, burs, and other protrusions resulting in a
 28 smooth substrate conforming to curvature. When a solvent is used, all solvent residue must be removed;
- 29 2. Bevel all sharp edges and corners;
- 30 3. Do not use steel shot or other non-angular blast material; and
- 31 4. Use clean, dry, oil-free air for nozzle blasting.

32 When surface preparation is complete and the surface is viewed without magnification, staining, oil, grease, dirt, dust,
 33 rust, pre-existing coating, loose oxides, and any other contaminant must not be visible. The prepared Material must be
 34 maintained clean for the coating.

35 **9-30.1(4)C4 APPLICATION OF POWDER COATING**

36 **Powder Coating:** Use PPA 571 thermoplastic powder coating as manufactured by Plascoat Systems Limited or an
 37 approved equal.

38 **Masking and Plugging:** All masking, where required, must be done using a high powder coating masking tape. The
 39 ends of pipe and fittings must be plugged both during heating in the oven, and during the coating process to keep the interior
 40 mortar lining cooler and to keep the powder coating from passing beyond the groove where the gasket is to be installed in the
 41 bell end of the pipe or fitting.

42 **Preheating:** All parts must be preheated to a maximum temperature of 240 °F before coating is applied.

43 A Raytek RAYNGER ST SERIES noncontact infrared temperature measurement tool or similar device must be used for
 44 determining coating temperature.

45 Preheating must be done using a gas fired convection oven or equivalent.

46 **Coating with Electrostatic Deposition:** After the part has been preheated to the 240 °F temperature followed by the
 47 powder application to the surface of the part using a corona powder coating discharge gun, a negative polarity is required and
 48 a voltage of 30kv is recommended. The powder is applied across the total surface of the part, taking care that the powder is
 49 applied in a level and homogenous build. The coating must be applied to a dry film thickness of 20 to 25 mils and be totally
 50 free of holidays/pinholes.

51 It is then necessary to convey the part to the oven which must be set between 285 °F and 385 °F in order to complete
 52 flowing out of powder.

53 The coating must be smooth, even and free of runs, sags, streaks, and overspray.

1 **Coating with Fluid Bed Dip System:** After the part has been preheated to 240 °F, the part is then dipped into a fluidized
2 bed of powder and left for a prescribed time to accomplish a coating thickness of 20 to 25 mils.

3 The part must be conveyed to the oven for a complete flowing of the powder.

4 The coating must be smooth, even, and free of runs, sags, streaks, and overspray.

5 **9-30.1(4)C5 TESTING**

6 **Holidays:** After completing the coating process, the part must be cooled to ambient temperature and then electrically
7 tested for holidays with a Tinker & Rasor AP/S1 holiday detector or equivalent. The voltage must not exceed 6kv for a 25 mil
8 coating. The testing must conform to NACE RP 02 74. All defects electrically detected must be repaired as specified in Section
9 9-30.1(4)C6.

10 **Thickness:**

11 Each coated part must be tested for coating thickness using an electronic coating thickness gauge such as Qua Nix 1500
12 or equivalent and the test results as specified in Section 1-06.5 must be submitted to the Engineer within 3 Working Days of
13 the testing.

14 **9-30.1(4)C6 FIELD REPAIR AND TOUCH UP**

15 Damaged coating or repair of cutback areas may be repaired after proper substrate preparation. Exposed substrate must
16 be thoroughly cleaned of corrosion products and contamination to expose bare metal. Abrasive techniques (such as wire
17 brush, sandpaper, and sandblast) followed by cleaning with mineral spirits, acetone, or alcohol are recommended.
18 Immediately after cleaning apply heat to the coating adjacent to the damaged area to re-melt and flow the coating over the
19 damaged area. If required, additional PPA571 powder may be added and melted to insure proper installation of a homogenous
20 protective coating of sufficient thickness.

21 Major repairs (large areas) may require a specialized Subcontractor with proper training and equipment to complete a
22 fault holiday free field repair. If that Subcontractor or the Contractor determine, or if the Engineer determines, that the level of
23 damage is such that a fault holiday free repair cannot be attained, then the Contractor must remove and replace the damaged
24 item.

25 **9-30.1(4)C7 MATERIAL REQUIREMENTS**

26 **Test Conditions:** Unless otherwise specified in the Contract, the testing conditions must be per ASTM D 3924 at
27 standard Conditions: 73.5 °F \pm 3.5 °F, 50 percent \pm 5 percent relative humidity.

28 **Specific Gravity:**

29 Specific gravity of the powder thermoplastic coating Material must be between 0.90 and 0.97. Specific gravity must be
30 determined per method B specified in ASTM D 729.

31 **Color:** Color of the thermoplastic powder coating must be specified by the purchaser and evaluated for conformance per
32 ASTM D 1729.

33 **Flexibility:** The thermoplastic powder coating must exhibit no cracking, peeling, or loss of adhesion when bent (coated
34 side in tension) 180 degrees over a conical mandrel per ASTM D 522, Test Method B. Panels must be examined immediately
35 after bending.

36 **Adhesion:** The thermoplastic powder coating must exhibit a minimum of 1000 psi adhesion to the aluminum and steel
37 substrates per ASTM D 4541.

38 **Thermal Shock Resistance:** The applied thermoplastic powder coating must withstand 10 temperature cycles without
39 cracking, checking, or disbonding. Cycles must be from + 104 °F to -40 °F.

40 **Impact Resistance:** The applied thermoplastic powder coating must resist minimum direct and reverse impacts of 36
41 inch pounds without cracking, disbonding, or holiday formation as determined by visual inspection. Test panels must be
42 impacted per ASTM D 2794 using a 2 pound weight with a 0.5-inch diameter indenter dropped from a height of 18 inches.

43 **Abrasion Resistance:** Weight loss from the applied thermoplastic powder must not exceed 90 milligrams. Test panels
44 must be tested for 1000 cycles using a Taber Abrader apparatus with CS 17 wheels and 1000 gram weights per ASTM D
45 4060. Weight loss must be determined immediately after test to 3 significant figures.

46 **Salt Spray Resistance-Unscribed:** There must be no blisters, wrinkles or loss of adhesion nor any general surface
47 corrosion or pitting after 1000 hours of salt spray exposure.

48 **Salt Spray Resistance-Scribed:** There must be no blisters, wrinkles nor any general surface corrosion or pitting after
49 1000 hours of salt spray exposure. There must be no more than 10mm loss of adhesion from a scribed line after 1000 hours of
50 salt spray exposure.

51 **Fluid Resistance Properties:** The applied thermoplastic powder coatings must exhibit no objectionable alteration to the
52 surface such as discoloration, change in gloss, blistering, softening, loss of adhesion, or formation of holidays or special
53 phenomena after immersion for 7 Days per ASTM D 1308 in the following fluids.

- 54 1. Distilled water.
- 55 2. Type III hydrocarbon (per Federal Spec. TT-S-735).
- 56 3. Hydraulic fluid (per Mil-H-83282).

1 **Chemical Resistance:** The applied thermoplastic coating must exhibit no objectionable alteration to the surface such as
 2 discoloration, change in gloss, blistering, softening, loss of adhesion, or formation of holidays or special phenomena after
 3 immersion for 7 Days per ASTM D 1308 in the following chemical solutions:

- 4 a. 3M aqueous CaCl₂.
- 5 b. 3M aqueous NaOH.
- 6 c. Saturated aqueous Ca(OH)₂.
- 7 d. Aqueous solution of H₂SO₄ (specific gravity = 1.29 ± 0.02).

8 **Dielectric Strength:** The applied thermoplastic coating must have a dielectric strength of 900 ± 100 v/mil at 15 mil per
 9 ASTM D 149.

10 **Weathering Properties:** The applied thermoplastic coating must exhibit the following resistance to weathering:

- 11 1) Accelerated weathering. The applied thermoplastic powder coating must show no cracking, significant color change
 12 (fade), chalking, Blistering, wrinkling or loss of adhesion, nor must there be any evidence of substrate corrosion after
 13 2000 hours exposure to accelerated weathering per ASTM G 53 using UVB-313 fluorescent lamps. The coating, must
 14 exhibit no more than 30 percent loss in 60 degree specular gloss after exposure.
- 15 2) Humidity resistance. Test panels must be exposed to a 120 °F ± 2 °F, 100 percent relative humidity environment per
 16 ASTM D 2247 for 30 Days. The coating must not show blistering, wrinkling, or loss of adhesion and there must be no
 17 evidence of substrate corrosion after humidity exposure.
- 18 3) Holidays. The applied thermoplastic powder coating must be free of holidays at an application thickness of 20 to 25
 19 mil. holiday detection must be performed with a low voltage (75 to 100 volts) direct current detector.
- 20 4) Shelf life. Powder coating Materials must meet the requirements of the Owner, with a minimum of 2 years from the
 21 date of manufacture when stored below 85 °F, 50 percent relative in the unopened original container.

22 MSDS must be provided to the Engineer.

23 **9-30.1(4)D POLYETHYLENE ENCASUREMENT (FILM WRAP)**

24 Plastic film wrap for polyethylene encasement must be 8 mil polyethylene conforming to AWWA C105.

25 See Section 9-30.1(4)B for multi-layered polyethylene encasement.

26 **9-30.1(4)E HEAT SHRINK JOINT SLEEVE**

27 The sleeve must be Aqua Shield, or approved equal. The sleeve must be a wraparound type with a joint closure and
 28 must contain a thermal indicator.

29 **9-30.1(4)F WAX TAPE COATINGS**

30 Petrolatum-impregnated wax tape coating must conform to AWWA C217. Acceptable products are:

- 31 1. #1 Wax-Tape as manufactured by The Trenton Corporation, Ann Arbor, MI, or
- 32 2. Densyl Tape as distributed by Denso North America Inc., Houston, TX, or
- 33 3. Approved equal.

34 See Section 7-11.3(8)A for field application construction requirements.

35 **9-30.2 FITTINGS**

36 **9-30.2(1) DUCTILE IRON PIPE**

37 Fittings for ductile iron pipe must be ductile iron conforming to AWWA C110, and AWWA C111 or AWWA C153 and must
 38 be cement mortar lined conforming to AWWA C104.

39 Except where restrained joint systems are required, fitting joints must be mechanical joint.

40 Where restrained joint pipe is required, threaded flanges by restrained joint adapters must not be longer than 3 pipe
 41 diameters. Threaded flanges and pipe must conform to AWWA C115. The exterior flange lip overlapping the pipe barrel must
 42 be sealed with a bituminous mastic.

43 Sleeves less than 12 inches in diameter must be 12 inches minimum length and must be mechanical joint.

44 Sleeves greater than 12 inches in diameter must be of the long body type and must be 15 inches minimum length and
 45 must be mechanical joint.

46 Where ductile iron pipe is to be joined to existing cast iron pipe of the same nominal size, and electrical isolation is not
 47 required at the connection, and the outside diameter of the existing cast iron pipe varies 0.05 inches or less from the specified
 48 outside diameter of the ductile iron pipe being joined, the pipe must be joined with a mechanical joint sleeve.

49 Where 10-inch through 24-inch diameter ductile iron pipe is to be joined to existing cast iron pipe of the same nominal
 50 size, and electrical isolation is not required at the connection, and the outside diameter of the existing cast iron pipe conforms
 51 to AWWA 1908 classifications A, B, C, or D, the pipe must be joined with a transition mechanical joint sleeve having a single
 52 piece body.

1 Where 8-inch or smaller diameter ductile iron pipe is to be joined to existing cast iron pipe of the same nominal size, and
2 electrical isolation is not required at the connection, and the outside diameter of the existing cast iron pipe conforms to AWWA
3 1908 classifications A, B, C, D, E, or F, the pipe must be joined with a transition mechanical joint sleeve having a single piece
4 body.

5 Hub by flange fitting length must conform to AWWA C110 or AWWA C153. The body of hub by flange fittings must be a
6 single piece casting. Do not use threaded pipe and flange combinations.

7 **9-30.2(2) STEEL PIPE**

8 Fittings for steel pipe 3-1/2 inches in diameter and smaller must be malleable iron threaded type with a pressure rating of
9 150 psi. Dimensions must conform to ANSI B16.3. Threading must conform to ANSI B2.1 Material must conform to ASTM A
10 47, Grade 32510. All fittings must be banded and hot dip galvanized inside and out.

11 Unions must be malleable iron with a pressure rating of at least 150 psi. Material must conform to ASTM A 47, Grade
12 32510. Unions must be ground joint, bronze to iron type.

13 Steel fittings for pipe 4 inches in diameter and larger must be per AWWA C208. The class of the fittings must be at least
14 the same as that of the pipe. Coatings for couplings and fittings must be factory applied. Field couplings must be compression
15 type. When flanges are required, they must conform to AWWA C207. Buried couplings, bolts and followers must be coated
16 with wax tape per Section 7-11.3(8)A.

17 **9-30.2(3) RESTRAINED JOINTS**

18 Restrained joints, where required on the Drawings, must be flexible after assembly and be able to be disassembled.
19 Restrained joints must meet the following criteria:

- 20 1. The restrained joint must have a positive metal to metal contact locking system without the use of gripping teeth,
- 21 2. The joint restraint system for the pipe must be the same as the joint restraint system for the pipe fittings, except as
22 provided in item 4. below.
- 23 3. The joint restraint system for the pipe must be boltless if the Drawings show joint bonding and,
- 24 4. Where restrained jointed fittings required on the Drawings cannot be furnished, or where restrained jointed fittings are
25 required in areas that are known to be subject to location adjustments, the Contractor may submit a lay plan showing
26 mechanically jointed fittings with Wedge Restraint Glands for approval. Mechanically jointed pipe with Wedge
27 Restraint Glands must not be substituted for restrained jointed pipe.

28 **9-30.2(4) WEDGE RESTRAINT GLANDS**

29 Wedge Restraint Glands must conform to AWWA C111, ASTM A 536-80 Grade 65-45-12. All bolts and wedges must be
30 ductile iron. Wedges must be heat-treated to a minimum 370 BHN. Wedge Restraint Glands must be rated for 350 psi for pipe
31 12 inches in diameter and smaller. All Wedge Restraint Glands must be wax tape encased. Wedge Restraint Glands must be
32 electrically joint bonded if installed on coated Water Main.

33 **9-30.2(5) TRANSITION REDUCING, AND INSULATING FLEXIBLE COUPLINGS**

34 Transition couplings, reducing couplings, transition reducing couplings, sleeves, and flexible insulating couplings for
35 Water Main must be compression type by pipe manufacturer: Romac or Ford or approved equal. Bolts and nuts must be
36 corrosion resistant per AWWA C111. Stainless steel bolts require anti seize compound. The long body pattern with a minimum
37 center ring or center sleeve length of 12 inches for pipe less than 12 inches in diameter and equal to or greater than the pipe
38 diameter for pipe greater than 12 inches in diameter. Solid sleeves (greater than 12-inch diameter) must be a 15-inch
39 minimum length. Factory finish must be fusion bonded epoxy or Plascoat PPA 571 thermoplastic coating.

40 **9-30.2(5)A INSULATING COUPLINGS**

41 Insulating couplings and flange kits must be required at any point of connection of two dissimilar metallic Material pipes
42 (i.e. ductile iron to cast iron) as shown on the Drawings. The insulating coupling body must be coated with either thermoplastic
43 powder coating Plascoat PPA 571 fusion bounded epoxy conforming to AWWA C213, or high build polyamide epoxy
44 conforming to AWWA C210, and must be a liquid coating, potable water grade, capable of 4 to 8 mil dry film thickness per
45 coat, or thermoplastic powder coat per Section 9-30.1(4)C; insulating boot must cover the pipe end to prevent metal contact
46 between pipe sections being joined. The insulating boots and rubber gaskets must be virgin synthetic butyl rubber compatible
47 for potable water service. The nuts and bolts must be stainless steel ASTM F 593, Type 316. The insulating coupling must be
48 manufactured by Romac Industries, Inc., or approved equal.

49 **9-30.2(5)B INSULATING FLANGE KITS**

50 Insulating flange kits must consist of a full face neoprene faced phenolic, type "E" O-ring gasket; insulating sleeves and
51 washers manufactured from glass reinforced epoxy design; and 1/8-inch thick plated, hot rolled steel washers. Acceptable
52 Suppliers are GPT Industries, Wheat Ridge, CO; Central Plastics Co., Shawnee, OK.; or approved equal.

53 **9-30.2(6) RESTRAINED FLEXIBLE COUPLINGS AND SLEEVES**

54 Restrained flexible couplings or sleeves must be as shown on the Drawings. Lengths must comply with the minimums
55 specified in Section 9-30.2(5).

1 9-30.2(7) SPECIAL FITTINGS

2 Special fittings must be as shown on the Drawings.

3 9-30.2(8) TWO INCH BLOWOFF ASSEMBLY

4 2-inch blowoff assembly must be as shown on Standard Plan 340a and 340b at the locations shown on the Drawings.

5 2-inch service tube must be Type K copper. Two-inch gate valve must be of iron body construction, having bronze seat
6 rings and stem, an o ring stem seal system, must be fitted with a 2-inch square operating nut, F.I.P.T. inlet and outlet threading
7 conforming to ANSI B2.1, and must be minimum 150 pounds working water pressure rated. Plastic foam Material must
8 conform to Section 9-30.2(9). Frame and cover must conform to Section 9-30.3(9)H. Meter Box must conform with Section 9-
9 30.5(7).

10 9-30.2(9) PLASTIC FOAM (ETHAFOAM)

11 Plastic foam must be as specified in Section 9-05.10.

12 9-30.2(10) CEMENT CONCRETE

13 Cement Concrete for pipe support saddles and cradles and for thrust blocking must be Class 3000 as specified in
14 Section 6-02.

15 9-30.2(11) STEEL CASING PIPE

16 Steel casing pipe must have a diameter and wall thickness as specified on the Drawings. Pipe must be smooth and bare.

17 9-30.2(12) SEALS AND SPACERS FOR STEEL CASING PIPE**18 9-30.2(12)A SEALS**

19 Casing end seals must be used to completely seal the annular space between the casing and the Water Main at each
20 end of the casing. Casing end seals must provide a moisture proof seal that is resistant to heat, cold, vibration, impact,
21 abrasion, disbonding, expansion and contraction, and must be impermeable. Acceptable seals are standard pull on model S,
22 or custom pull on model C as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.

23 9-30.2(12)B SPACERS

24 Casing spacers must be bands at least 12 inches in width, and must be either stainless steel or heavy-duty fusion
25 bonded epoxy coated steel. Runners must be 2" wide glass reinforced plastic securely bonded to the spacer, and must be
26 aligned on the spacer along the axis of insertion of Water Main into casing pipe. Runner length must approximate the width of
27 the spacer. Securing the spacer to the Water Main must be per the manufacturer's instruction.

28 Acceptable spacers are Pipeline Seal and Insulator, Inc. (PSI) model S12G-2 for stainless steel and model C12G 2 for
29 coated steel, or approved equal.

30 9-30.3 VALVES**31 9-30.3(1) GENERAL MANUFACTURE AND MARKING**

32 The valves must be a standard pattern of a manufacturer whose products are approved by the Engineer and must have
33 the name or mark of the manufacturer, year valve casting was made, size, and working pressure plainly cast in raised and
34 legible letters on the valve body. All valves must be NSF approved and valve bodies must be ductile iron. All valves must be
35 stamped with both NSF APPROVED and DI.

36 Where a valve is required to operate in a higher pressure environment than the Class of valve specified in Section 9-
37 30.3, the class of valve must be as specified in the Contract.

38 9-30.3(2) GATE VALVES**39 9-30.3(2)A GATE VALVES DOUBLE DISC**

40 In addition to 9-30.3(1), gate valves 3-inch through 12-inch must conform to AWWA C500, be equipped with nonrising
41 stems and O-ring stuffing box, and with double disc gates having a bronze wedging device.

42 All gate valves must have a ductile iron body.

43 Valves must open counterclockwise when viewed from above, and must be equipped with a standard AWWA 2-inch
44 square operating nut. Valves must be double disc bronze seated valves if they have iron bodies.

45 3 Manufacturer's Certificates of Compliance copies demonstrating performance tests comply with AWWA C500 must be
46 submitted to the Engineer.

47 Valve ends must be mechanical joint. Where restrained joints are called out, valve ends must be flanged with appropriate
48 flange by restrained joint adapters per Section 9-30.2(1).

49 The valves must be as manufactured by Clow, M & H, American Flow Control (ACIPCo), Pratt/Mueller, M&H/Kennedy, or
50 approved equal in sizes 12 inches or less.

1 Gate valves 2-1/2 inches and smaller must be of ductile iron body construction having bronze seat rings and stem, o ring
 2 seal system, F.I.P.T. (female iron pipe thread) inlet and outlet conforming to ANSI B2.1, a standard AWWA 2-inch operating
 3 nut, and must be minimum 150 pounds water working pressure.

4 The 2-inch and smaller valves must be manufactured by Kennedy, Nibco Scott, Stokum, or approved equal.

5 **9-30.3(2)B GATE VALVES RESILIENT SEAT**

6 Gate valves 3-inch through 12-inch must conform to AWWA C509 and Section 9-30.3(1).

7 **9-30.3(3) BUTTERFLY VALVES**

8 Water Main butterfly valves must be as specified in Section 9-30.3(1), must conform to AWWA C504, and must be Class
 9 150B. The valve must be short body type and must have flanged ends. Flanged ends must be sized and drilled in
 10 conformance with ANSI B16.1 Class 125. Valve must be suitable for direct burial installation; however butterfly valves 12-inch
 11 and larger must be installed within an access vault sized to permit removal and replacement of the valve.

12 All butterfly valve bodies and discs must be ductile iron.

13 Butterfly valves except AWWA C504 Class 150 and butterfly valves installed on water transmission pipeline must be as
 14 specified in the Contract.

15 Where butterfly valves are installed on restrained joint Water Mains, the valve ends must be flanged with flanged by
 16 restrained joint adapters per Section 9-30.2(1).

17 Valves must be mounted on the Water Main or pipeline such that the operating nut is accessible and operable from
 18 above.

19 Operator must be manual, fully enclosed, and suitable for buried service. It must open left (counterclockwise when
 20 viewed from above), and must be equipped with a standard AWWA 2-inch square operating nut.

21 Operators for 16-inch and larger valves must be equipped with external indicators, visible from above, which show the
 22 position of the valve disc.

23 Unless otherwise specified in the Contract, the minimum number of turns from fully open to fully closed on Class 150
 24 butterfly valves must be as follows:

| Diameter | Turns, Min. |
|----------------|-------------|
| 4"-8" | 16 turns |
| 10"-12" | 28 turns |
| 14"-18" | 30 turns |
| 20" | 60 turns |
| 24" | 100 turns |
| 30" | 150 turns |
| 36" and larger | 200 turns |

26
 27 A manufacturer's certificate of compliance stating that the valves to be furnished fully comply with AWWA C504 and the
 28 modifications contained here must be submitted to the Engineer before incorporation of the valve into the Work.

29 Unless the Contract specifies otherwise, bolting and torquing for the valve connection to the Water Main must be as
 30 recommended by the manufacturer including any connection coating requirement when buried in soil. Wearing surfaces must
 31 be bronze or other approved noncorrosive Material and there must be no moving bearing or contact surface of iron in contact
 32 with iron. Rubber seat must be kept in the body and must mate against a stainless steel surface mounted on the disc. Contact
 33 surfaces must be machined and finished in the best workmanlike manner, and all wearing surfaces must be easily renewable.

34 The butterfly valves must be manufactured by Henry Pratt Company, Mueller, DeZurick, Mosser Valve Division of Olsen
 35 Technologies, or approved equal.

36 The valve manufacturer must provide a non-corrosive durable metal tag, measuring 4 inches by 6 inches, or other size
 37 as approved by the Engineer, with the number of turns to fully open/close the valve permanently stamped on the tag. A non-
 38 corrosive high strength durable cord, approximately 18 inches in length, must permanently attach the tag to either the bottom
 39 end of the valve box or the lower section of the valve chamber frame, as applicable.

40 **9-30.3(4) VALVE BOXES**

41 Valve boxes must be installed on all buried valves. The box and lid must be cast iron, 2 piece slip type with cast iron
 42 extension as necessary, conforming to requirements and dimensions of the current Seattle Public Utilities Water Utility
 43 Standards.

44 The cover must have the word "WATER" or the letter "W" cast in it.

45 Valve boxes, lids, and extensions of the following manufacturers are approved for use:

- 1 1. Olympic Foundry, Inc.
- 2 a. 045 Valve Box; Standard Base and Extension
- 3 b. Lid Section # 13-5010
- 4 c. Top Section # 13-5020
- 5 d. Base Section # 13-5021
- 6 2. EJCO Part Numbers
- 7 a. 24-inch Valve Box Complete Assembly - 00366420A01
- 8 b. 30-inch Valve Box Complete Assembly - 00366420A02
- 9 c. 36-inch Valve Box Complete Assembly - 00366420A03.
- 10 d. Lid Section – 00366420
- 11 e. Top section – 00366412
- 12 f. Base Sections:
- 13 1) 24-inch – 85556024
- 14 2) 30-inch – 85556030
- 15 3) 36-inch – 85556036

16 Each top and lid section must be tested for accuracy of fit and must be marked in sets for delivery.

17 Valve box extension pieces must be provided for valves with ground cover in excess of the depth of the standard valve
18 box (see Standard Plans 315a and 315b).

19 **9-30.3(5) COMBINATION AIR RELEASE / AIR VACUUM VALVES**

20 Combination air release/air vacuum valves must comply with ANSI / AWWA C512.

21 **9-30.3(6) END CONNECTIONS**

22 The dimensions of hub or bell end connections must conform to the dimensions of AWWA C100. The dimensions for the
23 mechanical joint connections must conform to ANSI A21.11.

24 The end flanges of flanged valves must conform in dimensions and drilling to ANSI B16.1 for cast iron flanges and
25 flanged fittings, Class 125, unless specifically provided otherwise in the Contract. The bolt holes must straddle the vertical
26 center line.

27 **9-30.3(7) OPERATING NUT EXTENSIONS**

28 An operating nut extension conforming to Standard Plan 315b must be furnished and installed by the Contractor on all
29 valves where the finished grade is more than 30 inches above the valve operating nut.

30 **9-30.3(8) PLASTIC FOAM RINGS**

31 Valve boxes must have a 2-inch thick plastic foam cushion installed between the base flange of the valve box bottom
32 section ring conforming to the dimensions shown on Standard Plan 315b installed between the base and the valve casting.
33 The plastic foam must be as specified in Section 9-05.10.

34 **9-30.3(9) VALVE CHAMBERS**

35 **9-30.3(9)A PRECAST VALVE CHAMBER**

36 Size, shape, and Materials must be as shown on the Drawings.

37 The chambers must be furnished in precast concrete sections with sufficient strength to withstand HS 20 traffic loading
38 together or as specified on the Drawings with ladder and access frames and covers to provide the minimum clearance
39 dimensions shown on the Drawings.

40 The chambers must be water tight after assembly. Gasket Material must be installed in the groove of the keyway of each
41 chamber section as it is installed. There must be no evidence of moisture seeping into the chambers through the walls, floor,
42 or joints.

43 **9-30.3(9)B CONCRETE BLOCKS FOR VALVE CHAMBERS**

44 Portland cement concrete blocks must be solid, and must conform to ASTM C 139. Overall thickness of block must be 6
45 inches with optional lengths and widths. Curved maintenance hole blocks must be used for round valve chambers.

46 **9-30.3(9)C CONCRETE BRICK FOR VALVE CHAMBERS**

47 Concrete brick must be solid and conform to ASTM C 55, Grade A.

48 **9-30.3(9)D CLAY BRICK FOR VALVE CHAMBERS**

49 Clay brick must conform to ASTM C 62, Grade SW.

1 9-30.3(9)E MORTAR

2 Portland cement mortar must be 1 part Portland cement to not less than 1-1/2 parts nor more than 3 parts of plaster
3 sand, mixed with the least amount of water necessary to provide a workable mix. Dehydrated lime, in an amount not
4 exceeding 50 percent of the Portland cement by weight, may be added to the mix at the option of the Contractor.

5 9-30.3(9)F CEMENT CONCRETE

6 Cement Concrete for chamber foundation must be Class 3000 as specified in Section 6-02.

7 9-30.3(9)G CAST-IN-PLACE CONCRETE VALVE CHAMBER

8 The design, size, shape, and Materials for cast in place concrete valve chambers must be as shown on the Drawings.
9 The Contractor must submit Shop Drawings of the chamber indicating all features to the Engineer as specified in Section 1-
10 05.3.

11 9-30.3(9)H FRAME AND COVER AND VALVE BOX CASTINGS

12 Castings for cast iron frame and cover and for cast iron parts of valve boxes must conform to ASTM A 48, Class 30 and
13 must conform to the Standard Plans unless specified otherwise in the Contract.

14 The word WATER must be cast in the cover in 3-inch letters as shown on the Standard Plans.

15 Each ring and cover section must be tested for accuracy of fit and must be marked in sets for delivery.

16 An acceptable Supplier is Olympic Foundry Type SM29 standard box and lid, EJ Type EJ3761 Series or other approved
17 equal.

18 See Section 9-30.3(3) regarding the permanent connection of the tag, indicating the number of turns to fully open/close
19 the butterfly valve, to the valve box or to the valve chamber.

20 9-30.3(9)I MORTAR FOR PLASTER COATING

21 Mortar for plaster coating masonry unit maintenance holes must be proportioned according to either of the two following
22 tabulated alternates:

23

| Alternate | Parts By Volume Portland Cement | Parts By Volume Masonry Cement | Parts By Volume Hydrated Lime Or Lime Putty |
|-----------|------------------------------------|-----------------------------------|--|
| 1 | 1 | 1 (Type II) | 0 |
| 2 | 1 | 0 | 1/4 |

24

25 Plaster sand for either alternate 1 or alternate 2 above must be measured in a damp, loose condition, and must be not
26 less than 2-1/4 and not more than 3 times the sum of volumes of cement and lime.

27 A bituminous coating must be applied to all surfaces after plastering.

28 9-30.3(9)J LADDERS

29 Ladder must be made of steel, and must be galvanized after fabrication. They must be made of 1-inch deformed steel
30 bar conforming to ASTM A 615, intermediate or standard grade, hot bent at least 1600 °F. Galvanization must conform to
31 ASTM A 123.

32 9-30.3(10) PAINTING AT FACTORY

33 After the factory test and inspection, all ferrous parts of the valves except finished or bearing surfaces must be painted
34 inside and out with two coats of asphalt varnish, Federal Specification TT V 51A or approved equal.

35 9-30.3(11) WATER PRESSURE REGULATING VALVES

36 1. Water Pressure Regulating Valves, 3-inch through 12-inch Sizes: Valve must be flanged at both ends, Class 150
37 ASA drilling, with ductile iron body. Valve must be a diaphragm operated, single seat, globe valve with stainless steel
38 trim. It must be spring loaded and hydraulically operated. Seat ring must be replaceable. The diaphragm must be fully
39 guided top and bottom. All necessary repairs must be possible without removing the valve from the line. Packing
40 glands are not permitted. Disc must be synthetic rubber and have a rectangular cross-section. The stem must be
41 guided by a bearing in the valve cover and an integral bearing in the valve seat. There must be no piston operating
42 the main valve.

43 Valves must be designed to maintain a constant downstream pressure regardless of varying inlet pressure. They are
44 to be used in handling clean, cold water.

45 No control pilots or optional equipment is to be furnished. Valves must be CLA Valve No. 90 or approved equal.

46 2. Water Pressure Regulating Valves, 2-inch size: Valves must be Mueller No. H 9310 2-inch Water Pressure Reducing
47 Valves or approved equal.

1 **9-30.3(12) COATINGS FOR VALVES**

2 Special coatings, thermoplastic powder coating, and polyethylene encasement must be per Section 9-30.1(4).

3 **9-30.4 HYDRANTS**

4 **9-30.4(1) GENERAL**

5 Fire hydrants must conform to AWWA C502 and must be of standard manufacture and of a pattern approved by SPU
6 Water Operations. The name or mark of the manufacturer, size of the valve opening and year made must be plainly cast in
7 raised letters on the hydrant barrel to be visible after the hydrant is installed.

8 Hydrants of the following manufacture and pattern have been approved for use by the City of Seattle:

- 9 1. Kennedy K81D "Guardian"

10 **9-30.4(2) END CONNECTIONS**

11 The end connection must be 6 inches, standard flange, Class 125 drilling conforming to ANSI B16.1.

12 **9-30.4(3) HYDRANT DIMENSIONS**

13 The dimensions and details of hydrant and nozzles must be as follows:

- 14 1. Hydrant connection pipe size inside diameter: 6 inches.
- 15 2. Standpipe, minimum inside diameter: 7 inches.
- 16 3. Valve opening, minimum diameter: 5-1/4 inches.
- 17 4. Size of auxiliary gate valve: 6 inches.
- 18 5. Hose nozzles, number and size: two 2-1/2 inches.
- 19 6. Thread (National Board of Fire Underwriters): 7-1/2 per inch.
- 20 7. Total length of threaded male nipple: 1 inch.
- 21 8. Streamer nozzle, number, and size: one 4 inch.
- 22 9. Hydrants must be furnished with one pumper nozzle with size and threads conforming to dimensions as identified on
23 the current City of Seattle Standard Plans for Fire Hydrants.
- 24 10. Drain Valve: Drain valve must be automatic with outlet tapped with 1/4 to 3/4-inch female iron pipe threads. The
25 threads on the drain valve outlet holes must be protected with temporary pipe plugs until the hydrant is ready for
26 installation.
- 27 11. Breakaway flange (ring) to center of pumper nozzle: 14 inches or more.
- 28 12. Face: Pumper port toward the street.

29 All nozzles must be fitted with cast iron threaded caps with operating nut of the same design and proportions as the
30 hydrant stem nut. Caps must be threaded to fit the corresponding nozzles and must be fitted with suitable neoprene gaskets
31 for positive water tightness under test pressures.

32 **9-30.4(4) OPERATING NUTS**

33 The operating nuts on hydrant stem and nozzle caps must be as follows:

| Pattern of nut | Height | Size of pentagon |
|--------------------|------------|---|
| Tapered pentagonal | 1-1/6 inch | 1.35 inches at bottom of nut 1.23 inches at top of nut (measured from point to flat) |

35
36
37 The direction of opening must be clearly marked on the operating nut or hydrant and must be counter clockwise

38 **9-30.4(5) HYDRANT RESTRAINT**

39 **9-30.4(5)A RESTRAINT SYSTEM FOR SHACKLE RODS**

40 Shackling rods must be 3/4-inch diameter with threaded ends, and must comply with ASTM A 36. "All thread" rod is not
41 acceptable. If a tie bolt restraint system is used, it must be "COR TEN Steel Star National Products Super Star Tie Bolt
42 #SST7" or approved equal. If a mechanical joint gland with lugs restraint system is used, it must conform dimensionally as
43 shown on the hydrant detail, and must be ductile iron conforming to ASTM A 536 Class 80 55 06. Coating for shackling rods
44 must be as specified in Section 9-30.12.

45 **9-30.4(5)B RESTRAINT SYSTEM FOR WEDGE RESTRAINT GLANDS**

46 If a wedge restraint system is used in lieu of shackle rods, mechanical joint (MJ) pipe must be used rather than slip joint
47 (SJ) pipe. The wedge restraint system must be as specified in Section 9-30.2(4).

1 9-30.4(6) BREAKAWAY FLANGE CONSTRUCTION

2 Hydrants must be provided with a breakaway flange assembly and be equipped with breaking devices at the sidewalk
3 flange which allow the hydrant barrel to separate at this point with a minimum breakage of hydrant parts in case of damage.
4 There must also be provided at this point, a safety stem coupling on the operating stem that shears at the time of impact.
5 Unless otherwise specified in the Contract, all hydrants must be equipped with O-ring stem seals.

6 9-30.4(7) HYDRANT PAINTING**7 9-30.4(7)A HYDRANT SHOP PAINTING**

8 All iron parts of the hydrant must be thoroughly cleaned and painted at the factory. All inside surfaces and the outside
9 surfaces below the groundline must be coated with asphalt varnish, Federal Specification TT-V-51a or J.A.N.P-450, unless
10 otherwise specified in the Contract. They must be covered with two coats, the first having dried thoroughly before the second
11 is applied.

12 9-30.4(7)B HYDRANT FIELD TOUCH UP PAINTING

13 All iron parts of the hydrant must be thoroughly cleaned and painted at the factory. All inside surfaces and the outside
14 surfaces below the breakaway flanges must be coated with asphalt varnish, Federal Specification TT-V-51a or J.A.N.P-450,
15 unless otherwise specified in the Contract. They must be covered with two coats, the first having dried thoroughly before the
16 second is applied.

17 The hydrant curb stand section, including all exposed surfaces of the breakaway flange, must receive two coats of oil
18 based gloss enamel paint (Kelly Moore Luxlite or approve equal) in Caterpillar yellow. Based on the elevation of the hydrant
19 within the surrounding pressure zone, if the maximum static pressure at the hydrant is less than 60 psi, the engine port cap on
20 the hydrant must be painted with two coats of oil based gloss enamel paint (Kelly Moore Luxlite or approve equal) with the final
21 coat being Red.

22 9-30.4(8) HYDRANT FACTORY HYDROSTATIC TEST

23 All hydrants must be tested by the manufacturer, as required in AWWA C502. The Contractors must furnish to the Owner
24 an Affidavit of compliance from the manufacturer for all tests.

25 9-30.4(9) HYDRANT CONNECTION PIPE

26 Pipe connections from the hydrant to the Water Main must be 6-inch Ductile Iron Pipe, Class 52, as specified in Section
27 9-30.1(1).

28 9-30.4(10) HYDRANT VERTICAL EXTENSIONS

29 Hydrant barrel extensions must have a 7-inch minimum inside diameter and must be gray cast iron or Ductile Iron and
30 must conform to the AWWA Standards for such castings. The drillings of the connecting flanges on the extensions must match
31 the drillings of the flanges on the hydrant.

32 Hydrant vertical extensions must also include the necessary hydrant operating stem extension, complete with safety
33 stem couplings.

34 Extensions with threaded flanges must be ductile iron and must conform to AWWA C115. The exterior flange lip
35 overlapping the barrel pipe must be sealed with a bituminous mastic.

36 Vertical extensions shorter than 18 inches must be installed at the bottom of the factory supplied barrel pipe.

37 9-30.4(11) HYDRANT BLEEDER

38 The hydrant bleeder assembly, as shown on the hydrant detail, must be constructed of 3/4-inch copper tubing Type K,
39 conforming to Section 9-30.5(4).

**40 9-30.4(12) POLYETHYLENE ENCASEMENT AND SPECIAL TAPE COATING FOR HYDRANTS AND
41 CONNECTIONS**

42 Refer to Section 9-30.1(4).

43 9-30.5 SERVICE CONNECTIONS AND SERVICE PIPE OR TUBING**44 9-30.5(1) GENERAL**

45 Service piping standards must be used, and modified when shown on the Drawings, for 2-inch blowoff assembly and
46 hydrant bleeder assembly.

47 9-30.5(2) SADDLES

48 Saddles must be ductile iron, or bronze, double straps with thread standard outlet tapping. Saddles must be of a size
49 designed by the manufacturer to fit the pipe called for on the Drawings.

1 9-30.5(3) CORPORATION STOPS

2 Corporation stops for use with saddle must be of bronze alloy with inlet M.I.P. (male iron pipe) standard thread and outlet
3 thread compatible with connection piping, with no special adapters. Corporation stops for direct tapping must be bronze alloy
4 with AWWA tapered inlet. Outlets must be on 3/4-inch and 1-inch direct tap corporation stops must be copper tubing size
5 compression, with an external clamping or anti pullout feature. Outlets on 1-1/2-inch and 2-inch direct tap corporation stops
6 must be male iron pipe or tubing to be connected.

7 9-30.5(4) SERVICE PIPE**8 9-30.5(4)A COPPER TUBING**

9 Copper tubing must be per ASTM B 88, Type K, annealed. The tubing must be coupled using compression fittings having
10 a positive external gripping feature to prevent tubing pull out, per AWWA C800, minimum 150 psi working pressure.

11 9-30.5(5) COMPRESSION COUPLINGS

12 Compression couplings for use in connecting plain end water service pipes must be applicable for the type of pipe being
13 coupled. Compression couplings must have armored gaskets when similar metal pipes are being joined.

14 9-30.5(6) METER STOPS AND SETTERS

15 Meter stops and setters must be per the SPU Water Operation Standards.

16 9-30.5(7) METER BOX AND LID

17 Meter Box and Lid must be per the current SPU Water Operation Standards. The Meter Box casting must conform to
18 ASTM A 48, Class 30 for gray cast iron. The Lid casting must conform to ASTM A 536, Grade 80-55-06 for ductile iron.
19 Castings must be brushed or dipped with a bituminous coating. Meter Box and Lid must be Olympic Foundry (1984) Inc. SM
20 29, or approved equal.

21 9-30.5(8) VALVES

22 Valves must conform to Section 9-30.3.

23 9-30.6 BEDDING, FOUNDATION MATERIAL AND GRAVEL

24 When the Mineral Aggregate is specified by a "Type" designation, it must conform to the requirements in Section 9-03.
25 See Section 7-11.3(1)C for bedding requirements.

26 9-30.7 JOINT BOND CABLE

27 General joint bond cable must be single conductor No. 2 AWG stranded copper wire with 600 volt, 7/64 inches thick high
28 molecular weight polyethylene (HMWPE) insulation. Supply all joint bonds complete with a formed copper sleeve on each end
29 of the wire, as specified under THERMITE WELD MATERIALS, this Section.

30 9-30.8 THERMITE WELD MATERIALS**31 9-30.8(1) GENERAL**

32 Thermite weld Materials must consist of wire adapter sleeves, welders, and weld cartridges according to the weld
33 manufacturer's recommendations for each wire size and pipe or fitting size and Material. All welding Materials and equipment
34 must be the product of a single manufacturer. Interchanging Materials of different manufacturers will not be acceptable.

35 Molds must be made of graphite. Ceramic "one shot" molds will not be acceptable.

36 Steel thermite weld cartridges must be used for steel pipe and fittings. Cast iron thermite weld cartridges must be used
37 for all cast and ductile iron pipe and fittings. Maximum cartridge sizes for steel thermite welds must be: 15 grams for wire sizes
38 #14 AWG through #4 AWG stranded, and 32 grams for #2 AWG stranded.

39 Maximum sizes for cast iron thermite welds must be: 25 grams for #14 AWG through #6 AWG stranded, and 45 grams
40 for #4 AWG solid through #2 AWG stranded.

41 Thermite weld Material may be obtained from the following Suppliers: Erico Products Inc. (Cadweld), Cleveland, Ohio; or
42 Continental Industries, Inc. (Thermoweld), Tulsa, Oklahoma; or approved equal.

43 9-30.8(2) ADAPTER SLEEVES

44 Provide Adapter Sleeves for all No. 12 AWG through No. 2 AWG test station and joint bond wire. Prefabricated factory
45 sleeve joint bonds or bond wires with formed sleeves made in the field are acceptable. Field formed joint bond sleeves must
46 be attached with the appropriate size and type of hammer die provided by the thermite weld manufacturer.

47 9-30.8(3) THERMITE WELD CAPS AND PRIMER

48 Thermite Weld caps must be prefabricated weld caps with coating and suitable primer, such as Handy Cap II with
49 Royston Primer 707, as manufactured by Royston Laboratories, Inc., or equal.

1 9-30.8(4) COATING REPAIR AT THERMITE WELD

2 Repair of coating of pipe and fittings for spot damage at thermite weld connections not included in standard pipeline
3 coating repair procedure, must be 100 percent solid epoxy that cures in submerged or buried conditions. Repair of
4 thermoplastic powder coating must be as specified in Section 9-30.1(4)C6.

5 9-30.9 ELECTROLYSIS TEST STATION**6 9-30.9(1) GENERAL NON TRAFFIC AREA**

7 An electrolysis test station must consist of a standard meter box and lid as specified in Section 9-30.5(7) providing a
8 housing for a test box as specified in Section 9-30.9(2).

9 9-30.9(2) TEST BOX

10 Test box requirements must be as follows:

11 The 4-inch (10 cm) deep test box must provide a single piece enclosure 8" x 6" (20 cm x 15 cm) with a removable,
12 hinged lid. The test box must be Hoffman No. 864CHQRFG or approved equal.

13 The lid must be manufactured from molded fiberglass reinforced Material, and fitted with a one piece oil resistant O-ring
14 gasket. The lid must be attached to the test box with a Monel hinge pin and secured by quick release latches.

15 The test box must comply with NEMA 4X standards, to supply protection against corrosion, windblown dust, rain,
16 splashing water, and hose direct water.

17 A water tight connector consisting of a heat shrinkable cable entry system, must be used for passage of test wires into
18 the enclosure. The entry system must be a 3 part assembly consisting of a rigid plastic nut, a rubber O-ring, and molded heat
19 shrinkable cable entry seal including tape sealant. The cable entry system must be type CES 2 or CES 3, with SFTS 1 or
20 SFES 3 tape sealant as manufactured by Sigmaform Corporation; or approved equal.

21 9-30.9(3) TEST STATION WIRES

22 Test station wires must be single conductor, No. 10 AWG and No. 6 AWG stranded copper with 600 volt XHHW
23 insulation. Color of insulation per Drawings.

24 9-30.9(4) WIRE CONNECTORS INSIDE TEST BOX

25 Wire connectors inside the test box must be one piece, tin plated crimp on lug connector as manufactured by Burndy
26 Co., Thomas and Betts, or equal.

27 9-30.9(5) ZINC REFERENCE ELECTRODES

28 The electrode must be a 5 pound 99.9 percent pure zinc ingot packaged in a thoroughly mixed backfill material consisting
29 of 75 percent gypsum, 20 percent bentonite clay and 5 percent sodium sulfate or a 50 percent gypsum and 50 percent
30 bentonite mix. The package must be water permeable and of sufficient size to ensure complete envelopment of the reference
31 electrode and must include 50 feet of 12-gauge yellow RHW lead wire.

32 9-30.9(6) ELECTRICAL CONDUIT AND FITTINGS

33 PVC electrical conduit and fittings must be schedule 40 and UL listed for direct burial. Conduit and fittings must comply
34 with NEMA TC and TC3, Federal Specification W C 1094, UL and NEC.

35 9-30.9(7) SACRIFICIAL ANODES

36 The sacrificial anode must be a 17 pound high potential magnesium anode for cathodic protection with improved core,
37 style #17D3-R, wire per standard plan 364 and 365, length of wire as necessary. If prepackaged, the anode must be
38 packaged with backfill consisting of 75 percent gypsum, 20 percent bentonite, and 5 percent sodium sulfate contained in a
39 cloth bag. Backfill used for pare anodes must consist of the same mixture as prepackaged anodes. Anode must conform to
40 ASTM B843 Industry Standard for M1C high potential magnesium anodes.

41 9-30.10 TURBINE METERS (METER, COLD WATER, MAGNETIC DRIVE TURBINE TYPE, SIZES 2" - 12")**42 9-30.10(1) GENERAL**

43 These requirements apply to Magnetic Drive Turbine Type Cold Water Meters 2 inches through 12 inches in size,
44 manufactured for use on customer water services. Turbine Meters must consist of a cast bronze case containing the
45 measuring mechanism with a strainer housing attached.

46 Meters must comply with AWWA C701, current edition, Class II type, except as modified here.

47 9-30.10(2) REGISTER AND REGISTER BOX

48 Registration must be in cubic feet.

1 **9-30.10(3) MEASURING MECHANISM**

2 The measuring mechanism must be the inline type, and so designed that it can be readily removed from the main case
 3 as a complete unit. The measuring mechanism must be capable of operating within the accuracy limits specified under Normal
 4 Flow Limits in Section without recalibration when transferred from one turbine meter case to another.

5 **9-30.10(4) INTERMEDIATE GEAR TRAIN**

6 If an intermediate gear train is utilized, it must operate in a dry, hermetically sealed compartment, separated from the
 7 water passage by a bronze wall.

8 **9-30.10(5) CAPACITY AND ACCURACY**

9 The turbine meter must register all rates of flow through it with an accuracy of 100 percent ± 2 percent at rates of flow
 10 within the limits specified under Normal Flow Limits in Section 9-30.10(6).

11 **9-30.10(6) NORMAL FLOW LIMITS**

| Size | Normal Flow Limit |
|------|-------------------|
| 2" | 5 - 160 GPM |
| 3" | 10 - 350 GPM |
| 4" | 15 - 800 GPM |
| 6" | 30 - 1800 GPM |
| 8" | 50 - 3500 GPM |
| 10" | 55 - 5500 GPM |
| 12" | 70 - 7000 GPM |

12
 13 NOTE: Above flow limit must be for continuous flows, all turbine meters must have a 25 percent overspeed capacity
 14 for intermittent flows.

15
 16 **9-30.10(7) HEAD LOSS**

17 Maximum loss of head must not exceed 7 psi at the flow rates listed under "Normal Flow Limits" in Section 9-30.10(6).

18 **9-30.10(8) CONNECTIONS**

19 All main case connections must be flanged. The flanges for 2-inch meters must be of the two bolt oval type. Meters must
 20 be furnished without companion flanges.

21 **9-30.10(9) INTERCHANGEABLE PARTS**

22 All parts of turbine meters of the same size, make and model must be interchangeable.

23 **9-30.10(10) STRAINER**

24 Turbine meters must be supplied with a strainer attached. Strainers must be short pattern, 125 lb. ANSI, iron body, with
 25 heavy gauge 1/4 inch perforated, stainless steel screen having an effective straining area at least double that of the meter
 26 main case inlet.

27 **9-30.10(11) REMOTE READING**

28 Turbine meters must be compatible with existing SPU Automated Meter Reading and Demand Recording Hardware
 29 and/or switches. Manufacturer, type, and style of switch must be submitted for approval by the Engineer before ordering.

30 **9-30.10(12) MANUFACTURE AND APPROVAL**

31 Only meters manufactured by a well-established firm will be considered. Only those meters of a specific model and
 32 manufacturer, samples of which have been submitted to SPU Water Meter Shop for inspection and approval, and carrying a
 33 minimum 1 year guarantee will be acceptable.

34 **9-30.10(13) INSPECTION**

35 All turbine meters purchased under this Specification will be subject to inspection and testing by SPU Water Meter Shop
 36 upon receipt, and if any meter is found not to conform with these Specifications, the lot or any portion thereof may be rejected.

37 **9-30.10(14) GUARANTEE**

38 All turbine meters must be guaranteed for a period of 1 year after installation. This guarantee must be against defects in
 39 Materials, workmanship, and construction.

1 9-30.10(15) TEST REPORT

2 All turbine meters purchased under this Specification must be accompanied by a notarized test report of the factory
3 accuracy test.

4 9-30.11 LOCATING WIRE

5 Locating wire must be 14 gauge solid copper with neoprene coating. Connections and splices must be made with
6 Grainger Industrial Supply WeatherProof and Underground Wire Connectors, Item # 21GR20, or approved equal.

7 9-30.12 COATING FOR ALL BOLTS AND SHACKLE RODS

8 On corrosion protected Water Mains, all shackle rods, concrete blocking anchor rods, and shackle clamps must have a
9 factory applied protective coating with fusion bonded epoxy per ASTM A 755. After threading and assembly, the threaded
10 ends, nuts, and washers must be coated with a wrapping of Trenton wax tape #1 or approved equal.

11 9-30.13 BACKFLOW PREVENTION ASSEMBLIES (BPAS)**12 9-30.13(1) GENERAL**

13 All backflow prevention assemblies (formerly called backflow prevention devices or BPDs) must be on the Washington
14 State Department of Health current list of approved backflow prevention assemblies, and both temporary and permanent
15 installations of such assemblies must be verified acceptable by the Engineer. The list of Washington State Approved
16 assemblies is available at (503) 246-5845.

17 All backflow prevention assemblies, whether temporary or permanent, are subject to inspection by SPU Inspection
18 Services before connection with any Water Main. See Section 1-07.28 item 7D regarding BPA inspection notification
19 requirements. After initial inspection and acceptance, annual testing is required.

20 Backflow prevention assemblies installed on premises, or not installed for premise isolation purposes, must be inspected
21 by Seattle King County Health Department Plumbing Inspection.

22 9-30.13(2) ATMOSPHERIC VACUUM BREAKERS (AVBS)

23 Atmospheric vacuum breakers must be of a type included in the Washington State Department of Health current listing of
24 "Acceptable Atmospheric (Non Pressure) Type Vacuum Breaker" or other types with IAPMO approval. AVBs must be installed
25 downstream of the last shutoff valve and a minimum of 6 inches above the highest outlet or overflow level of the irrigation
26 system. AVBs must be installed above ground.

27 An atmospheric vacuum breaker must be attached to each hose bib. An AVB must not be operated for more than 12
28 hours in any 24 hour period. AVBs must not be used on systems with chemical additions.

29 9-30.13(3) PRESSURE VACUUM BREAKER ASSEMBLIES (PVBAS)

30 Pressure vacuum breakers must be of a type included in the Washington State Department of Health current listing of
31 "Acceptable Pressure Type Vacuum Breaker" or other types with IAPMO or University of Southern California approval. PVBAs
32 must be installed a minimum of 12 inches above the highest outlet or overflow level of the irrigation system and located so that
33 adequate room is available for maintenance and testing. PVBAs must be inspected and tested annually during the life of the
34 Contract by backflow device testers certified by the Washington State Department of Health. PVBAs must not be installed
35 below ground. PVBAs must not be used for systems with chemical additions.

36 9-30.13(4) DOUBLE CHECK VALVE ASSEMBLIES (DCVAS)

37 Double check valve assemblies must be of a type included in the Washington State Department of Health current listing
38 of "Approved Double Check Valve Assemblies."

39 Installations must be according to procedures outlined in the current edition of "Accepted Procedure and Practice in
40 Cross Connection Control Manual" published by the Pacific Northwest Section, American Water Works Association. DCVAs
41 must be inspected and tested annually during the life of the Contract by backflow device testers certified by the Washington
42 State Department of Health.

43 DCVAs can be installed below ground only if enclosed in an approved irrigation vault, chamber, or other approved
44 enclosure. DCVAs must not be used for systems with chemical additions.

45 9-30.13(5) REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLIES (RPBAS)

46 Reduced pressure principle backflow prevention assemblies will be required for any system using chemical additions or
47 proposed to use chemical additions. Such systems include irrigation systems with fertilizer or other chemical addition. These
48 units must be of a type included in the Washington State Department of Health current listing of "Approved Reduced Pressure
49 Backflow Assemblies." Inspection of the installation, to insure proper operation, will be conducted by SPU Inspection Services.
50 RPBAAs must be inspected and tested annually during the life of the Contract by backflow device testers certified by the
51 Washington State Department of Health.

52 Installation must be according to procedures outlined in the current edition of "Accepted Procedure and Practice in Cross
53 Connection Control Manual" published by the Pacific Northwest Section, American Water Works Association.

54 RPBAAs must not be installed below ground.

1 SECTION 9-31 ILLUMINATION AND ELECTRICAL MATERIALS**2 9-31.1 LUMINAIRES****3 9-31.1(1) GENERAL**

4 Luminaires must have attached to the housing, an ANSI approval decal (3 inches square) which must be readily visible
5 from the ground, indicating lamp type by color code (i.e. white for Light-Emitting Diode (LED), blue for Mercury Vapor, gold for
6 High Pressure Sodium, red for Metal Halide); and lamp wattage by numerical code, i.e.:

7 Legends must be a minimum of 2 inches in height and weather resistant.

8 External labels for (LED) luminaires must conform to ANSI C136.15.

9 The Contractor must be prepared to provide a sample luminaire for testing when requested by the Engineer.

10 9-31.1(2) ROADWAY LIGHTING LUMINAIRE

11 LED luminaires must comply with the following SCL Material Standards:

- 12 1. For residential LED luminaires refer to SCL Material Standard 5723.47.
- 13 2. For collector-arterial LED luminaires refer to SCL Material Standard 5723.61.
- 14 3. For principal-arterial LED luminaires refer to SCL Material Standard 5723.71.
- 15 4. HPS luminaires must comply with SCL Material Standard 5723.10.

16 Glare control must be accomplished by use of a field-installable, house-side shield. For house-side shields, refer to
17 above SCL Material Standards.

18 9-31.1(3) LAMPS

19 High pressure sodium lamps must comply with Material Standard 5722.45.

20 9-31.1(4) PHOTOELECTRIC CONTROLS

21 Photoelectric controls must be used with all luminaires and must comply with SCL Material Standard 5693.00 for
22 standard applications, and SCL Material Standard 5693.10 for 20-year design life applications.

23 9-31.1(5) UNDERDECK MOUNTED UNDERCROSSING LUMINAIRE

24 For underdeck mounted undercrossing luminaires, refer to SCL Stock Catalog stock class 57.

25 Underdeck luminaires must be pendant mounted as called for on the Drawings. The ballast must be integral with the
26 luminaire. Ballast housing and structural parts must be of cast aluminum. Mounting devices must provide positive, vibration
27 proof locking. Luminaires must be UL listed as "Enclosed and Gasketed" and must be suitable for wet locations. All exposed
28 screws and/or rivets must be of stainless steel Material.

29 All exposed cast aluminum parts are to be furnished with a baked enamel paint.

30 The ballast housing and optical assembly must be provided with easy to read moisture proof nameplates that can be
31 read without disturbing the luminaire when installed.

32 Ballast and optical assemblies must include provision for field mounting of safety chains.

33 Luminaires must have a wiring compartment with a single fuse holder.

34 Mounting of the optical assembly to the ballast assembly or pendant cap must be secured by positive vibration proof
35 means. The optical and ballast or pendant cap assemblies must include a positive aligning electrical disconnect allowing the
36 socket to be shipped factory assembled in the optical assembly.

37 The luminaire must be enclosed and gasketed and must include an activated charcoal filter to permit passage of air.

38 Heat resistant polycarbonate plastic must be used for the refractor. The optical assembly must be hinged and latched for
39 lamp access. An automatic disconnect must ensure that optical assembly is electrically cold when servicing. The optical
40 assembly must be removable from the ballast without tools.

41 The filter assembly must be factory installed, but easily removable and must be located to prevent accidental
42 dislodgement when the luminaire is installed.

43 The unit must provide at least 3 percent uplight dispersed widely across the surrounding area.

44 Luminaire must be suitable for continuous service in an ambient temperature of 40.8 °C. The unit must be weatherproof
45 and dustproof.

46 Ballasts must be multi tap, high power factor, regulator type.

47 9-31.1(6) WALL PACK LUMINAIRE

48 For wall-pack luminaires, refer to SCL Stock Catalog stock class 57.

49 The luminaire must consist of a rear die cast back housing which encloses the ballast, lamp socket and reflector, and a
50 refractor frame assembly. The back casting assembly must mount against the wall (or pole) and the refractor housing
51 assembly must fasten to it by means of concealed hinges and a single point, positive acting latch. There must be plated steel

1 retaining chain attached between the main housing and refractor frame. Overall dimensions must be approximately 16 inches
2 square by 10-3/8 inches deep.

3 Units must be prewired and equipped to be wall mounted directly on conduit for surface wiring without bending the
4 conduit or to a recessed outlet box, and must require no tools for lamp replacement.

5 The optical train must consist of the lamp, fluted specular aluminum reflector, and molded prismatic borosilicate thermal
6 shock resistant glass refractor. The dimensions of the refractor must be approximately 16 inches square by 4 inches deep and
7 must have internal splitting prisms and external dispersing prisms. The refractor frame color must be anodized aluminum.

8 The integral ballast must operate the high pressure sodium 55 volt lamp at the wattage shown on the Drawings, and
9 provide reliable starting at temperatures as low as 20 °F. The ballast must be multi tap to allow field adjustments of voltage.

10 All insulation must be UL listed Class H; core, coil, and capacitors must be positioned for maximum heat dissipation.
11 Supply wires to the unit are to be of proper temperature rating for the type of entry used. The housing must be finished with a
12 black polyester powder paint coating. The complete unit must be UL listed as "Suitable for Wet Locations." The unit must be
13 Moldcast catalog no. PCL 1 or approved equal, to be furnished with photocontrol, wireway conduit adapter, and polycarbonate
14 shield.

15 The wall pack luminaire must be furnished with photocontrol, wireway conduit adapter, and polycarbonate shield.

16 **9-31.2 WIRE**

17 Street light wire size and type must be constructed per the Drawings.

18 Street light wire in conduits must comply with SCL Material Standard 6122.30. Wire size will be shown on the Drawings.

19 Wire used inside of poles and bracket arms (including wood pole mounted bracket arms) or bonded to signal spanwires
20 must comply with SCL Material Standard 6404.40.

21 Duplex wire must comply with SCL Material Standard 6404.40.

22 Triplex wire must comply with SCL Material Standard 6007.50. Color coding is not required for triplex wire.

23 Multiple conductors must be color coded per the NEC. Wire must be continuously color coded. Neutral wire must always
24 be white. Grounding conductors must be green and insulated. The first hot conductor must be black, the second hot conductor
25 must be red, and the third hot conductor must be blue.

26 Trench ground wire must conform to SCL Material Standard 6102.20.

27 Plastic molding for covering wire attached to the side of wood poles must be per SCL Material Standard 5820.50.

28 **9-31.3 WIRE SPLICES**

29 This standard applies to wire connections made in above grade or below grade installations except where the wires are
30 attached directly to the terminal board. All connectors must be U.L. or equivalent, labeled and approved for the intended use.

31 1. Above Grade Installations (Including connections in pole handholes):

32 a. Copper to Copper Connector - The connector must be a high strength bronze alloy of the split bolt type specified
33 in SCL Material Standard 6688.7.

34 b. Copper to Aluminum Connector - The connector must be of the one or two bolt type labeled CO/ALR and include
35 an approved spacer bar.

36 c. Aluminum to Aluminum Connector - The connector must be of the 1 or 2 bolt type and comply with SCL Material
37 Standard 6693.5.

38 d. Split bolt connections must be insulated as specified in Section 8-30.3(5).

39 2. Below Grade Installations (including on Structures):

40 a. Below grade splices must be made in a 2 piece rigid body transparent moisture proof spliced enclosure. The body
41 must be webbed to ensure centering of the splice and even distribution of the encapsulant. The body and
42 encapsulant must be composed of Material that do not support fungi or mold. The encapsulant must be a re-
43 enterable, gel like, transparent type. Non-reenterable encapsulant may be approved if each splice is approved by
44 the Engineer prior to installing encapsulant.

45 b. Connectors must be as described in "a" above, or a copper mechanical crimp type may be used when submitted
46 to, and allowed by, the Engineer at least 3 Working Days in advance of proposed use, or when shown on a Shop
47 Drawing submitted to and reviewed by the Engineer. Mechanical crimp splices must be made with an approved
48 crimping tool.

49 3. Inside Cabinets and Panels: Wire nuts may be used only inside cabinets and panels. Copper or silver plated
50 terminals must be used at terminal blocks.

51 **9-31.4 FUSES AND FUSE HOLDERS**

52 Fuses must be of the voltage and amperage specified on the Drawings.

53 Fuses must comply with SCL Material Standard 6855.50

54 Fuse holders and insulating boots must comply with SCL Material Standards 6857.05. Fuse holders must be crimp-type
55 terminations and be sized appropriately for wire and fuse size.

1 Fuse, fuse holders, and insulating boots must be UL-listed for the intended application.

2 **9-31.5 GROUND RODS, CLAMPS, AND HARDWARE**

3 Ground rods, couplings, and driving studs must comply with SCL Material Standard 5642.10, and the dimension must be
4 3/4" x 10'.

5 Ground rod clamps must comply with SCL Material Standard 5640.32.

6 Ground plates must be a minimum of 2 square feet surface area copper plate.

7 **9-31.6 ENCLOSURES**

8 Enclosures located outside must be weather proof type, NEMA Type 3R. All doors and covers must be gasketed. All
9 enclosure metal must be formed of stainless steel or aluminum as noted on the Standard Plans, and must be constructed to
10 the dimensions shown on the Drawings. All doors must be provided with a heavy-duty hasp suitable for padlocking.

11 All joints must be seam welded. Enclosures must be fabricated to allow for anchor bolt mounting.

12 A permanent sign must be attached to the exterior of the enclosure cover or door. The sign must be engraved into a 2" x
13 6" stainless steel plate with a minimum thickness of 18 gauge. The lettering must be in 3 lines as follows:

14 DANGER

15 HIGH VOLTAGE

16 KEEP OUT

17 The letters must be 1/2 inch high with a stroke width of 3/32 inch, and must be filled with a red paint.

18 The completed sign must be coated with a clear polyurethane enamel with exterior catalyst and attached to the enclosure
19 cover with a minimum of 6 stainless steel drive rivets.

20 **9-31.7 RECEPTACLES**

21 Festoon receptacles must comply with SCL Material Standard 7330.00. Festoon receptacle must be 20 amp, 125 volt,
22 AC, GFCI, Hospital Grade receptacles NEMA configuration 5-20R, to be UL listed "Hospital Grade" under UL No. 498.

23 **SECTION 9-32 TRAFFIC SIGNALS SYSTEM**

24 **9-32.1 SIGNAL HEADS, VEHICLE**

25 **9-32.1(1) GENERAL**

26 **9-32.1(1)A SIGNAL HEAD COMPONENTS**

27 Signal heads must be per the Institute of Transportation Engineers publication, current edition of Adjustable Face Vehicle
28 Traffic Control Signal Head Standard and the following additional requirements:

29 The equipment must be designed for operation under temperature and humidity conditions encountered in the Pacific
30 Northwestern United States.

31 Materials and workmanship must conform to the best commercial standards of the industry.

32 Signal hanger pins must include a stainless steel washer between each cotter key and the signal hanger.

33 A terminal block of an approved type must be mounted inside at the back of each signal head. It must have sufficient
34 studs to terminate 6) lamp wires independently to 6 field wires. The screws must be of sufficient length to easily accommodate
35 14 AWG field wires without having to remove the screws. The terminals to which field wires are attached must be permanently
36 tagged to facilitate field work. Lamp socket wires must consist of a white wire and a wire of the same color as the lens
37 connected to the terminal block.

38 All signal heads must be installed as shown on the Drawings.

39 The housing, door, visor exterior, and mounting hardware/framework must be dark green in color. The visor interior and
40 both sides of the back plate must be optical black or flat black in color. The paint must be of the best quality synthetic resin
41 enamel.

42 Adjustable signal heads must consist of separate signal sections, expandable type, for vertical or horizontal mounting,
43 rigidly and securely fastened together into one weather tight signal assembly. The signal sections must be 8 inches or 12
44 inches in diameter, as shown on the Drawings.

45 Each section must consist of a housing, door assembly, LED technology module optical unit, and backplate and must be
46 so constructed as to provide complete interchangeability of parts.

47 Weather resistant mildew proof gasketing must be provided between the housing and door assembly and between the
48 lens and LED module, which must exclude dust and moisture.

49 **9-32.1(1)B HOUSING**

50 The housing must be cast aluminum alloy, free of flaws, cracks, blowholes and other imperfections.

51 Each vehicular signal head must have a 1/4-inch drain hole in the bottom of the head.

1 Each section must house 1 individual optical unit complete with 1 piece hinged square door, mounting for the lens and
2 other parts of the optical system and a simple noncorrodible door locking device.

3 Sections must be interchangeable and so constructed that sections can be added or removed. The top and bottom must
4 be drilled for 1-1/2-inch supporting pipe fittings. Hexagonal heavy plumbers lock nuts 2-1/2 inches across flats for 1-1/2-inch
5 pipe must be provided for top and bottom.

6 The 4 backplate mounting holes (2 in the top of the backplate and 2 in the bottom of the backplate) must be a maximum
7 distance of 1-1/4 inches on 8-inch signal and 2-1/2 inches on 12-inch signals from the top or bottom edge of the signal
8 housing.

9 **9-32.1(1)C DOOR ASSEMBLY**

10 The door assembly must consist of the door, lens, and visor.

11 The door of each section must be made of aluminum alloy and must be hinged to the housing so as to permit access or
12 removal. The door must be secured to the housing by a single finger type locking device. The door locking device must be
13 easily removable to allow door removal.

14 Each section must have a visor made from aluminum alloy sheet of a tunnel design attached to the door by means of 4
15 panhead screws. The mounting holes must be slotted. Visor length must be 8 inches for 8-inch signals and 12 inches for 12-
16 inch signals.

17 The lens must be glass, circular in shape of the color, type, and size specified. The lens must be designed to provide an
18 outward distribution of light with a minimum above the horizontal. Each lens must be true to color and must conform to the
19 current ITE Standard. The lenses must have a minimum visible diameter of 7-3/4 inches (eight inches nominal) or 11-1/2
20 inches (12 inches nominal).

21 **9-32.1(1)D OPTICAL UNIT**

22 All vehicle signal head sections must be provided with an expanded view LED technology rather than incandescent
23 unless otherwise specified in the Contract. A sample of the LED module to be used, the manufacturer's Specifications, and a
24 manufacturer's certificate of compliance to the VTCSH Specifications must be provided to the Engineer for approval. If
25 approved, the LED sample submitted will then be used as the basis for accepting all further units to be installed. Written
26 approval by the Engineer will be required prior to the first installation.

27 LED modules must fit into traffic signal housings built to the VTCSH standards without modification to the housing and
28 must not require special tools for installation. It must be weather tight and fit securely in the housing and must connect directly
29 to the electrical wiring terminals.

30 The lens Materials to enhance ON/OFF contrasts must not affect luminous intensity or chromaticity and must be uniform
31 across the face of the lens and must be UV stabilized. The lens must be a replaceable part without the need to replace the
32 complete module.

33 The module must be a single, self-contained device, not requiring on-site assembly for installation and with its power
34 supply packaged within the module enclosure and must be completely protected against dust and moisture intrusion as per
35 NEMA Standard 250-1991 requirements, for Type 4 enclosures to protect all internal LED, electronic, and electrical
36 components.

37 The LED signal module must be rated for use in the ambient operating temperature range of 40 °F to 165 °F.

38 The LED signal modules when operated at nominal voltage and 25 °C (77 °F) must provide a power factor of 0.90 or
39 greater and a total harmonic distortion not to exceed 20 percent on modules with power consumption of 15 watts or greater,
40 and 40 percent for modules with power consumption of less than 15 watts.

41 All electronic components must be adequately supported to withstand mechanical shock and vibration from high winds
42 and other sources. Materials used for the module enclosure must be made of UL94VO flame retardant with the exception of
43 the lens. The lens must have no scratches (abrasions), cracks, chips, discoloration, or other defects. Any such defects must
44 be cause for rejection.

45 Each individual LED signal module must be identified for warranty purposes, nominal operating voltage, power
46 consumption, volt-ampere, and a vertical indexing indicator for correct orientation.

47 The minimum luminous intensity throughout its useful life and at the end of the warranty period, must not be less than the
48 values shown in Table 1 Section 4.1 of the latest edition of the ITE Specifications for LED traffic signal modules. When
49 operating within the temperature range specified in Section 3.3.1 during the warranty period, the maximum luminous intensity
50 must not exceed 800 candelas for the red.

51 The electrical, wiring, and terminal blocks must comply with Section 13.02 of the VTCSH standard. Fluctuations in line
52 voltage over the range of 80VAC to 135VAC must not affect luminous intensity by more than ± 10 percent. The circuitry must
53 prevent perceptible flicker and include voltage surge protection to withstand high repetition noise transients and low repetition
54 high energy transients as stated in Section 2.1.6, NEMA Standard TS-2, 1992. A catastrophic failure of one LED light source
55 must result in the loss of not more than 5 percent of the signal module light output. The module must be operationally
56 compatible with NEMA (TS-1 or later) load switches. All LEDs must be of the AllnGap technology or proven equal in brightness
57 and bulb life.

1 Manufacturers must replace or repair an LED module that fails to function as intended due to workmanship or Materials
2 defects, or if it exhibits luminous intensity of less than the minimum values specified within the first 60 months from the date of
3 installation.

4 Written Warranty: In addition to the Specifications of Section 1-05.10, the manufacturer must provide a written warranty
5 against defects in materials and workmanship for the LED vehicle signal modules for a period of 60 months, and against loss
6 of intensity below 50 percent of original values for a period of 36 months. This warranty must become effective after installation
7 of the modules and acceptance by the Engineer.

8 **9-32.1(1)E BACKPLATE**

9 The signal, with backplate, must be designed to meet or exceed the load requirements per Section 2 of the current
10 edition of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. Back
11 plates must be furnished and attached to each signal head assembly. Back plates must be louvered type to reduce wind
12 loading, constructed of anodized, 3-S half hard aluminum sheet, 0.058 inches minimum thickness. The back plates must be
13 attached with stainless steel hardware. Back plates must not interfere with either the operation of the door or the mounting of
14 the signal. Mounting hole pattern must match pattern on signal head housing. The front and back of the back plates must be
15 finished with 2 coats of flat black enamel.

16 Back plates must be permanently attached so as to provide a 5-inch border for either 8-inch or 12-inch signal heads. On
17 combination heads (i.e. 12-inch and 8-inch sections) the back plate must have a 5-inch border relative to the 8-inch head.
18 Therefore, the border on the 12-inch head must be approximately 3 inches.

19 Back plates must be provided with a minimum of 2 mounting holes per signal section, one on each side. The 2 top and 2
20 bottom backplate mounting holes must be a maximum distance of 1-1/4 inch from the corners of an 8-inch signal housing, and
21 2-1/2 inches from the corners of a 12-inch signal housing.

22 Backplates must have a 1-inch yellow, diamond grade retroreflective tape applied to the outside border.

23 **9-32.1(2) BI MODAL VEHICLE SIGNALS SECTION**

24 The signal section must display both yellow and green arrow indications from the same face and must use a fail-safe 2
25 lamp system to direct light of either color into a fiberoptic display. The section must be adaptable to conventional 12-inch
26 vehicle signal heads.

27 **9-32.1(3) DIRECTIONAL LOUVERS**

28 Where so shown on the Drawings, louvers must be furnished and installed in signal visors. Directional louvers must be
29 so constructed as to have a snug fit in the signal visor. The outside cylinder must be constructed of No. 22 U.S. gauge sheet
30 steel, and the vanes must be constructed of No. 27 U.S. gauge sheet steel. Dimensions and arrangement of vanes must be as
31 shown on the Drawings.

32 Louvers must be galvanized after fabrication by the hot dipped process in conformance with ASTM A 153 and painted flat
33 black.

34 **9-32.2 SIGNAL HEADS, PEDESTRIAN**

35 **9-32.2(1) GENERAL**

36 Pedestrian signal heads must conform to the current version of Pedestrian Traffic Control Signal Indications published in
37 the Equipment and Materials Standards of the Institute of Transportation Engineers (PTCSI), and in the Applicable Sections of
38 the current version of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), as modified and
39 adopted by the Washington Department of Transportation (WSDOT); see Section 4E. Current versions are the versions in
40 effect on the Day the Work was advertised for Bids by the Owner.

41 Pedestrian signal head must consist of a Light Emitting Diode (LED) message module, case, eggcrate visor, and
42 directional louvers.

43 The maximum overall dimension of the signal must be 19-1/2 inches wide, 19 inches high and 9 inches deep, not
44 including eggcrate visor and hinges. In order to facilitate installation and maintenance, the signal must be designed so that all
45 components are readily accessible from the front by merely opening the signal door.

46 Written Warranty: In addition to the Specifications of Section 1-05.10, the manufacturer must provide a written warranty
47 against defects in materials and workmanship for the entire pedestrian signal including LED message module, and all
48 Acrylonitril Butadiene Styrene (ABS) or polycarbonate plastic parts for a period of 60 months from the date of delivery.

49 **9-32.2(2) MESSAGE MODULE**

50 Light Emitting Diode (LED) Pedestrian Traffic Signal with Countdown Feature: The Pedestrian Signal Display must
51 consist of a Light Emitting Diode (LED) message module, case, eggcrate visor, and directional louvers; and must be in
52 conformance with the PTCSI and MUTCD. The case, sun shield, and mounting hardware must be painted dark green in color.
53 The eggcrate visor interior and directional louvers must be painted flat black in color.

54 Pedestrian signals must display international symbols (Portland orange Hand and the lunar white Walking Person) and
55 numerical countdown (Portland orange digit portion) LED's encased in a molded plug in plastic message module. The LED

1 module must have a visual appearance of the display must be similar to that of an incandescent lamp (i.e. smooth and non-
2 pixilated). The Hand & Walking Person symbols must be a minimum of 12 inches in height and 7 inches in width.

3 LED pedestrian and countdown signal module must be made of UL94 flame-retardant Materials. The lens is excluded
4 from this requirement. The lens of the LED pedestrian and countdown signal module must be polycarbonate UV stabilized and
5 the exterior of the lens must be uniform and frosted to reduce sun phantom effect.

6 All pedestrian and countdown signal display modules must be the Light Emitting Diode (LED) type. Pedestrian and
7 countdown LED traffic signal modules must be designed such that they can be used as a retrofit replacement for optical units
8 in Standard Plan 520 pedestrian signal housing and must not require special tools for installation. The installation of an LED
9 pedestrian and countdown signal module must not require modification to the City of Seattle standard housings built to PTCSI
10 standards.

11 The Walking Person, Hand icons, and Countdown digits (16" x 18" module size) must be incandescent looking and fit
12 within a traffic signal housing built to the Pedestrian Traffic Control Signal Indication (PTCSI) standards. The numbers 00 to 99
13 on the numerical display must be side by side, not offset, and must have a 7" x 9" high area for the countdown numerals.

14 LED pedestrian and countdown signal modules must be weather tight, fit securely in the housing and must connect
15 directly to existing electrical wiring. Installation of a replacement LED module into the existing pedestrian housing must only
16 require the removal of the existing optical unit components, i.e. lens, lamp, gaskets, and reflector. Each LED pedestrian and
17 countdown signal module must be a single, self-contained device, not requiring on-site assembly for installation into any City
18 of Seattle standard pedestrian signal housing; and must include an insulated gasket. However, the power supply for the LED
19 pedestrian signal module may be packaged as a separate module. The LED pedestrian and countdown signal modules must
20 be operationally compatible with the traffic signal controllers and conflict monitors existing at the Project Site

21 The LED pedestrian and countdown signal module must be rated for use in the ambient operating temperature range of -
22 40 °F to 165 °F. Each LED pedestrian signal module must be protected against dust and moisture intrusion in compliance with
23 MIL-STD-810F Procedure 1, Rain & Blowing Wind. The assembly, manufacturing, and mounting of the LED pedestrian signal
24 module must be designed to assure all internal LED and electronic components are adequately supported to withstand
25 mechanical shock and vibration from high winds and other live loading sources in compliance with MIL-STD-883 Test Method
26 2007.

27 LED pedestrian and countdown signal modules must operate at a maximum power consumption of 11 Watts for Hand, 8
28 watts for Walking Person and 6 watts for Countdown (Display 88). Each LED pedestrian and countdown signal module must
29 operate from a 60 ± 3 Hz AC line over a range of 80VAC to 135VAC. Nominal operating voltage for all measurement must be
30 120 ± 3 volts rms. The LED circuitry must prevent flicker at less than 100 Hz over the specified voltage range. Fluctuations in
31 the specified line voltage must not affect luminous intensity by more than ± 10 percent. The signal module on-board circuitry
32 must include voltage surge protection to withstand high-repetition noise transients and low-repetition high-energy transients as
33 stated in Section 2.1.6, NEMA Standard TS-2, 1992. The individual LED light sources must be wired so that catastrophic
34 failure of one LED must not result in the loss of more than the light from that one LED. The LED pedestrian and countdown
35 signal modules must provide a power factor of 0.90 or greater when operated at nominal voltage and at 77 °F. Total harmonic
36 distortion induced into an AC power line by the LED pedestrian and countdown signal module must not exceed 20 percent
37 when operated at nominal voltage and at 77 °F.

38 LED Countdown modules must have two separate power supplies for power the Walking Person and Hand icons. The
39 circuitry must be unrelated to power the LED Walking Person and Hand icons in order to substantially eliminate the risk of
40 displaying the wrong icon.

41 A sample of the LED module to be used, the manufacturer's Specifications, the warranties specified in this Section, a
42 manufacturer's certificate of compliance indicating Specifications are met, and the Requirements Checklist by Manufacturer
43 chart below, must be submitted to the Engineer for approval. Included in the submittal must be the manufacturer's
44 recommendations for how the Contractor permanently marks the date of installation on the outside plate. If approved, the
45 sample will then be held for comparison to the remainder of the units to be installed. The approved sample will be allowed for
46 use as the last LED installation.

47 Requirements Checklist to be filled out by Manufacturer to demonstrate compliance

48

| Requirement | Comply |
|---|--------|
| The LED module (16" x 18") must have a visual appearance similar to that of an incandescent lamp (i.e. Smooth and Non-Pixilated). | |
| The numbers 00-99 on the numerical display must be side by side, not offset, and must have a 7" x 9" high area for the countdown numerals. | |
| The display of seconds remaining must begin only at the beginning of the clearance interval. After zero, the display must remain dark until next countdown. | |
| Manufacturer must warrant the product with replacement or repair of a pedestrian signal including LED message module that fails due to workmanship or materials within 5 years from date of delivery. | |

| Requirement | Comply |
|--|--------|
| For a period of 5 years, the maintained minimum luminance values for the module must not be: 2,200 cd/SqM for Walking Person, and 1,400 cd/SqM for Hand & Countdown displays. | |
| Default condition: for abnormal conditions when nominal voltage to the unit across the two phase wires (rather than being applied to the phase & neutral wires) the unit must default to the Hand display. | |
| The Maximum power consumption: 11 watts for Hand, 8 watts for Walking Person, and 6 watts for Countdown (when display is "88"). | |
| The units must not have any external attachments, dip switches, or options that will allow the mode to be changes from counting the clearance cycle to the full walk/don't walk cycle. | |
| Provide Model Number | |

1

2 The manufacturer's name, trademark, operating characteristics, i.e. rated voltage, power consumption, and volt-ampere,
 3 and serial number must be permanently marked on the outside surface of the back of the LED pedestrian and countdown
 4 signal module including a permanently attached label or extra blank space that can be permanently marked with the date of
 5 installation of the module by the Contractor.

6 The LED pedestrian and countdown signal modules must be manufactured per a Vendor quality assurance (QA)
 7 program including both design and production quality assurance. All QA process and test result documentation must be kept
 8 on file for a minimum of 5 years.

9 **9-32.2(3) CASE**

10 The case must consist of a housing and door each made from 1 piece, aluminum alloy die casting. It must be dustproof,
 11 weatherproof and corrosion resistant and must provide for easy access to and replacement of all components. The housing
 12 must have an integral cast top, bottom, sides, and back. 4 integrally cast hinge lug pairs must be provided for operation of a
 13 swing down door.

14 The housing must be suitable for left or right hand (with pre drilled holes and rubber plugs) clamshell mounting hardware,
 15 post top mounting, or bracket mounting.

16 The top and bottom of the housing must have an opening to accommodate 1-1/2-inch pipe brackets. The bottom opening
 17 of the signal housing must have a standard 72 tooth locking boss integrally cast into the case. The teeth must be clean and
 18 sharp and provide full engagement. The radial angular grooves of the boss must provide positive positioning of the entire
 19 signal to eliminate rotation or misalignment of the signal.

20 The door must be attached to the case by means of 2 stainless steel spring pins. 2 stainless steel hinged bolts with
 21 captive stainless steel wingnuts and washers must be attached to the case with the use of stainless steel spring pins. Hence,
 22 latching or unlatching of the door must require no tools.

23 A 1/4-inch drain hole must be provided in the bottom of the case. All unused openings must be capped with corrosion
 24 resistant metal caps, and weatherproofed with approved washers.

25 Clamshell mounting must be a two piece cast aluminum alloy assembly. One piece must be the pole half, the other piece
 26 the signal housing half. The clamshell assembly must have two integrally cast hinge lug pairs so, that when the clamshell is
 27 mounted in final position for pedestrian traffic, the clamshell must rotate horizontally to the open position for easy access to the
 28 control wiring inside the clamshell.

29 **9-32.2(4) EGGCRATE VISOR**

30 Each signal must be provided with an eggcrate type visor designed to eliminate sun phantom.

31 The eggcrate type visor must be installed parallel to the face of the Hand Person message lens and must be held in
 32 place by stainless steel screws. The eggcrate assembly must consist of vertical members and horizontal members. The
 33 completed assembly must be approximately 1-1/2 inches deep.

34 The basic Material used in construction of the eggcrate must be nominally 0.030 inches thick polycarbonate plastic.
 35 Additional members may be employed outside the two legend areas but are not required unless needed to develop the full
 36 potential structural strength attainable through the particular assembly technique employed.

37 The assembly must be enclosed in a mounting frame constructed of 0.040 inches minimum thickness aluminum or
 38 polycarbonate plastic. This frame must be approximately 1-1/2 inches deep and may contain alternate mounting holes for use
 39 on alternate types of pedestrian signals.

40 **9-32.3 PEDESTRIAN PUSHBUTTON ASSEMBLY**

41 The complete pushbutton assembly must include these components:

- 42 1. The frame assembly must consist of an integral pushbutton mount and the sign platform. It must be cast aluminum
 43 and powder coat finished with the manufacturer's specified black color. The frame assembly must consist of a

- 1 backplate to accept a 5" x 7" sign secured with metal screws, and a round housing with predrilled holes to mount the
2 pushbutton assembly.
- 3 2. The pushbutton housing must be die-cast aluminum, round body of approximately 3 inches diameter, and powder
4 coat finished with the manufacturer's specified black color.
- 5 3. The pushbutton must be stainless steel, with a raised tactile directional arrow on the pushbutton. The manufacturer
6 must provide arrow options of: Left, Right, Up, and bi-directional Left and Right.
- 7 4. The pushbutton assembly must include a Latching Mode with an LED indicator light that will stay ON and a
8 percussive beeper for audible feedback. The LED and beeper must be actuated each time the pushbutton is pressed
9 and must terminate at the beginning of the pedestrian walk phase.
- 10 5. The central control unit must be available in both rack mounted and shelf mounted systems. The central control unit
11 must be rack mounted for TS2 traffic control units and shelf mounted for all other traffic control unit types. The central
12 control unit must have a minimum of 12 feet of power connection cable.
- 13 6. The sign must be an MUTCD R10-3 and size must be 5" x 7".
- 14 The complete pushbutton assembly must have the following characteristics:
- 15 a. Vandal resistant construction;
- 16 b. NEMA 250-6P or IP-68 enclosure protection rating;
- 17 c. NEMA TS-2 compliance for temperature and humidity, transient voltage protection, and mechanical shock and
18 vibration rating;
- 19 d. IEC 61000-4-4 and IEC 61000-4-5 compliance for transient suppression;
- 20 e. A minimum call pulse length must be 240 milliseconds.
- 21 f. Constant call fail-safe.
- 22 g. 3-year minimum warranty.

23 9-32.3(1) ACCESSIBLE PEDESTRIAN SIGNAL SYSTEM

24 An Accessible Pedestrian Signal (APS) system must be provided and installed at the intersection as specified as an APS
25 system as shown on the Drawings. The APS System must consist of all components from the Standard Specifications from
26 Section 9-32.3 and include the additional components and features:

- 27 1. Confirmation of button push via a latching sunlight visible red LED indication, audible tone, and vibrating indication;
- 28 2. The audible sound must be emitted from a weather proof and vandal resistant speaker within the pushbutton
29 assembly. All sounds must automatically adjust for ambient noise;
- 30 3. The pushbutton assembly must come programmed to emit a rapid tick. It must also have the capability to record
31 custom voice messages and custom sounds during the walk or clearance interval or if the button is held for 3
32 seconds or more;
- 33 4. Standard and customized locating tone and message features;
- 34 5. In addition to the standard locate sounds, ability for custom locate sounds and location messages;
- 35 6. Capability for extended pushbutton press customized functions;
- 36 7. And all sounds are synchronized.

37 The complete APS system must have the characteristics as described in Section 9-32.3 with the addition of the following:

- 38 a. Volume Over Ambient Noise: adjustable up to a minimum of 10dB;
- 39 b. Locate Tone Volume: -24dB to + 6dB Ambient (must meet or exceed);
- 40 c. Maximum Volume: 100 dB@ 1m.

41 9-32.4 DETECTOR LOOPS

42 Detectors must be used for actuating traffic actuated controllers and sample stations. A complete detector loop
43 installation must consist of loop wire and lead in cable from the loop to the amplifier. Loop wires and lead-in cables must be
44 600 volt rated.

45 Loop wire in concrete pavement must be either #14 AWG or IMSA 51-3. Loop wire in asphalt pavement must be IMSA
46 51-7 with either black PVC or polyethylene tube.

47 The lead in from the detector junction box to the controller cabinet or remote amplifier cabinet must be either 3 pair #16
48 AWG 7 x 24, or 6 pair #16 AWG 7 x 24 stranded tinned copper, polyvinyl chloride/nylon individual insulated, overall PVC
49 jacketed, twisted pair cable with aluminum foil polyester shield. The 3 pair and the 6 pair lead in cables must have a #18 AWG
50 stranded tinned copper drain wire. The conductors must be twisted together approximately 3 turns per foot. Connections of the
51 loop wire to the lead in wire must be made only in a handhole with a waterproof splice as shown on the Drawings.

52 9-32.5 ILLUMINATED SIGN

53 The equipment must be designed and manufactured for operation under temperature and humidity conditions
54 encountered in the Pacific Northwestern United States.

1 The sign, when mounted, must be designed to meet or exceed the load requirements per Section 2 of Standard
2 Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, AASHTO current edition.

3 The sign size must be as shown on the Drawings. The housing must be a double faced design made of extruded
4 aluminum alloy or polyvinyl, dark green in color or with a brushed aluminum finish. The interior must be painted white.

5 Standard signal mounting hardware must be used to mount illuminated signs to all street furniture. The sign must be
6 fitted with a 1-1/2-inch iron pipe (IP) with tapped straight thread hub on top, for mast arm and span wire mount, and on top and
7 bottom for bracket mount.

8 The front message panel must be translucent white Rohm and Haas Plexiglass, or Tuflite white fiberglass, or equal. The
9 back message panel must be constructed of aluminum alloy or polyvinyl, colored dark green or brushed aluminum finish to
10 match the housing, unless the sign is double faced in which case it must be the same as the front message panel. Sign
11 message must be as shown on the Drawings.

12 A terminal block for power input hookup must be accessible by opening either message panel.

13 Signs must be completely wired and assembled.

14 Unless otherwise specified in the Contract, the sign must be equipped with four 24-inch T12 CW fluorescent tubes with
15 weatherproof tube type sockets and ballast transformer. The ballast transformer must be non-flashing 425 mil amp type, 0 °F
16 starting, 120 VAC, 60 Hz.

17 Hardware (such as rivets, screws, bolts, and nuts) and non-aluminum parts must be stainless steel.

18 Each interior illuminated sign assembly must be fused. All fuses must be accessible by opening either of the message
19 panels. Both message panels must be of the sliding type with stop bars to prevent total removal, and for ease of maintenance.

20 **9-32.6 EMERGENCY VEHICLE PREEMPTION**

21 All emergency vehicle preemption detectors must be Opticom™, without substitution. All detector wiring must be
22 Opticom™, Model 138, shielded detector cable, without substitution, and must comply with International Municipal Signal
23 Association (IMSA) Specification 51-5.

24 **9-32.6(1) OPTICOM DISCRIMINATORS**

25 The Contractor must furnish and install Opticom™ Model 764 phase selector with Model 768 auxiliary interface panel,
26 without substitution, in the control cabinets when called for on the Drawings.

27 **9-32.7 INTERCONNECT CABLE**

28 **9-32.7(1) UNDERGROUND**

29 Interconnect cable (UIC) must be #19 or #22 solid aerial/duct communication cable and must conform to REA
30 Specification PE 39 or I.M.S.A. Specification No. 20-2. The number of pairs and size must be as shown on the Drawings.

31 **9-32.7(2) AERIAL (FIGURE 8)**

32 Interconnect cable (AIC) must be #19 or #22 solid figure 8 communication cable and must conform to REA Specification
33 PE-38, or I.M.S.A. Specification no. 20-4. The number of pairs and size must be as shown on the Drawings.

34 **9-32.7(3) INDOOR**

35 Interconnect cable must be #19 or #22 multiple pair communications cable and conform to REA Specification PE 22, or
36 I.M.S.A. Specification no. 20-2. The number of pairs and size must be as shown on the Drawings.

37 **9-32.8 SERVICE CABINET**

38 The service cabinet must serve a 200 A, 120/240 VAC (or 120/208 VAC for SCL Network area), 1 phase, 3 wire system.
39 The service cabinet must be rated for 22K ampere interrupting capacity (AIC). The service cabinet must accommodate a ring-
40 type socket with test/bypass blocks per ERC 308.

41 The service cabinet must be constructed of .125-inch thick natural mill finish aluminum. The service cabinet must be
42 rated NEMA 3R. The service cabinet must have separate sealable and lockable utility termination section, separate sealable
43 and lockable metering section, and separate sealable and lockable customer section. Metering section must be a 180 degree
44 hinged hooded section. The cabinet must be pad mounted per the standard plan. A separate mounting base must be cast into
45 the concrete foundation pad and secured with four 5/8-11 x 18" anchor bolts.

46 The service cabinet load center must be always on. The load center must have a main circuit breaker and a minimum of
47 9 blank breaker spaces. Additional breakers must be added per the Drawings. Signal, ITS, and auxiliary breakers must be
48 attached to line 1 and lighting breakers must be attached to line 2. Compatible breakers must be specified by the service
49 cabinet manufacturer. A documentation holder must be attached to the customer door with a circuit directory. Circuit labels
50 must be provided using phenolic labels with white background and black lettering. Labels must be permanently adhered in
51 load center. Tape and chemical adhesives must not be considered permanent. For traffic signal loads the label must be
52 ascending beginning with SG1. For lighting loads the label must be ascending beginning with SL1. For ITS loads the label
53 must be ascending beginning with ITS1. For auxiliary loads the label must be ascending beginning with AUX1.

1 9-32.9 SIGNAL WIRING**2 9-32.9(1) TRAFFIC SIGNAL CABLE**

3 Signal Cable must have stranded #14 or #16 AWG copper conductors and must conform to IMSA Specification 20-1.

4 9-32.9(2) PEDESTRIAN PUSHBUTTON CABLE

5 Pedestrian pushbutton cable must be single pair #16 AWG 19 x 29 stranded copper, polyethylene insulated, PVC
6 jacketed, twisted pair cable with copper or aluminum polyester shield and a No. 18 AWG stranded tinned copper drain wire.
7 The conductors must be twisted together approximately 3 turns per foot.

8 9-32.9(3) ELECTRICAL SERVICE CONNECTIONS

9 For underground service conductors, THWN must be used. Conductors must be sized as shown on the Drawings. Color
10 coding must be per industry standard for voltage.

11 For overhead service conductors, SCL Standard Material Specification 6007.50 must be used.

12 9-32.9(4) OVERCURRENT PROTECTION

13 Circuit breakers in service cabinets must comply with the specifications of the service cabinet manufacturer.

14 9-32.9(5) TERMINAL CABINETS

15 Junction boxes or terminal cabinets must conform to NEMA 4X requirements.

- 16 1. Junction boxes or terminal cabinets must be constructed of welded 14 gage (minimum) hot-dipped galvanized sheet
17 steel, 14-gage, minimum type 316 stainless steel or 0.125 inch, minimum 5052 alloy aluminum H32 ASTM designator
18 minimum.
- 19 2. Nominal Junction boxes or terminal cabinets dimensions must be:

| Depth | Height | Width |
|-------|--------|-------|
| 8" | 16" | 12" |

- 21
- 22 3. The doors must have two stainless steel piano hinges. The door must also be provided with a spring loaded
23 construction core lock capable of accepting a Best 6-pin CX series core. The locking mechanism must provide a
24 tapered bolt. The Contractor must supply construction cores with two master keys. The keys must be delivered to the
25 Engineer.
- 26 4. All seams must be continuously welded.
- 27 5. Junction boxes or terminal cabinets must provide a gasketed door flange.
- 28 6. One spare 12-position terminal block must be installed.
- 29 7. Each Junction box or terminal cabinet must have 1/8-inch drain holes in back corners.

30 9-32.9(6) GROUND RODS, CLAMPS AND BONDING

31 See Section 9-31.5.

32 9-32.9(7) SQUEEZE CABLE FITTINGS

33 Cable fittings for entry of cable through metal walls of poles, signs, and signals must be squeeze type cable fittings with
34 water tight neoprene bushings. Size must be carefully chosen to match the cable diameter to assure a water tight fitting
35 without damaging the cable.

36 9-32.10 SPAN WIRE

37 Span wire must be 5/16 inch, 7 strand aluminum covered steel span wire conforming to ASTM B 415 with rated breaking
38 strength of 10,270 lbs. per SCL Material Standard No. 5664.1.

39 Catenary span wire must be 7/16 inch, 7 strand aluminum covered steel span wire conforming to ASTM B 415 with rated
40 breaking strength of 20,800 lbs. per SCL Material Standard No. 5664.1.

41 9-32.11 POLE LINE HARDWARE

42 Strain insulators must be wet process, porcelain, conforming to EEI NEMA TDJ 54 as follows:

| Size | Class |
|----------------|------------|
| 5/16 inch wire | Class 54-2 |
| 7/16 inch wire | Class 54-3 |

1 Tether wire must be 1/8-inch galvanized steel stranded wire conforming to ASTM A 475, extra high strength grade (rated
2 at 1500 pounds minimum), Class A galvanized.

3 Bull rings (purse seine rings) must be low carbon steel with an ultimate strength of 25,000 pounds. The ring must be
4 closed with a weld equal to or greater than 90 percent of the unwelded steel. The ring must be galvanized with at least 2
5 ounces of zinc per square foot, which is equivalent to 3 mils of thickness. The steel must be 3/4 inches in diameter and must
6 form a ring with a 3-inch ID. Higher strength steel must be used when more than 4 signal heads are being supported.

7 All pole hardware, bolts, plate rods, hangers, clamps, wire guards, and pole bands must be hot dipped galvanized per
8 ASTM A 153, or must be stainless steel.

9 All miscellaneous pole line hardware required to complete the project as planned must be standard Material
10 manufactured for pole line construction.

11 Pole band assembly must consist of 4 band sections and must be 4-way adjustable mounting connection on 4 sides.
12 Each band must have four 3/4-inch diameter all threaded studs and four 3/4-inch regular nuts per stud (total 16 nuts per
13 assembly). Pole band assembly must have 20,000 pounds ultimate tensile strength. All parts of the pole band must be hot-
14 dipped galvanized per ASTM A153. .

15 **9-32.12 GALVANIZING REPAIR PAINT**

16 Field repair of galvanized surfaces must be a coating of heated zinc alloy solder to a minimum thickness of 2 mils per
17 ASTM A 780.

18 **SECTION 9-33 POLES, PEDESTALS, AND FOUNDATIONS**

19 **9-33.1 GENERAL**

20 **9-33.1(1) POLES, MAST ARMS, AND BRACKET ARMS**

21 All metal poles, mast arms, and bracket arms must be designed and fabricated per AASHTO Standard Specifications for
22 Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 2009 edition (referred to as "AASHTO"), and EEI TDJ
23 135 and 139. All load requirements must be accommodated as shown on the Standard Plans.

24 Poles must be galvanized steel, timber, or aluminum as shown on the Drawings.

25 Poles not complying with the Drawings and Specifications will be rejected.

26 **9-33.1(2) ANCHOR BOLTS**

27 Anchor bolts for light poles (steel or aluminum) must conform to ASTM A 307 or ASTM A 576, unless otherwise specified
28 in the Contract. Anchor bolts for steel strain poles Type T, and mast arm poles must conform to ASTM A 576 (Type 1040 or
29 1045), ASTM A 675 (Gr. 90), or ASTM A 36 Mod, with $F_y = 55$ ksi minimum. Anchor bolts for steel strain poles Types V, X, Z
30 must conform to ASTM F 1554-99, Grade 105, Class 2A including supplementary requirements S2, S3 and S5. Each anchor
31 bolt must have a hexagonal leveling nut with a washer for leveling and a hexagonal nut with a flat washer and a lock washer
32 for the top of the anchor base plate. All anchor bolts (full length), nuts and washers must be galvanized per ASTM A 153.
33 Anchor bolts must not be bent or cut after fabrication. Bending of anchor bolts must be cause of rejection and removal of entire
34 foundation.

35 Anchor bolt extenders (sleeve nuts), where required, must be of a strength greater than the existing anchor bolts. The
36 bolt extenders must have a hexagonal tightening nut, and must be galvanized per ASTM A 153.

37 **9-33.1(3) GALVANIZING**

38 Before galvanizing, all sharp edges on welds and cut-ins inside the pole shaft, mast arm, and luminaire arms must be
39 removed or filed smooth to prevent damage to the wires in the pole.

40 Structural Material must be zinc coated by hot dip process per ASTM A 123 and the final coating must measure 0.003
41 inches or more in thickness as determined by a magnetic thickness gauge. Hardware and appurtenances must be coated per
42 ASTM A 153. Threads must be recut after galvanizing without exposing base metal. Galvanizing certification of compliance
43 with the applicable ASTM Standards signed by an ASTM accredited independent testing laboratory must be submitted to the
44 Engineer before shipment.

45 The finished pole must be straight and free from injurious defects. Poles distorted by the galvanizing process must be
46 straightened without damage to the galvanizing coating. The finish coating must be smooth and free of dross. After
47 galvanizing, the interior of the pole and arms must be free from sharp edges to prevent damage to wiring.

48 **9-33.1(4) GROUND LUGS**

49 Metal poles must have a 3/8-inch tapped hole in the bottom edge of the handhole inside the pole. A 3/8-inch stainless
50 steel bolt with stainless steel lock washer suitable for grounding must be provided.

51 **9-33.1(5) NUT COVERS**

52 On light poles, the Contractor must furnish and install separate nut covers to cover anchor bolts and nuts only (not the
53 base flange). Nut covers must fit snugly to the bolt. Nut covers must be made of the same Materials as the pole and must be

1 provided by the pole manufacturer. Nut covers are not required on steel strain or Chief Seattle base type poles unless
2 specified on the Drawings.

3 **9-33.1(6) CONCENTRICITY**

4 Unless otherwise noted on the Drawings, poles, mast arms, and luminaire extensions must be within $\pm 1/16$ inch of
5 perfect round with a constant taper of approximately 0.14 inches per foot and of uniform thickness.

6 **9-33.1(7) GROUT**

7 Grout must be as specified in Section 9-04.3(2) for non-shrink cement sand grout.

8 **9-33.2 STEEL POLES, MAST ARMS, BRACKET ARMS, AND LUMINAIRE EXTENSIONS**

9 **9-33.2(1) GENERAL**

10 Poles must be inspected for Material compliance and acceptance by the Engineer prior to installation.

11 The term "steel strain pole" as used here refers to any steel pole subjected to a span wire load (including METRO trolley
12 loads) or mast arm load. Luminaires or other street lighting appurtenances may be mounted on a steel strain pole. The term
13 "steel lighting pole" refers to any steel pole which carries a luminaire but does not carry a span wire or mast arm load.

14 The length of the mast arm, height of pole, and size and type of bracket extension must be as shown on the Drawings.
15 An aluminum or stainless steel pole identification plate must be securely attached immediately above the handhole, and must
16 indicate gauge, manufacturer, bolt circle, design principle moment in kip feet, length, and date of manufacture.

17 Outside diameter of pole shafts must be as shown on the Standard Plans.

18 **9-33.2(2) STRENGTH AND DEFLECTION REQUIREMENTS**

19 The pole shaft must have strength sufficient to support all indicated loads.

20 The following design loads must be used: Dead load must consist of the weight of the signals, luminaires, and bracket
21 arms, signs and supporting structure, and associated appurtenances; wind and ice loads must be as indicated by AASHTO.
22 The signal head mast arm must be of such size and gauge as to resist the bending moment.

23 The design of steel strain poles that support overhead trolley loads must be governed by King County METRO Transit
24 design standards as detailed on the Drawings.

25 Structural steel having a yield point of 33,000 psi or more must be used for all structural parts. Silicon content of the steel
26 must be no more than 0.04 percent or 0.15 to 0.25 percent to prevent discoloration during galvanizing.

27 The total deflection at the top of metal poles resulting from all dead loads applied must not exceed 2.5 percent of pole
28 height.

29 The deflection of the mast arm after loading must not cause the end of the mast arm to extend below a horizontal line
30 from the center of the arm flange. The maximum rise of the mast arm after loading from a horizontal line must be 2 degrees.

31 The tenon for the luminaire must be between 1 and 4 degrees above horizontal with the luminaire installed and all other
32 loads applied to the pole.

33 **9-33.2(3) BOLT CIRCLE**

34 Mast arm flange and pole base bolt circles must be as shown on the Standard Plans.

35 **9-33.2(4) WELDS**

36 Circumferential butt welds must have permanent back up rings and full penetration for 100 percent of the circumference.
37 All exposed butt welds must be ground flush. All welds must be as specified in Section 6-03.3(25).

38 **9-33.2(5) HANDHOLES, FESTOONS, AND CABLE OUTLETS ON POLES**

39 Steel poles must have one oval 4" x 6-1/2" handhole, as shown in the Standard Plans, reinforced so as to result in no
40 loss of shaft strength. The handhole must have matching cover attached with stainless steel bolts. The cover must be rain tight
41 and removable. The handhole must be fabricated into the pole in a position 90 degrees clockwise from the side on which the
42 bracket or mast arm is attached.

43 Festoon outlets, when required, must be as shown on the Standard Plans.

44 Cable outlets (on poles) as shown on Standard Plan 563b must be schedule 40 steel pipe extending perpendicularly from
45 the pole. Both ends of the pipe must be rounded for wire protection. The cable outlet must be installed, drilled and edges
46 rounded before galvanizing.

47 **9-33.2(6) ANCHOR BASE PLATES**

48 A one piece steel anchor base plate must be secured to the lower end of the shaft by continuous electric arc welds as
49 shown in the Standard Plans. The welded connection must develop the full strength of the adjacent shaft section.

1 9-33.2(7) POLE AND MAST ARM CAPS

2 All metal poles (except davit poles) and mast arms must be equipped with a rain tight pole cap constructed of the same
3 Material as the pole, and attached with stainless steel bolts.

4 9-33.2(8) BRACKET ARMS

5 Bracket arms must be per SCL Material Standard 5705.1 or 5705.2 or manufactured as shown on the Standard Plans
6 and per AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 2009
7 edition, to support a luminaire of 50 pounds, a 1.2 square foot effective projected area for an 80 mph wind and a coefficient of
8 height of 1.10.

9 Bracket arm hardware must include the bolts, nuts, and washers galvanized for wood and steel poles and stainless steel
10 for aluminum pole types. Bracket arms must be the same style as depicted on the Drawings. Small differences in dimensions
11 may be acceptable to the Engineer when structural calculations accompany these dimension differences shown on the Shop
12 Drawings, as specified in Section 1-05.3(12).

13 Bracket arms must accommodate the luminaire slipfitter attachment. The terminal end of the arm must be a straight,
14 tubular section with external dimensions of 2 inches NPS by 6-1/2 inches long.

15 Bracket arms mounted on metal poles must be constructed of the same Material as the poles. If the bracket arm and
16 metal pole are of dissimilar metals, they must be separated by an approved plastic dielectric pad of 5 mils minimum thickness.

17 The longitudinal axis at the end of the bracket arm must be at least 1 degree and not more than 4 degrees above the
18 horizontal with the luminaire installed under load as shown on Standard Plan 572.

19 All tubing used for aluminum bracket arm members must be seamless, Alloy 6063 heat treated to T 6 after fabrication.
20 Aluminum bracket arms must be per ANSI C136.13.

21 9-33.3 ALUMINUM POLES**22 9-33.3(1) ROADWAY**

23 Aluminum street light poles for cobra-head style fixtures must comply with SCL Material Standard 5750.03, except as
24 modified here and in the Contract. Aluminum street light poles for pedestrian and decorative style fixtures must comply with
25 SCL Material Standard 5752.05, 5754.07, and/or 5756.09, as appropriate.

26 Anchor bolts for aluminum poles must be the same as required for steel poles.

27 9-33.3(2) PEDESTRIAN ROUND

28 Round aluminum street light poles for post-top style fixtures must comply with SCL Material Standard 5752.05.

29 9-33.3(3) PEDESTRIAN SQUARE

30 Square aluminum street light poles for shoe-box style fixtures must comply with SCL Material Standard 5754.07.

31 9-33.3(4) DECORATIVE

32 Decorative aluminum street light poles for decorative post-top style fixtures must comply with SCL Material Standard
33 5756.09.

34 9-33.4 WOOD POLES**35 9-33.4(1) GENERAL**

36 Strain poles must be either Douglas Fir, class 1, or Western Red Cedar, class 1.

37 Street light poles must be Western Red Cedar, class 3.

38 Poles must be framed (notched) before treatment with a 1/2-inch deep by 2-inch high setting gain on the pole face, 12
39 feet from the pole butt.

40 Poles must be branded by burning the pole face, as specified by ANSI 05.1, 12'-6" above the pole butt. Metal marking
41 tags will not be accepted.

42 Poles must be butt treated per AWPA C7, and the entire butt section of the pole must be incised. After framing and
43 roofing, the cuts must be well brushed with the hot preservative.

44 9-33.4(2) DOUGLAS FIR

45 Douglas fir wood poles must comply with SCL Material Standard 5082.00.

46 9-33.4(3) WESTERN RED CEDAR

47 Western red cedar wood poles must comply with SCL Material Standard 5072.00.

1 9-33.5 STEEL PEDESTALS AND ALUMINUM PEDESTALS**2 9-33.5(1) STEEL PEDESTALS**

3 Shafts must be constructed of welded structural steel, open hearth lap welded steel, or standard steel pipe per ASTM A
4 53. Shafts must be 4-inch schedule 40 galvanized steel pipe with threaded end for mounting to the base. The overall height of
5 the shaft excluding the base must be as shown on the Drawings.

6 Pedestal base must be of cast iron per ASTM A 48, Class 40 and made in accordance to the configuration on the
7 Standard Plans. Bases for pedestals must be threaded, square cast iron equipped with an access door for wiring. A 13-1/2-
8 inch diameter bolt circle size must be used. The base must have a grounding lug inside which is accessible from the handhole.
9 The base must be silver in color.

10 9-33.5(2) ALUMINUM PEDESTALS

11 Shafts must be 4-inch schedule 80 aluminum pipe with one threaded end for mounting to the base. The overall height of
12 the shaft excluding the base must be as shown on the Drawings.

13 Pedestal base must be of cast aluminum conforming to the configuration on the Standard Plans. Bases for pedestals
14 must be threaded, square, aluminum and equipped with an aluminum access door for wiring. A 13-1/2-inch diameter bolt circle
15 size must be used. The base must have a grounding lug inside which is accessible from the handhole. The base must be
16 aluminum in color.

17 9-33.6 PEDESTRIAN PUSHBUTTON POSTS

18 Pedestrian pushbutton posts must be constructed of 2-inch I.D. schedule 40 galvanized steel pipe with length as shown
19 on the Drawings. The post collar, pipe flange, bolts, nuts, and washers must conform to the details of the Drawings.

20 9-33.7 BACK GUY ASSEMBLIES AND GUY WIRE

21 Unless otherwise specified in the Contract, guy wire must be 5/16 inch, aluminum covered steel strand wire.

22 Guy assembly components including the dead end grips, the porcelain strain insulator, and the automatic feed thru dead
23 end must be sized so as to meet or exceed the rated breaking strength of guy wire.

24 Anchors for back guys must consist of one of the following types:

- 25 1. A 4 way or 8 way steel expanding anchor, having a minimum of 300 square inches, made of pressed steel, coated
26 with asphalt or similar preservative and fitted with 3/4 inch minimum guy eye anchor rod 8 feet long.
- 27 2. Plate anchor fitted with 3/4-inch minimum guy eye anchor rod 8 feet long.
- 28 3. An approved steel screw, such as a power installed steel helix anchor with extension rods, extension rod coupling,
29 and strand eye nut. The steel screw must be sized based upon its load and soil conditions by the Engineer.

30 The following components must conform to the SCL Material Standards:

31

| Component | SCL Material Standard |
|---------------------------------|-----------------------|
| Guy Wire | 5664.1 |
| Guy Hook with Integral Spurs | 5651.15 |
| Dead End Grip | 5651.4 |
| Porcelain Strain Insulator | 6901.1 |
| Plastic Wire Guard | 5651.8 |
| Automatic Feed Through Dead End | 5650.3 |
| Plate Anchor | 5622.17 |
| Single Strand Eye Nut | 5652.1 |
| Sidewalk Pipe Guy Fittings | 5650.1 |

32

33 The pipe brace must be galvanized extra strong steel pipe.

34 SECTION 9-34 ELECTRICAL AND SIGNAL CONDUITS**35 9-34.1 GENERAL**

36 Conduit must be PVC coated galvanized rigid steel, galvanized rigid steel, or schedule 80 PVC conforming to Articles
37 346 (rigid metal conduit) or 347 (rigid nonmetal conduit) of the NEC type and size as shown on the Drawings. All conduit,
38 elbows, fittings, and accessories must be UL listed.

39 Factory bends and elbows must be utilized in all cases where they provide the required deflection.

40 Field bends, when required, must be performed so as to result in no flattening of conduit or damage to the galvanizing or
41 PVC coating.

1 9-34.2 RIGID STEEL CONDUIT**2 9-34.2(1) GENERAL**

3 Exterior and interior surfaces of all steel conduit, including threads, except field cut threads, must be uniformly and
4 adequately zinc coated by a hot dip galvanizing process. The average weight of zinc coating must not be less than 0.80
5 ounces of zinc per square foot of single surface area as determined by tests on 12-inch samples taken from a standard length
6 of conduit of each size. The weight of zinc coating on any individual test specimen must be not less than 0.7 ounces of zinc
7 per square foot of single surface area. The weight of zinc coating will be determined per AASHTO T 65. Determinations and
8 nominal weights must conform to the requirements of the Underwriters Laboratory Publication No. 6 (current edition). In
9 addition, the exterior as well as the interior conduit samples must withstand 4 dips in the PREECE test per ASTM A 239.

10 Every length of rigid metal conduit must bear the label of Underwriters Laboratories, Inc., or the label of the Canadian
11 Standards Association, if affected items of Canadian manufacture are approved for use on the project as specified in the
12 Contract. Installation must conform to appropriate articles of the NEC.

13 Rigid steel conduit may be substituted where PVC is shown on the Drawings at the Contractor's option when approved
14 by the Engineer at no additional expense to the Owner, except on pole risers.

15 Fittings for field and factory bends must be identical and interchangeable.

16 9-34.2(2) THREADS

17 The exposed thread ends of rigid steel conduit must be hot dipped galvanized. Field cut threads must be painted with
18 galvanized repair paint approved by the Engineer.

19 9-34.2(3) COUPLINGS AND FITTINGS

20 Couplings and fittings for rigid steel type conduits must be hot dip galvanized, with the same quantities of zinc noted
21 above. Couplings must withstand 4 dips in the PREECE test as specified above.

22 9-34.2(4) PVC COATING

23 All galvanized rigid steel conduit must be PVC (polyvinyl chloride) coated with dark gray, and U.V. resistant type plastic
24 where shown on the Drawings.

25 The zinc surface prior to plastic coating must be conditioned with chromic acid to provide an anchor for the plastic
26 coating.

27 Both interior and exterior must be coated with an epoxy acrylic primer not to exceed 0.0005 inches thick prior to the
28 application of the PVC coating.

29 A PVC coating must be bonded to the outside of the pipe (excluding the threads) with a thickness between 0.035 inches
30 and 0.045 inches. The PVC coating must be applied by the plastisol dip method and must contain ultraviolet inhibitors.

31 A urethane coating of a nominal 2 mil thickness must be applied to the interior of all conduits.

32 A coupling with the same PVC coating must be furnished loose with each length of conduit and must have a plastic
33 sleeve extending 1 pipe diameter or 2 inches (whichever is less) beyond the end of the coupling. The inside diameter of the
34 plastic sleeve must be the same as the outside diameter of uncoated pipe of the same nominal size. The wall thickness of the
35 plastic sleeve must be the same as the plastic coating on the pipe. The bond between the metal and the PVC coating must be
36 equal to or greater than the tensile strength of the PVC coating.

37 All conduit fittings which are hollow and serve as part of the raceway must be coated with the same coatings on the
38 outside and inside as described above. The fittings must have PVC sleeves at all female openings similar to the sleeves on
39 the couplings. The coated conduit must conform to NEMA Standard No. RNI 2005.

40 All coated conduit brackets, supports, clamps, NEMA 4 junction boxes, drains, breathers, expansion/deflection fittings,
41 and seals must be PVC coated by the producer of the conduit. Field repair and touch up must be made with Materials
42 approved by the Engineer.

43 9-34.2(5) EXPANSION/DEFLECTION FITTINGS IN NON HAZARD AREAS

44 Expansion/deflection fittings must be installed in all structural expansion joints. The expansion portion of the set must
45 provide for 4 inches of movement, 2 inches in each direction, unless specified otherwise on the Drawings. The deflection
46 portion of the set must provide for a movement of 3/4 inch in all directions, and an angular deflection of 30 degrees from
47 normal in any direction. Fittings must be O.Z. Gedney Type AXDX or approved equal.

48 9-34.3 PVC CONDUIT

49 Plastic conduit and fittings must be rigid PVC Type EPC schedule 80.

50 PVC rigid nonmetallic conduit may be used for all installations except the first 10 feet above ground on a pole riser and
51 the adjacent bend, unless specified otherwise in the Contract.

52 Rigid PVC must be per ASTM D 1785 and ASTM D 2466. The conduit must be suitable for use above ground, for direct
53 burial, and for corrosive atmosphere areas.

54 Rigid PVC must comply with SCL Material Standard 7020.05.

1 9-34.4 CONDUIT RISER

2 Refer to Section 8-33.3(3).

3 9-34.5 PULL CORD

4 Pull cords must be 1/4-inch polypropylene complying with SCL Material Standard 7272.2.

5 9-34.6 HANDHOLES

6 Handholes must comply with SCL Material Standard 7203.10.

7 Installation of polymer concrete handholes must be approved by the Engineer and must comply with SCL Material
8 Standard 7203.20.

9 SECTION 9-35 ELASTOMERIC BEARING PADS

10 Elastomeric bearing pads must be per AASHTO M 251. The elastomer must not contain any form of wax.

11 All bearing pads must be individually cast with fully molded edges. Corners and edges of molded pads may be rounded
12 at the option of the Contractor. Radius at corners must not exceed 3/8 inch, and radius of edges must not exceed 1/8 inch.

13 Shims contained in laminated bearing pads must be mill rolled steel sheets not less than 20 gage in thickness with a
14 minimum cover of elastomer on all edges of:

- 15 1. 1/8 inch for pads up to 3 inches thick
- 16 2. 1/4 inch for pads over 3 inches thick, and
- 17 3. 1/2 inch for pads greater than 7 inches thick.

18 Steel shims must conform to ASTM A 1011, Grade 36, unless otherwise noted.

19 The shims must be spaced to divide the pad thickness into equal laminations. The bond between the elastomer and
20 metal shims must be such that, when a sample is tested for separation, failure must occur within the elastomer and not
21 between the elastomer and the metal shim.

22 The shear modulus at 73 °F or the durometer hardness of the bearing pads must be as noted in the Contract. If
23 durometer hardness is noted, the following shear modulus must be applicable for shear modulus testing purposes: 50
24 durometer - 112 psi, 60 durometer-165psi, 70 durometer - 250psi. Elastomer must be Grade 3.

25 Elastomeric bearing pads must be manufactured with the following tolerances:

26

| Overall Vertical Dimensions: | |
|---------------------------------------|------------|
| Design thickness 1 1/4" or less | -0, + 1/8" |
| Design thickness over 1 1/4" | -0, + 1/4" |
| Overall Horizontal Dimensions: | |
| 36" and less | -0, + 1/4" |
| Over 36" | -0, + 1/2" |

27

28 SECTION 9-36 DETECTABLE WARNING**29 9-36.1 GENERAL**

30 The detectable warning plate (cast in place with curb ramp or surface) and the detectable warning plate retrofit (surface
31 applied to existing curb ramp or surface) must comply with the requirements for tactile warning surfaces established by the
32 ADA (Americans with Disability Act) Accessibility Guidelines (ADAAG).

33 Detectable warnings must consist of a surface of truncated domes and must comply with the following:

- 34 1. Dome Size: Truncated domes in a detectable warning surface must have a base diameter of 0.9 inches (23 mm)
35 minimum and 1.4 inches (36 mm) maximum, a top diameter of 50 percent of the base diameter minimum to 65
36 percent of the base diameter maximum, and a height of 0.2 inches (5.1 mm).
- 37 2. Dome Spacing: Truncated domes in a detectable warning surface must have a center-to-center spacing of 1.6 inches
38 (41 mm) minimum and 2.4 inches (61 mm) maximum, and a base-to-base spacing of 0.65 inches (17 mm) minimum,
39 measured between the most adjacent domes on a square grid.

40 See Standard Plan 422a for truncated domes detail.

41 Unless the Contract specifies otherwise, the detectable warning must extend the full width of the curb ramp (exclusive of
42 flared sides) and must extend either the full depth of the curb ramp or 24 inches (610 mm) deep minimum measured from the
43 back of the curb on the ramp surface. The truncated dome pattern must be perpendicular to the long axis of the ramp.

44 The detectable warning plate must comply with the following:

- 45 a. Federal Safety Yellow (Federal Standard 595 Color FS 33538) in color;

- b. ASTM Compressive strength of 10,000 psi unless otherwise approved;
- c. Slip resistance (coefficient of friction on top of domes and on field area,) wet and dry of 0.80 minimum (ASTM C 1028);
- d. Resistant to breakage, fading, permanent deformation, and loss due to abrasion;
- e. Durable, high impact resistant, and possess thermal and moisture stability; and,
- f. Approval by the Engineer.

9-36.2 DETECTABLE WARNING PLATE – CAST-IN-PLACE

Acceptable cast-in-place Materials are:

- 1. CASTinTACT®3 by Masons Supply Company, prestained and sealed with Miracote® Mirastain II “Federal Safety Yellow” and Mascoseal Silane 40. A local Supplier of CASTinTACT is MASCO; (425) 487-6161 (<http://www.masco.net>);
- 2. Cast-In-Place System by Armor-Tile™ Tactile Systems. A Seattle Supplier is White Cap Construction Supply; (206) 783-8400 (<http://www.armor-tile.com>);
- 3. Step-Safe® as manufactured by Castek, Inc. a subsidiary of Transpo Industries; (914) 636-1000 (<http://www.transpo.com>);
- 4. Cast-In-Place Composite Paver Tiles by ADA Solutions, (800) 372-0519 (<http://www.adatile.com>);
- 5. ADA Replaceable (Wet-Set) Composite Tactile by ADA Solutions, (800) 372-0519 (<http://www.adatile.com>); or,
- 6. Alertcast by AlertTile.
- 7. An approved equal; for products other than named above, the Contractor must provide the Engineer with a submittal on the alternate Material as specified in Section 9-36.4. See Section 8-14.3(7)B.

9-36.3 DETECTABLE WARNING PLATE RETROFIT – SURFACE APPLIED

The warning pattern must be capable of being bonded to an existing cement concrete surface. The surface of the warning pattern, excluding the domes, must not be more than 3/8 inch above the surface of the concrete after installation.

Acceptable surface applied Materials are:

- 1. Surface Applied Systems by Armor-Tile™ Tactile Systems. A Seattle Supplier is White Cap Construction Supply; (<http://www.armor-tile.com>);
- 2. Surface-Mount / Retrofit Detectable Warning Tiles by ADA Solutions, (<http://www.adatile.com>);
- 3. TopMark® as manufactured by Flint Trading, Inc: (<http://www.flinttrading.com>); or,
- 4. An approved equal; for products other than named above, the Contractor must provide the Engineer with a submittal on the alternate Material as specified in Section 9-36.4. See Section 8-14.3(7)B.

9-36.4 “APPROVED EQUAL” REQUIREMENTS

Should the Contractor propose an “or equal” Material to those Materials named in Sections 9-36.2 and 9-36.3, the Contractor must make the following submittal to the Engineer for approval at least 5 Working Days in advance as specified in Section 1-05.3:

- 1. All information required in Section 8-14.3(7)B;
- 2. 2 rectangular or square samples of the “or equal” material with minimum 6” x 6” dimensions; color acceptance will be based on Engineer comparison to Federal Safety Yellow comparison chip (SPU Lab).
- 3. For the detectable warning retrofit plate, include information on the bonding material and its performance.
- 4. Documentation of the testing laboratory accreditation by a testing standards organization recognized by ASTM, the National Cooperation for Laboratory Association (NACLA) or approved by the Engineer.
- 5. At least 5 hard copies of the installation instruction or manual.

SECTION 9-37 CONSTRUCTION GEOTEXTILES

9-37.1 GEOTEXTILE AND THREAD FOR SEWING

The material must be a geotextile consisting only of long chain polymeric fibers or yarns formed into a stable network such that the fibers or yarns maintain their position relative to each other during handling, placement, and design service life. At least 95 percent by weight of the material must be polyolefins or polyesters. The material must be free from defects or tears. The geotextile must also be free of any treatment or coating which might adversely change its hydraulic or physical properties after installation. The geotextile must conform to the properties as per Tables 1 through 6 for each use specified in the Contract. Specifically, the geotextile uses included in this Section and their associated tables of properties are as follows:

| Geotextile Application | Applicable Property Tables |
|--|----------------------------|
| Underground Drainage, Low Survivability, Classes A, B, and C | Tables 1 and 2 |

| Geotextile Application | Applicable Property Tables |
|--|----------------------------|
| Underground Drainage, Moderate Survivability, Classes A, B, and C | Tables 1 and 2 |
| Separation | Table 3 |
| Soil Stabilization | Table 3 |
| Permanent Erosion Control, Moderate Survivability, Classes A, B, and C | Tables 4 and 5 |
| Permanent Erosion Control, High Survivability, Classes A, B, and C | Tables 4 and 5 |
| Ditch Lining | Table 4 |
| Temporary Silt Fence | Table 6 |

Thread used for sewing must consist of high strength polypropylene, polyester, or polyamide. Nylon threads will not be allowed. The thread used to sew permanent erosion control geotextiles must be resistant to ultraviolet radiation. The thread must be of contrasting color to that of the geotextile itself.

9-37.2 GEOTEXTILE PROPERTIES

Table 1. Geotextile for Underground Drainage Strength Properties for Survivability

| Geotextile Property | Test Method ² | Geotextile Property Requirements ¹ | |
|--|--------------------------|--|--|
| | | Low Survivability | Geotextile Property |
| Grab Tensile Strength, min. in machine and x machine direction | ASTM D 4632 | 180 lbs / 115 lbs min., | 250 lbs / 160 lbs min |
| Grab Failure Strain, in machine and x machine direction | ASTM D 4632 | <50% / 50% | <50% / 50% |
| Seam Breaking Strength | ASTM D 4632 ³ | 160 lbs / 100 lbs min. | 220 lbs / 140 lbs min. |
| Puncture Resistance | ASTM D 4833 | 67 lbs / 40 lbs min. | 80 lbs / 50 lbs min. |
| Tear Strength, min. in machine and x machine direction | ASTM D 4533 | 67 lbs / 40 lbs min | 80 lbs / 50 lbs min. |
| Ultraviolet (UV) Radiation stability | ASTM D 4355 | 50% strength retained min., after 500 hrs in weatherometer | 50% strength retained min., after 500 hrs in weatherometer |

See Notes after Table 6, this Specification.

Table 2. Geotextile for Underground Drainage Filtration Properties

| Geotextile Property | Test Method ² | Geotextile Property Requirements ¹ | | |
|---------------------|--------------------------|---|-------------------------------|-------------------------------|
| | | Class A | Class B | Class C |
| AOS | ASTM D 4751 | .43 mm max. (No. 40 sieve) | .25 mm max. (No. 60 sieve) | .18 mm max. (No. 80 sieve) |
| Water Permittivity | ASTM D 4491 | .5 sec ⁻¹ min. | .4 sec ⁻¹ min. | .3 sec ⁻¹ min. |

See Notes after Table 6, this Specification.

Table 3. Geotextile for Separation or Soil Stabilization

| Geotextile Property | Test Method ² | Geotextile Property Requirements ¹ | |
|--|--------------------------|---|-----------------------------------|
| | | Separation Woven/Nonwoven | Soil Stabilization Woven/Nonwoven |
| AOS | ASTM D 4751 | .60 mm max. (No. 30 sieve) | .43 mm max. (No. 40 sieve) |
| Water Permittivity | ASTM D 4491 | .02 sec ⁻¹ min. | .10 sec ⁻¹ min. |
| Grab Tensile Strength, min. in machine and x machine direction | ASTM D 4632 | 250 lbs / 160 lbs min. | 315 lbs/200 lbs min. |
| Grab Failure Strain, in machine and x machine direction | ASTM D 4632 | <50% / 50% | <50% / 50% |

| | | | |
|--|--------------------------|--|--|
| Seam Breaking Strength | ASTM D 4632 ² | 220 lbs / 140 lbs min. | 270 lbs/180 lbs min. |
| Puncture Resistance | ASTM D 4833 | 80 lbs / 50 lbs min. | 112 lbs/79 lbs min. |
| Tear Strength, min. in machine and x machine direction | ASTM D 4533 | 80 lbs / 50 lbs min. | 112 lbs/79 lbs min. |
| Ultraviolet (UV) Radiation stability | ASTM D 4355 | 50% strength retained min., after 500 hrs in weatherometer | 50% strength retained min., after 500 hrs in weatherometer |

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See Notes after Table 6, this Specification.

Table 4. Geotextile for Permanent Erosion and Ditch Lining

| | | Geotextile Property Requirements ¹ | | |
|--|--------------------------|--|--|--|
| | | Permanent Erosion Control | | Ditch Lining |
| Geotextile Property | Test Method ² | Moderate Survivability Woven / Nonwoven | High Survivability Woven/Nonwoven | Woven/Nonwoven |
| AOS | ASTM D 4751 | See Table 5 | See Table 5 | .60 mm max (No. 30 sieve) |
| Water Permittivity | ASTM D 4491 | See Table 5 | See Table 5 | .02 sec ⁻¹ min. |
| Grab Tensile Strength, min. in machine and x machine direction | ASTM D 4632 | 250 lbs / 160 lbs min | 315 lbs / 200lbs min. | 250 lbs / 160 lbs min. |
| Grab Failure Strain, in machine and x machine direction | ASTM D 4632 | 15% 50% / > 50% | 15% 50% / > 50% | <50% / ≥ 50% |
| Seam Breaking Strength | ASTM D 4632 ³ | 220 lbs/ 140 lbs min. | 270 lbs / 180 lbs min. | 220 lbs / 140 lbs min. |
| Burst Strength | ASTM D 3786 | 400 psi / 190 psi min. | 500 psi / 320 psi min. | -- |
| Puncture Resistance | ASTM D 4833 | 80 lbs/ 50 lbs min. | 112 lbs / 79 lbs min. | 80 lbs / 50 lbs min. |
| Tear Strength, min. in machine and x machine direction | ASTM D 4533 | 80 lbs/ 50 lbs min. | 112 lbs / 79 lbs min. | 80 lbs / 50 lbs min. |
| Ultraviolet (UV) Radiation stability | ASTM D 4355 | 70% strength retained min., after 500 hrs in weatherometer | 70% strength retained min., after 500 hrs in weatherometer | 70% strength retained min., after 500 hrs in weatherometer |

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See Notes after Table 6, this Specification.

Table 5. Filtration Properties for Geotextile for Permanent Erosion Control

| | | Geotextile Property Requirements ¹ | | |
|---------------------|--------------------------|---|----------------------------|-----------------------------|
| | | Class A | Class B | Class C |
| Geotextile Property | Test Method ² | | | |
| AOS | ASTM D 4751 | .43 mm max. (No. 40 sieve) | .25 mm max. (No.60 sieve) | 0.22 mm max. (No. 70 sieve) |
| Water Permittivity | ASTM D 4491 | 0.7 sec ⁻¹ min. | 0.4 sec ⁻¹ min. | 0.2 sec ⁻¹ min. |

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See Notes after Table 6, this Specification.

Table 6. Geotextile for Temporary Silt Fence

| Geotextile Property | Test Method ² | Geotextile Property Requirements ¹ | |
|--|--------------------------|---|---|
| | | Unsupported Between Posts | Supported Between Posts With Wire Or Polymeric Mesh |
| AOS | ASTM D 4751 | for slit film wovens .60 mm max. (No. 30 sieve) for all other geotextile types .30 mm max. (No. 50 sieve) .15 mm min. (No. 100 sieve) | for slit film wovens .60 mm max. (No. 30 sieve) for all other geotextile types .30 mm max. (No. 50 sieve) .15 mm min. (No. 100 sieve) |
| Water Permittivity | ASTM D 4491 | .02 sec ⁻¹ min. | .02 sec ⁻¹ min. |
| Grab Tensile Strength, min. in machine and x machine direction | ASTM D 4632 | 180 lbs min. in machine direction, 100 lbs min. in x machine direction | 100 lbs Min |
| Grab Failure Strain, in machine and x machine direction | ASTM D 4632 | 30% max. at 180 lbs or more | -- |
| Ultraviolet (UV) Radiation Stability | ASTM D 4355 | 70% Strength retained min., after 500 hrs in weatherometer | 70% Strength retained min., after 500 hrs in weatherometer |

NOTES:

1. All geotextile properties in Tables 1 through 6 are minimum average roll values (i.e. the test result for any sampled roll in a lot must meet or exceed the values shown in the table).
2. The test procedures used are essentially in conformance with the most recently approved ASTM geotextile test procedures, except for geotextile sampling and specimen conditioning, which are per WSDOT Test Methods 914 and 915, respectively.
3. With seam located in the center of 8-inch long specimen oriented parallel to grip faces.

9-37.3 AGGREGATE CUSHION FOR PERMANENT EROSION CONTROL GEOTEXTILE

Aggregate cushion for permanent erosion control geotextile, Class A must be as specified in Section 9-03.7(2).
Aggregate cushion for permanent erosion control geotextile, Class B or Class C, must be as specified in Sections 9-03.7(3) and 9-03.7(2).

9-37.4 GEOTEXTILE APPROVAL AND ACCEPTANCE**9-37.4(1) SOURCE APPROVAL**

For each geotextile application, the Contractor must submit to the Engineer for approval, the manufacturer's name, address, the geotextile full product name, and the geotextile Structure including fiber/yarn type.

If the geotextile source has not been previously evaluated, a sample of each proposed geotextile must be submitted to the Engineer for evaluation. After the sample and required information for each geotextile type has been received by the Engineer, a maximum of 14 Calendar Days will be required for this testing. Source approval will be based on conformance to the applicable values from Tables 1 through 6 in Section 9-37.2.

Source approval is not the basis of acceptance of specific lots of Material unless the lot sampled can be clearly identified and the number of samples tested and approved per WSDOT Test Method 914.

9-37.4(2) GEOTEXTILE SAMPLES FOR SOURCE APPROVAL AND ENGINEER TESTING

Each sample must have minimum dimensions of 5 feet by the full roll width and must be a minimum 6 square yards. The machine direction must be marked clearly on each sample and is defined as the direction perpendicular to the axis of the geotextile roll. Source approval for temporary silt fences will be by manufacturer's certificate of compliance, as specified in Section 1-06.3.

Samples must be cut from the geotextile roll by a suitable method that produces a smooth geotextile edge without edge ripping or tearing. The samples must not be taken from the outer wrap of the roll nor the inner wrap of the core.

9-37.4(3) ACCEPTANCE SAMPLES

Samples will be taken by the Engineer at the Project Site to confirm the geotextile complies with Specifications.

Approval will be based on testing of samples from each lot. A "lot" must be defined for the purposes of this Specification as all geotextile rolls within the consignment (i.e. all rolls sent to the Project Site) which were produced by the same manufacturer during a continuous period of production at the same manufacturing facility and have the same product name.

1 After receipt of the samples by the Engineer, a maximum of 14 Calendar Days will be required for testing. If the results of the
 2 testing show that a geotextile lot, as defined, does not meet the properties required for the specified use as per Tables 1
 3 through 6 in Section 9-37.2, the roll or rolls which were sampled will be rejected. Two additional rolls for each roll found
 4 defective from the lot tested will then be sampled at random by the Engineer for retesting. If retesting shows that any of the
 5 additional rolls tested do not meet the required properties, the entire lot will be rejected. If the test results from all the rolls
 6 retested meet the required properties, the entire lot minus the roll which failed will be accepted. All geotextile with defects,
 7 deterioration, or damage will be rejected and must be replaced at no expense to the Owner.

8 **9-37.4(4) ACCEPTANCE BY CERTIFICATE OF COMPLIANCE**

9 When the quantities of geotextile proposed for use in each geotextile application are less than or equal to the following
 10 amounts, acceptance must be by manufacturer's certificate of compliance:

| Application | Geotextile Quantity |
|-----------------------------------|---------------------|
| Underground Drainage | 600 sq. yards |
| Soil Stabilization and Separation | 1,800 sq. yards |
| Permanent Erosion Control | 1,200 sq. yards |
| Temporary Silt Fence | All quantities |

12
 13 The manufacturer's certificate of compliance must include the manufacturer's name, current address, full product name,
 14 geotextile Structure including fiber/yarn type, geotextile roll number, proposed use, and certified test results.

15 **9-37.4(5) APPROVAL OF SEAMS**

16 If the geotextile seams are to be sewn in the field, the Contractor must provide a section of sewn seam which can be
 17 sampled by the Engineer before the geotextile is installed.

18 The seam sewn for sampling must be sewn using the same equipment and procedures as are to be used to sew the
 19 production seams. If production seams are to be sewn in both the machine and cross machine directions, the Contractor must
 20 provide sewn seams for sampling which are oriented in both the machine and cross machine directions. The seams sewn for
 21 sampling must be at least 2 yards in length in each geotextile direction. If the seams are sewn in the factory, the Engineer will
 22 obtain samples of the factory seam at random from any of the rolls to be used. The seam assembly description must be
 23 submitted by the Contractor to the Engineer and are to be included with the seam sample obtained for testing. This description
 24 must include the seam type, stitch type, sewing thread type, and stitch density.

25 **SECTION 9-38 TEMPORARY TRAFFIC CONTROL MATERIALS**

26 **9-38.0 GENERAL REQUIREMENTS**

27 Temporary traffic control materials in this Section consist of various traffic communication, channelization and protection
 28 items described in Section 1-10 and listed below:

- 29 1. Stop/Slow Paddles
- 30 2. Construction Signs
- 31 3. Wood Sign Posts
- 32 4. Sequential Arrow Signs
- 33 5. Portable Changeable Message Signs
- 34 6. Barricades
- 35 7. Traffic Safety Drums
- 36 8. Barrier Drums
- 37 9. Traffic Cones
- 38 10. Tubular Markers
- 39 11. Warning Lights and Flashers
- 40 12. Truck-Mounted Attenuator
- 41 13. Portable Temporary Traffic Control Signal
- 42 14. Tall Channelizing Devices

43 The Contractor's TCM and TSC must be responsible for assuring that temporary traffic control devices and materials
 44 comply with these Specifications. Certification for crashworthiness according to NCHRP 350 will be required as described in
 45 Section 1-10.2(5)B .

46 MUTCD, as used in this Section, refers to the latest WSDOT-adopted edition of the Manual on Uniform Traffic Control
 47 Devices for Streets and Highways. The RCW 47.36, Traffic Control Devices, requires traffic control devices along city streets

1 to conform to the WSDOT adopted standards to the extent possible. In the event of conflicts between the MUTCD, and the
2 Contract Documents, then the Contract Documents must govern.

3 9-38.1 STOP/SLOW PADDLES

4 Paddles must conform to the MUTCD, except that the minimum width must be 24 inches.

5 9-38.2 CONSTRUCTION SIGNS

6 Construction signs must conform to the MUTCD and must be per NCHRP Report 350 for Category 2 devices. Any
7 sign/sign stand combination that satisfies these requirements will be acceptable. Post mounted Class A construction signs
8 must be as specified in Section 9-38.2 and additionally must be as specified in Section 9-28.

9 All Class A and Class B signs must utilize materials and be fabricated as specified in Section 9-28. All regulatory signs
10 having a red background (such as Stop and Yield) and all other regulatory information signs (for example Speed Limit or
11 Traffic Fines Double in Work Zones) must have Type III or IV sheeting in urban areas. All signs having a green background
12 (such as Exit arrow) must have Type II sheeting for the background and Type III or IV sheeting for the letters, border, and
13 symbols.

14 9-38.3 WOOD SIGN POSTS

15 Post sizes for construction signs must be as follows:

16 One Post Installation

| Post Size | Min. Sign sf | Max. Sign sf |
|-----------|--------------|--------------|
| 4 x 4 | -- | 16 |
| 4 x 6 | 17 | 20 |
| 6 x 6 | 21 | 25 |
| 6 x 8 | 26 | 31 |

18 Two Post Installation

| Post Size | Min. Sign Sq. Ft. | Max. Sign Sq. Ft. |
|-----------|-------------------|-------------------|
| 4 x 4 | - | 16 |
| 4 x 6 | 17 | 36 |
| 6 x 6 | 37 | 46 |
| 6 x 8 | 47 | 75 ¹ |

19 NOTE:

- 20 1. The Engineer must determine post size for permanent signs greater than 75 square feet.

21 Sign posts must conform to the grades and usage listed below. Grades must be determined by the current standards of
22 the West Coast Lumber Inspection Bureau (WCLIB) or the Western Wood Products Association (WWPA).

| Post Size | Grade |
|----------------------|--|
| 4 x 4 | Construction grade (Light Framing, Section 122-b WCLIB) or (Section 40.11 WWPA) |
| 4 x 6 | No. 1 and better, grade (Structural Joists and Planks, Section 123-b WCLIB) or (Section 62.11 WWPA) |
| 6 x 6, 6 x 8, 8 x 10 | No. 1 and better, grade (Posts and Timbers, Section 131-b WCLIB) or (Section 80.11 WWPA) |
| 6 x 10, 6 x 12 | No. 1 and better, grade (Beams and Stringers, Section 130-b WCLIB) or (Section 70.11 WWPA) |

26 9-38.4 SEQUENTIAL ARROW SIGNS

27 Sequential Arrow Signs must conform to the MUTCD supplemented with the following:

- 28 1. Sequential arrow signs furnished for stationary lane closures on this project must be Type C.
29 2. The color of the light emitted must be yellow.
30 3. The dimming feature must be automatic, reacting to changes in light without a requirement for manual adjustment.
31

9-38.5 PORTABLE CHANGEABLE MESSAGE SIGNS

Portable Changeable Message Signs (PCMS) must conform to the MUTCD.

The PCMS must employ one of the following technologies:

1. Fiber optic/shutter
2. Light emitting diode
3. Light emitting diode/shutter
4. Flip disk

Regardless of the technology, the PCMS must comply with the following general requirements:

- a. Be light emitting and must not rely solely on reflected light. The emitted light must be generated using fiber optic or LED technology.
- b. Have a display consisting of individually controlled pixels no larger than 2-1/2" x 2-1/2". If the display is composed of individual character modules, the space between modules must be minimized so alphanumeric characters of any size specified below can be displayed at any location within the matrix.
- c. When activated, the pixels must display a yellow or orange image. When not activated, the pixels must display a flat black image that matches the background of the sign face.
- d. Be capable of displaying alphanumeric characters that are a minimum of 18 inches in height. The width of alphanumeric characters must be appropriate for the font. The PCMS must be capable of displaying 3 lines of 8 characters per line with a minimum of one pixel separation between each line.
- e. The PCMS message, using 18-inch characters, must be legible by a person with 20/20 corrected vision from a distance of not less than 800 feet centered on an axis perpendicular to the sign face.
- f. The sign display must be covered by a stable, impact resistant polycarbonate face. The sign face must be non-glare from all angles and must not degrade due to exposure to ultraviolet light.
- g. Be capable of simultaneously activating all pixels for the purpose of pixel diagnostics. Any sign that employs flip disk or shutter technology must be programmable to activate the disks/shutters once a day to clean the electrical components. This feature must not occur when the sign is displaying an active message.
- h. The light source must be energized only when the sign is displaying an active message.
- i. Primary source of power must be solar power with a battery backup to provide continuous operation when failure of the primary power source occurs.
- j. The sign controller software must be NTCIP compliant.

The PCMS panels and related equipment must be permanently mounted on a trailer with all controls and power generating equipment.

The PCMS must be operated by a controller that provides the following functions:

- 1) Select any preprogrammed message by entering a code.
- 2) Sequence the display of at least 5 messages.
- 3) Blank the sign.
- 4) Program a new message, which may include animated arrows and chevrons.
- 5) Mirror the message currently being displayed or programmed.

9-38.6 BARRICADES

Barricades must conform to the MUTCD further supplemented by the Contract Drawings or Standard Plans when provided.

9-38.7 TRAFFIC SAFETY DRUMS

Traffic safety drums must conform to the MUTCD and must have the following additional physical characteristics:

| Characteristic | Requirement |
|----------------|--|
| Material | Fabricated from low-density polyethylene per ASTM D 4976 and is UV stabilized. |
| Overall Width | 18-inch minimum regardless of orientation. |
| Shape | Rectangular, hexagonal, circular, or flat-sided semi-circular. |
| Color | The base color of the drum must be fade resistant safety orange. |

The traffic safety drums must be designed to accommodate at least one portable light unit. The method of attachment must ensure that the light does not separate from the drum upon impact.

1 Drums and light units must comply with the crashworthiness requirements of NCHRP 350 as specified in Section 1-
2 10.2(5)B.

3 When recommended by the manufacturer, drums must be treated to ensure proper adhesion of the reflective sheeting.
4 Retroreflective bands must be fabricated from Type III or Type IV reflective sheeting as described in Section 9-38.15.

5 **9-38.8 BARRIER DRUMS**

6 Barrier drums must be small traffic safety drums, manufactured specifically for traffic control purposes to straddle a
7 concrete barrier and must be fabricated from low density polyethylene that complies with ASTM D 4976 and is UV stabilized.

8 The barrier drums must comply with the following general Specifications:
9

| Characteristic | Requirement |
|--|---|
| Total height | 22" ± 1" |
| Cross-section | Hollow oval 10" x 14", ± 1" |
| Formed support legs length | 3" ± 1" |
| Space between legs(taper to fit conc. barrier) | 6-1/4" min. |
| Weight | 33 lb ± 4 lb with legs filled with sand |
| Color | Fade resistant safety orange |

10
11 Barrier drums must have three 4-inch retro-reflective white bands, (one complete and two partial). Bands must be
12 fabricated from Type III or Type IV reflective sheeting as described in Section 9-38.15.

13 **9-38.9 TRAFFIC CONES**

14 Cones must conform to the MUTCD, except that the minimum height must be 28 inches.

15 Retroreflective bands must be fabricated from Type III or Type IV reflective sheeting as specified in Section 9-38.15.

16 **9-38.10 TUBULAR MARKERS**

17 Tubular markers must conform to the MUTCD, except that the minimum height must be 28 inches.

18 The devices must be stabilized by affixing them to the pavement by using either weighted bases or adhesive. Adhesive
19 used to glue the device to the pavement must be as specified in Section 9-26.2. Retroreflective bands must be fabricated from
20 Type III or Type IV reflective sheeting as specified in Section 9-38.15.

21 **9-38.11 WARNING LIGHTS AND FLASHERS**

22 Warning lights and flashers must conform to the MUTCD.

23 **9-38.12 TRUCK-MOUNTED ATTENUATOR**

24 The Truck-Mounted Attenuator (TMA) must be selected by the Contractor as required, or as specified in the Contract
25 Documents. The TMA must be mounted on a vehicle with a minimum weight of 15,000 pounds and a maximum weight per the
26 manufacturer's recommendations. Ballast used to obtain the minimum weight requirement, or any other object that is placed
27 on the vehicle must be securely anchored such that it will stay on the vehicle during an impact. The Contractor must provide
28 certification that the unit complies with NCHRP 350 Test level 3 requirements.

29 The TMA must have an adjustable height so that it can be placed at the correct elevation during usage and to a safe
30 height for transporting. If needed, the Contractor must install additional lights to provide fully visible brake lights at all times.

31 The TMA unit must have a chevron pattern on the rear of the unit. The standard chevron pattern must consist of 4-inch
32 yellow stripes, alternating non-reflective black and retro-reflective yellow sheeting, slanted at 45 degrees in an inverted V with
33 the V at the center of the unit.

34 **9-38.13 TALL CHANNELIZING DEVICES**

35 Tall channelizing devices must comply with MUTCD Part VI for channelizing devices and must conform to these general
36 Specifications:

- 37 1. Fabricated of fade resistant, safety orange color, low-density polyethylene that is resistant to deformation upon
38 impact and complies with ASTM D 4976 and is UV stabilized.
- 39 2. 42 inches in height minimum, using a tapered cone type shape of consistent dimensions regardless of orientation to
40 traffic.
- 41 3. 4 inches in width minimum at the top and 8 inches in width minimum at the base, which incorporates a separate
42 ballast that is designed to resist overturning or other movement from wind gusts or other external forces.
- 43 4. 4 retroreflective 6-inch wide horizontal bands, alternating orange and white beginning 6-inch from the top of the
44 device. Retroreflective bands must be fabricated from Type III or Type IV reflective sheeting as described in Section
45 9-38.15.

5. Warning lights are not required unless specifically shown on the traffic control Plan but provisions for securely attaching a warning light are required. The method of attachment must ensure that the light does not separate from the device upon impact and light units must be crashworthy per NCHRP 350 as specified in Section 1-10.2(5)B.
6. Devices must be regularly maintained to ensure that they are clean and the reflective sheeting is in good condition.

Except for the Specifications and requirements specifically listed above, Tall Channelizing Devices are defined to be Traffic Cones. All non-conflicting Contract provisions related to Cones apply to Tall Channelizing Devices.

9-38.14 PORTABLE TEMPORARY TRAFFIC CONTROL SIGNAL

Portable traffic control signals must comply with MUTCD and these Specifications.

The portable temporary traffic control signal must be fully operational for two-phase traffic actuated, pretimed, or manual control. The portable temporary traffic control signal must conform to the following requirements:

1. Controllers must demonstrate conflict-monitoring capability be as specified in Section 9-38.14(1)A, with a flashing red display in both directions. The portable traffic control signal must be capable of terminating the movement 1 or movement 2 all red clearance, in order to repeat the previous movements operation.
2. Signal head displays must be either hard wired or controlled by radio signal. Manual operation will not require hardwiring or radio control except for the use of two-way radio communication by manufacturer trained qualified operators.
3. The system must be equipped with a means of informing the operator of signal indications, such as a light on the back of each signal head that illuminates when the signal displays a red indication, during manual operation.
4. A vehicle detection system is required. The system must be capable of operating either as fixed time or traffic actuated controller. The detection system must provide presence detection (continuous call to the controller) while there is a vehicle in the detection zone.
5. Signal supports used with portable traffic control signals must provide a minimum of two signal displays, spaced a minimum of 8 feet apart. When trailer mounted portable traffic signals are used to provide alternating one-way control, a minimum of one of the signal displays must be suspended over the traveled way. The minimum vertical clearance to the traveled way for this signal display is 16-1/2 feet. Vehicular signal heads must be of the conventional type with standard ITE approved, 12-inch ball LED display. Tunnel visors must be provided for all indications. The system must include a countdown display capable of a 199 second countdown clock for motorist information when there is no direct line of sight between the stop bar locations.
6. Back plates must be furnished and attached to the signal heads. Back plates must be constructed of 5-inch wide .050-inch thick corrosion resistant louvered aluminum, with a flat black finish. A highly retroreflective strip, 3 inches wide, must be placed around the perimeter of the face of all vehicle signal backplates to project a rectangular image at night towards oncoming traffic.
7. Trailers must have a leveling jack installed at all 4 corners. The crank for the leveling jacks and trailer hitch must be locked. The signal pole and mast arm assemblies must be of the collapsible type, which can be erected and extended at the Job Site. The mast arm assemblies must be firmly attached to the trailer to form a stable unit, which can withstand an 80 mph design wind speed with a 1.3 gust factor.
8. The portable temporary traffic control signal must be powered using a self-contained battery system capable of providing over 12 Days of continuous operations without solar array assistance. A solar panel array will be allowed.

9-38.14(1)A FLASHING OPERATIONS

All temporary traffic signals must be equipped for flashing operation of signal displays. Controllers must be programmed for flashing red displays for all approaches. During flash display, all pedestrian circuits must be de-energized.

Actuated traffic signal control mechanisms must be capable of entry into flash operation and return to normal operation as follows:

1. Terminal Strip Input (Remote Flash). When called as a function of a terminal strip input, the controller must provide both sequenced entry into flash and sequenced return to normal operation consistent with the requirements of the latest edition of the Manual on Uniform Traffic Control Devices.
2. Police Panel Switch. When the flash-automatic switch located behind the police panel door is turned to the flash position, the signals must immediately revert to flash; however, the controller must "STOP TIME." When the switch is placed on automatic, the signals must immediately time an 8 to 10 second all red period then resume normal cyclic operations at the beginning of major street green.
3. Controller Cabinet Switches. When the flash-automatic switch located inside the controller cabinet is placed in the flash position, the signals must immediately revert to flash; however, the controller must continue to function. When the flash-automatic switch is placed in the automatic position, the controller must immediately resume normal cyclic operation at the beginning of the artery green. Adjacent to the flash-automatic switch must be a controller on-off switch. If the flash-automatic switch is in the automatic position and the controller on-off switch is placed in the OFF position, the signals must immediately revert to flash.
4. Power Interruption. On "NEMA" controllers any power interruption longer than 475 ± 25 milliseconds, signals must re-energize consistent with No. 2 above to ensure an 8 second flash period prior to the start of major street green. A

power interruption of less than 475 ± 25 milliseconds must not cause resequencing of the controller and the signal displays must re-energize without change. Type 170 controllers must re-energize consistent with No. 2 above after a power interruption of 1.75 ± 0.25 seconds. The 8 second flash period will not be required.

5. Conflict Monitor. Upon sensing conflicting signals or unsatisfactory operation voltages, the conflict monitor must immediately cause the signal to revert to flash; however, the controller must stop time at the point of conflict. After the conflict monitor has been reset, the controller must immediately take command of the signal displays at the beginning of major street green.

9-38.15 TYPE III OR TYPE IV REFLECTIVE SHEETING

Type III and Type IV reflective sheeting must consist of spherical or prismatic lens elements adhered to a synthetic resin and encapsulated by a flexible, transparent, weatherproof plastic having a smooth outer surface. All sheeting must be weather resistant and have a protected precoated adhesive backing.

The reflective sheeting must have the following minimum coefficient of retroreflection values at 0.2 degrees and 0.5 degrees observation angle expressed as average candelas per foot-candle, per square foot of material. Measurements must be conducted per ASTM E 810.

Type III Glass Bead Retroreflective Element Material

| Obs. Angle | Entrance Angle | Silver White | Yellow | Orange | Green | Red | Blue | Brown |
|-------------|----------------|--------------|--------|--------|-------|-----|------|-------|
| 0.2 degrees | -4 degrees | 250 | 170 | 100 | 45 | 45 | 20 | 12 |
| 0.2 degrees | +30 degrees | 150 | 100 | 60 | 25 | 25 | 11 | 8.5 |
| 0.5 degrees | -4 degrees | 95 | 62 | 30 | 15 | 15 | 7.5 | 5.0 |
| 0.5 degrees | +30 degrees | 65 | 45 | 25 | 10 | 10 | 5.0 | 3.5 |

Type IV Micro Prismatic Retroreflective Element Material

| Obs. Angle | Entrance Angle | White | Yellow | Green | Red | Blue | Brown |
|-------------|----------------|-------|--------|-------|-----|------|-------|
| 0.2 degrees | -4 degrees | 250 | 170 | 35 | 35 | 20 | 7.0 |
| 0.2 degrees | +30 degrees | 80 | 54 | 9 | 9 | 5.0 | 2.0 |
| 0.5 degrees | -4 degrees | 135 | 100 | 17 | 17 | 10 | 4.0 |
| 0.5 degrees | +30 degrees | 55 | 37 | 6.5 | 6.5 | 3.5 | 1.4 |

1. The standard rainfall test specified in Federal Specification LS 300C and the brightness of the reflective sheeting totally wet by rain must not be less than 90 percent of the above values.
2. Samples must be submerged in a tank of clean water (approximately 72 °F) for a period of 5 minutes. Reflex-reflective performance of the sheeting must be viewed in a darkened room by reflected light through the surface of the water or through a transparent plane surface of the tank parallel to the sample surface. Light source must be such as a hand flashlight held close to the eye. The wet sheeting must show no apparent loss of reflective performance as compared to dry material.

The diffuse day color of the reflective sheeting must be visually evaluated by comparison with the applicable Highway Color Tolerance Chart. Color comparison must be made under north daylight or a scientific daylight having a color temperature from 6500 K to 7500 K. Daytime color evaluation must be illuminated at 45 degrees and viewed at 90 degrees. There must be no significant color shift when viewed under nighttime (retroreflective) conditions.

END OF DIVISION

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INDEX

1
2
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The City of Seattle is aware the Section references in the index are not all correct. The final 2017 Construction Standards will be updated with the correct index references, including creating linked references throughout, prior to publication.

INDEX

A

Abandon catch basin, valve chamber, maintenance hole or inlet2-02.3(4)

Abandon and fill, and plug pipe2-02.3(5)

Abbreviations, associations and miscellaneous1-01.2(1)

Abbreviations, items of work and units of measurement1-01.2(2)

Abbreviations, standard - see Standard Plan No. 002

Abbreviations, standard symbols - see Standard Plan No. 003

Acceptance – see "Completion, time for" and "Final inspection"

Access to private property during construction1-07.24

Access to work (inspection)1-05.6

Addenda1-02.6

Adjusting utility and similar structure casting to grade7-20

Admixtures for Portland cement concrete9-23

Aggregates9-03

Air release/ air vacuum valves- see "Water Valves"

Air relief valve – see "Irrigation valves"

Alley, blocking of – see "Notifications relative to contractor's activities"

Alley.....8-19

Aluminum pipe in contact with Portland cement, treatment for9-05.7(1)

Amendments and mulches, landscaping9-14.4

American-made material requirements - see section 1-06.1 of the project manual

Anchor bolts

 grout for6-02.3(20), 9-04.3(2)B

 material requirements9-06.4(3)

 placed in concrete structure6-02.3(18)

 placed in steel structure6-03.3(35)

 poles and pedestals, lighting and signal9-33.1(2)

Anti-stripping additive, see "Hot mix asphalt"

Appeals (protest of an intended award of contract)1-03.7

Approval of

 materials1-05.6, 1-06.2

 source of materials1-06.1

Approved equal, or1-06.1(1)

As-built drawings, see "Submittals, contractor required"

Asphalt concrete - see "Hot mix asphalt"

Asphalt treated base (ATB)4-06

Assignment1-08.2

Associations and miscellaneous1-01.2(1)

Audits of contractor records1-09.10

Authority of contractor's personnel1-05.13

Authority of assistants and electrical safety observer1-05.2

Authority of engineer1-05.1

Award and execution of contract1-03

B

Backfill types

 CDF, pipe bedding & trench backfill2-10

 mineral aggregates9-03.10

 selected material2-10

Backfilling construction

 flow control system7-16.3(1)

 irrigation system8-03.3(11)

 sewer and drainage structures7-05.3

 structure excavation2-04

 trench2-10

Backflow prevention inspection notice – see "Notifications relative to contractor's activities"

Backflow prevention assemblies9-15.9

Backflow prevention requirement

 irrigation8-03.3(1)

 water main7-11.3(16)G

Back guy assembly8-32.3(3), 9-33.8

Ballasting and crushed surfacing4-04

Ballasts, electrical

 luminaires9-31.1(5)

 overhead interior illuminated signs9-32.5

Bark mulch9-14.4(3)

Barricades

 construction under traffic1-07.23(1)

 pedestrian control and protection1-07.23(2)

 traffic control plans1-10.2(5)

Barrier, concrete6-10

Base

 asphalt treated4-06

 ballasting and crushed surfacing4-04

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|--|------------------------|
| maintenance holes | 7-05.3(1)D |
| Beam guardrail | |
| construction | 8-11 |
| non-weathering steel | 9-16.3 |
| weathering steel | 9-16.6 |
| Bearing pad, elastomeric | 9-35 |
| Bearing test, 3 edge - for concrete pipe | 9-05.2(2)A |
| Bearing value | |
| falsework piling | 6-02.3(17)D2 |
| piles, determination of | 6-05.3(12) |
| Bearings, bridge | 6-02.3(19) |
| Bedding for pipe | |
| sewer and drainage | 7-17.3(1) |
| water main | 7-11.3(1) |
| Beginning work (notice to proceed) | 1-08.4 |
| Benches | 8-02.3(20), 9-14.13 |
| Bending reinforcing steel | 6-02.3(24)A, 9-07.1(2) |
| Bid(s) | |
| appeals | 1-03.7 |
| documents, where to obtain | 1-02.4 |
| consideration of | 1-03.1 |
| form and style of | 1-02.5 |
| guaranty | 1-02.7 |
| irregular | 1-02.13 |
| modification or withdrawal | 1-02.10 |
| public opening | 1-02.12 |
| procedures and conditions | 1-02 |
| return of guaranty | 1-03.6 |
| submittal | 1-02.9 |
| tabulation | 1-03.1(1) |
| withdrawal or modification | 1-02.10 |
| Bidder | |
| disqualifications | 1-02.14 |
| qualifications | 1-02.1 |
| Bituminous materials | 9-02 |
| Bituminous surface treatment | 5-02 |
| Block traffic curb | 8-07, 9-18.2 |
| Blocking alley, street, sidewalk – construction notification requirement | 1-07.28 |
| Blowoff assembly (water main) | 7-11.3(18), 9-30.2(8) |
| Bollards | 8-02.3(19), 9-14.12 |
| Bolt holes -see "Holes" | |
| Bolted connections | |
| falsework & formwork, timber | 6-02.3(17) |
| preparation for steel structures | 6-03.3(27)F |
| steel structures | 6-03.3(33) |
| Bond | |
| bid guaranty | 1-02.7 |
| contract bond | 1-03.4 |
| Bonding and grounding | |
| illumination & electrical | 8-30.3(7) |
| traffic signal system | 8-31.3(10) |
| Borrow and borrow sites | 2-10.2(2) |
| Borrow, gravel | 9-03.12 |
| Bracket arm | 8-32.3(5), 9-33.2(9) |
| Bridge approach slab, reinforced concrete | 6-02.3(10) |
| Bridge downspouts | 7-08.3(9) |
| Bridge drains | 7-05.3(4) |
| Bridge railings | 6-06 |
| Bridge under construction, load restrictions | 6-01.5 |
| Bus shelter footing | 8-14.3(9) |
| Buttons, traffic | 8-08, 9-21 |
| "Buy American" requirements - see section 1-06.5 of the project manual | |

C

| | |
|--|-------------------|
| Cable outlets on poles | 9-33.2(5) |
| Calcium chloride in concrete admixtures | 9-23.4 |
| Castings | |
| adjustment in pavement | 7-20 |
| sewer and drainage | 7-20, 9-12.7 |
| survey monuments | 9-22 |
| water main | 9-30.3(9)H |
| Catch basins | 7-05.3(2), 9-12.7 |
| CCTV – see "Television inspection with audio assessment" | 7-17.3(3)G |
| CDF – see "Controlled density fill" | |
| Cement | |
| admixtures | 9-23 |
| CDF – see "Controlled density fill" | |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|--|----------------------|
| classification of concrete for pavements | 5-05.3(1) |
| classification of concrete for structures | 6-02.3(1) |
| Portland cement | 9-01 |
| slurry, abandon and fill pipe | 2-02.3(5)A, 9-05.15 |
| slurry, annular space between pipes | 7-17, 9-05.15 |
| Cement concrete in contact with aluminum pipe, treatment of | 9-05.7(1) |
| Cement concrete pavement - see "Pavement, cement concrete" | |
| Cement concrete structural – see "Concrete structures" | |
| Cement concrete sidewalks | 8-14 |
| Cement slurry for abandoning pipe and filling annular space between pipes – see "Cement" | |
| Chain link fence and wire fence | 8-12, 9-16 |
| Changed conditions – see "Differing site conditions" | |
| Changes, equitable adjustment for | 1-09.4 |
| Change orders | 1-04.3 |
| Channel excavation | 2-05, 2-10 |
| Chemical spill | |
| notification requirement | 1-07.28 |
| prevention and control plan..... | 1-07.15(1) |
| water quality | 1-07.5(2) |
| Chloride | |
| dose | 7-11.3(16)E |
| in concrete admixtures | 9-23.4 |
| in prestressed concrete | 9-19.1 |
| in structural concrete | 6-02.3(2)A |
| in water for concrete | 9-25.1 |
| ion content in precast prestressed concrete | 9-19.1 |
| Claims and dispute resolution process | 1-04.4 |
| Clay Pipe – see "Vitrified clay pipe" | |
| Cleanup | |
| roadside and final..... | 1-04.10 |
| quarry and pit sites | 3-01.2(1)E |
| Cleaning existing drainage structures | 7-07 |
| Clear plastic covering, erosion control | 8-01.3(8), 9-14.5(4) |
| Clearances with utilities | 1-07.17(2) |
| Clearing and grubbing..... | 2-01 |
| Clearing, site for structures | 6-01.3 |
| Coatings, water main | 7-11.3(2)B |
| Cofferdams | 2-08.3(2) |
| Cold weather work/unfavorable weather - see "Weather limitations" | |
| Collusion | 1-02.8 |
| Coloring agent for concrete sidewalk | 8-14.2, 9-25.1 |
| Compacting | |
| asphalt, hot mix | 5-04.3(9) |
| asphalt treated base (ATB)..... | 4-06.3(7) |
| ballasting and surfacing | 4-04.3(5) |
| backfill, sewer & drainage structures | 7-05.3, 2-10 |
| backfill, electrical conduit | 8-33.3(1), 2-10 |
| backfill, flow control structure | 7-16.3(1), 2-10 |
| backfill, sewer and drainage | 7-17, 2-10 |
| backfill, water main | 7-11, 2-10 |
| earth embankments | 2-04 |
| full depth asphalt pavement recycling | 4-05.3(2)C |
| full depth pavement reclamation | 4-07.3(2)D |
| lawn installation | 8-02.3(14) |
| planting area preparation | 8-02.3(4) |
| rock embankments | 2-04 |
| structure excavations | 2-04.3(5) |
| subgrade , pavements | 2-11 |
| Compaction control tests | 2-11.3(2) |
| Completion, contract | 1-05.12 |
| Completion, time for | 1-08.5 |
| also see agreement form in the project manual | |
| Compost | 9-14.4(8) |
| Concrete - see "Concrete structures" or "Pavement, cement concrete" | |
| Concrete barrier | 6-10 |
| Concrete brick | |
| sewer & drainage structures | 9-12.5 |
| valve chambers | 9-30.3(9)C |
| Concrete, cement – see "Cement" | |
| Concrete curing materials and admixtures | 9-23 |
| Concrete driveway | 8-19 |
| Concrete, equipment | 5-05.3(3) |
| Concrete in contact with aluminum pipe, treatment | 9-05.7(1) |
| Concrete pipe, sewer and storm drain | 9-05 |
| permeability test | 9-05.2(2)A |
| three edge bearing test | 9-05.2(2)A |
| Concrete slope protection | 8-16 |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|---|-------------------|
| Concrete structures | 6-02 |
| admixtures | 6-02.3(3), 9-23 |
| bonding new concrete to existing | 6-02.3(34)A2 |
| class concrete | 6-02.3(1) |
| compression seal | 6-02.3(10)F |
| concrete placing requirements | 6-02.3(5) |
| construction joint | 6-02.3(12) |
| curing | 6-02.3 (11) |
| curing materials | 9-23 |
| expansion joint | 6-02.3(13) |
| exposed to alkaline soils or water | 6-02.3(8) |
| exposed to seawater | 6-02.3(7) |
| finishing surfaces (Class finish) | 6-02.3(14) |
| formwork and falsework | 6-02.3(17) |
| precast panels | 6-02.3(28) |
| prestressed girders | 6-02.3(25), 9-19 |
| proportioning materials | 6-02.3(2) |
| rate of placing, concrete pressure | 8-15.3(4) |
| vibration | 6-02.3(9) |
| weather and temperature limits to protect | 6-02.3(4)D |
| Conduit and trenching, electrical | 8-33 |
| risers | 8-33.3(3) |
| jacking or boring | 8-33.3(5) |
| rigid steel | 9-34.2 |
| PVC | 9-34.3 |
| Conformity with and deviations from drawings and stakes | 1-05.4 |
| Connection, catch basin, inlet and drop | 7-08 |
| Construction joint, concrete structures | 6-02.3(12) |
| Construction Stormwater and Erosion Control Plan (CSECP) | 8-01.3(2)A |
| Construction notification requirements | 1-07.28 |
| Construction stakes | 1-05.5 |
| Contaminant spill – notification requirement | 1-07.28 |
| Contract | |
| assignment | 1-08.2 |
| award of | 1-03.2 |
| bond | 1-03.4 |
| change in | 1-04.3 |
| completion | 1-05.12 |
| coordination of documents | 1-04.2 |
| execution of | 1-03.3 |
| extension of time and delays | 1-08.8 |
| failure to execute | 1-03.5 |
| final inspection | 1-05.11(2) |
| intent of | 1-04.1 |
| liquidated damages, overrun of contract time | 1-08.9 |
| physical completion | 1-05.11(2) |
| subcontracting | 1-08.1(2) |
| substantial completion | 1-05.11(1) |
| termination | 1-08.10 |
| time (defined term) | 1-01.3 |
| working days, time for completion | 1-08.5 |
| Contract bond | 1-03.4 |
| Contraction joints | |
| concrete driveway | 8-19.3(3) |
| concrete pavement | 5-05.3(8)A |
| concrete sidewalk | 8-14.3(6) |
| joint sealants for sawed | 9-04.2(1) |
| Contractor | |
| compliance with law | 1-07 |
| construction activities, notification requirements | 1-07.28 |
| cooperation with other contractors | 1-05.14 |
| defective work and unauthorized work | 1-05.7 |
| examination of bid documents and project site | 1-02.4 |
| patented devices, materials, and processes | 1-07.20 |
| load limits | 1-07.7 |
| prevailing wages | 1-07.9(1) |
| responsibility for work and damage | 1-07.13 |
| submittals | 1-05.3, 1-08.3(1) |
| Contractor performance evaluation program | 1-05.13(2) |
| Controlled blasting (see special provisions in the project manual) | |
| Controlled density fill (CDF) | |
| CDF pipe bedding | 2-10.2(3) |
| CDF structural bedding | 2-10.2(3) |
| CDF trench backfill | 2-10.2(3) |
| see "Cement, slurry" for filling abandoned pipe and for filling annular space between 2 pipes | |
| Control of materials | 1-06 |
| Control of work | 1-05 |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|---|-------------------------|
| Controller | |
| irrigation, automatic | 9-15.4 |
| irrigation, electrical wire | 9-15.6 |
| irrigation, flushing & testing | 8-03.3(9) |
| irrigation, installation | 8-03.3(7) |
| traffic signal, assembly | 8-31.3(2) |
| traffic signal, assembly testing | 8-31.1(5) |
| traffic signal, intersection check-out & turn-on procedures | 8-31.3(1) |
| traffic signal, check-out procedure | 8-31.3(15) |
| traffic signal, detector loops to | 9-32.4 |
| traffic signal, final inspection & as-built drawings | 8-31.3(17) |
| traffic signal, foundations | 8-32.3(2)B |
| traffic signal, turn-on / cut-over procedure | 8-31.3(16) |
| Coordination of contract documents | 1-04.2 |
| Copper seals | 9-06.10 |
| Corrosion protection, water main | |
| coating for bolts and shackle rods | 9-30.12 |
| couplings | 9-30.2(5) |
| electrolysis test station | 9-30.9 |
| pipe coatings | 9-30.1(4) |
| Corrosion resistant material | |
| aluminum poles | 9-33.3 |
| ground rods, clamps, and hardware, electrical | 9-31.5 |
| pedestrian signal heads, case | 9-32.2(3) |
| water main fittings, bolts and nuts | 9-30.2(5) |
| Corrugated | |
| drain installation | 7-01.3 |
| flow control systems, limitations | 7-16.2 |
| sewer and drainage piping | 9-05 |
| cut-in tee to pipe connection | 7-17.3(2)C3 |
| Cover, depth of | |
| electrical & signal conduit | 8-33.3(1) |
| water main, distribution | 7-11 |
| Crack repair, concrete structure | 6-02.3(33) |
| Crack sealing, asphalt | 5-04.3(4)D |
| Critical path schedule | 1-08.3(1) |
| Crushed surfacing | 4-04, 9-03.7 |
| Cultivation, landscaping | 8-02.3 |
| Culverts | 7-17 |
| Curb | |
| cement concrete | 8-04 |
| extruded, asphalt & cement concrete | 8-06 |
| placed with concrete sidewalk | 8-14 |
| precast, traffic & block | 8-07 |
| Curb ramps..... | 8-14.3(7) |
| Curb wall | 8-17 |
| Curing | |
| concrete curb | 8-04.3(1)E |
| concrete driveway | 8-19.3(4) |
| concrete extruded curb | 8-06.3(5) |
| concrete maintenance hole | 7-05.3(1)C2 |
| concrete pavement | 5-05.3(13) |
| concrete piles | 6-05.3(3)C |
| concrete precast panels | 6-02.3(28)C |
| concrete prestressed girders | 6-02.3(25)D |
| concrete sidewalks | 8-14.3(5) |
| concrete slope protection | 8-16.3(3) and 8-16.3(4) |
| concrete stairways, landing, and steps | 8-18.3(5) |
| concrete structures | 6-02.3(11) |
| concrete structures, removal of falsework and forms | 6-02.3(17)N |
| curing materials | 9-23 |
| full depth pavement reclamation | 4-07.3(2)D |
| traffic curb, precast & block | 9-18.1(6) |

D

| | |
|---|------------|
| Damage, contractor responsible for work and | 1-07.13 |
| Damages, liquidated | 1-08.9 |
| Date numerals, for concrete structures | 6-02.3(15) |
| Dates | |
| landscape planting | 8-02.3(6)A |
| contract, various, defined terms | 1-01.3 |
| Defective work and unauthorized work | 1-05.7 |
| Definitions and tests, materials | 9-00 |
| Delays, contract time | 1-08.8 |
| Deleted or terminated work | 1-09.5 |
| Delineator posts, flexible | 8--08 |
| Density, | |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|--|--------------------|
| asphalt, hot mix | 5-04.3(9) |
| asphalt treated base (ATB) | 4-06.3(7) |
| compaction control tests, soils | 2-11.3(2) |
| full depth asphalt pavement recycling | 4-05.3(2)C |
| full depth pavement reclamation | 4-07.3(2)D |
| trench backfill, sewer / drainage & related structure excavation | 7-17.3 |
| trench backfill, water main & related structure excavation | 7-11.3 |
| Detectable marking tape, irrigation system | 8-03.3(1), 9-15.11 |
| Detectable warning, wheelchair ramp | 9-36 |
| Detector loops | 8-31.3(5), 9-32.4 |
| Detention pipe | 7-16.3(3) |
| Detention storage – see "Flow control structures" | |
| Dewatering | |
| casing for cast-in-place concrete piles | 6-05.3(15)B |
| concrete seals & foundations | 2-08.3(3) |
| sewer & drainage pipe excavation | 2-08 |
| sewer & drainage structure excavation | 2-08 |
| structure excavation | 2-08 |
| water main excavation | 2-08 |
| water main excavation, during water main pipe installation | 2-08 |
| Differing site conditions | 1-04.6 |
| Directional Drilling | 2-16 |
| Disputes and Claims Resolution Process | 1-04.4 |
| Disposal of waste – see "Waste management" | |
| Disqualification of bidders | 1-02.14 |
| Ditch and channel construction | 2-05 |
| Dowel bars | |
| concrete pavement | 5-05.3(10), 9-07.5 |
| curb construction | 8-04.3(1)C |
| timber structures | 6-04.3(5) |
| Downspouts, concrete structures | 7-08.3(9) |
| Drainage | |
| of box girder cells | 6-02.3(21) |
| of substructure | 6-02.3(22) |
| underground, geotextile | 2-15.3(2) |
| Drains | |
| bridge, construction of | 7-05.3(4) |
| bridge, maintenance of | 6-01.14 |
| storm - see "Storm drain and sanitary sewer" | |
| subsurface | 7-01 |
| Drawings..... | 1-01.3 |
| Driveway | |
| asphalt concrete | 5-04.3(17) |
| cement concrete | 8-19 |
| Drop connections, inside and outside | 7-08.3(6) |
| Ductile iron castings | 9-06.11 |
| Dust ratio | |
| definition | 9-00.5 |
| of mineral aggregate types | 9-03 |

E

| | |
|--|-----------------------|
| Ecology block, concrete | Standard Plan no. 460 |
| Edge Wall | 8-17, 8-19 |
| Edging | |
| cedar, landscape construction | 8-02.3(18) |
| cedar material | 9-14.11 |
| paver restraint block construction | 8-02.3(18)B |
| paver restraint block material | 9-14.9(14) |
| Elastomeric bearing pads | 9-35 |
| Elastomeric expansion joint seal, concrete pavement | 9-04.1(2) |
| Electrical, applicable codes | 8-30.1(2) |
| Electrical, on-site lead | 1-01.3 |
| Electrical safety observer | |
| authority of | 1-05.2(2) |
| construction notification requirement | 1-07.28 |
| Electrical wire, irrigation system | 9-15.6 |
| Electrical wire and controller installation, irrigation system | 8-03.3(7) |
| Electrical vaults – construction notification requirement | 1-07.28 |
| Embankments | |
| construction of | 2-04 |
| stepped slope construction | 2-04.3(4)B |
| Engineer | |
| authority of | 1-05.1 |
| Entry onto private property – see "Private property" | |
| Epoxy Resins | 9-26 |
| anchoring bars and rods to concrete | 6-02.3(31) |
| material properties | 9-26 |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|---|-----------------------|
| patching, coated rebar for structural concrete | 6-02.3(24)H |
| Equal Employment Opportunity and non-discrimination requirements | 1-07.11 |
| Equipment | |
| contractor's machinery and | 1-05.9 |
| superintendent, labor, and | 1-05.13 |
| weighing | 1-09.2 |
| Erosion and water pollution control, temporary | 1-07.15 |
| Erosion Control | 8-01 |
| Erosion Control, materials | 9-14 |
| Erosion control lead | 1-05.13(2)A |
| Error, claim of, bid | 1-03.1(2) |
| Estimates | |
| material on hand, progress payment for | 1-09.8 |
| payment for progress estimate | 1-09.9(1) |
| Ethafoam (plastic foam) | 9-05.10 |
| Examination of bid documents and project site | 1-02.4 |
| Excavation | |
| classification – common, unsuitable foundation, solid rock | 2-04 |
| ditch and channel | 2-05 |
| roadway | 2-04 |
| safety systems, trench | 2-07 |
| stripping pits and quarries | 3-01.2(1)B |
| structure | 2-04 |
| trench, sewer and drainage | 7-17.3 |
| trench, water main | 7-11 |
| Execution of contract | 1-03.3 |
| Expansion joint filler and sealer | 9-04.1, 9-04.2 |
| concrete bridge roadway slabs | 6-02.3(13) |
| concrete pavement | 5-05.3(8) |
| material, concrete pavement | 9-04.1(2) |
| material, structural concrete | 6-01.12 |
| Expansion bearings | |
| concrete structures | 6-02.3(19)A |
| steel structures | 6-03.3(37) |
| Explosives, use of | 1-07.22 |
| Extension of contract time | 1-08.8 |
| Execution of contract | 1-03.3 |
| Execution of contract, failure to | 1-03.5 |
| Eyebars, steel | 6-03.3(22) |
| F | |
| Fabric, waterproofing | 6-08 |
| Falsework and formwork | |
| concrete structure construction | 6-02.3(17) |
| steel structure construction | 6-03.3(12) |
| Fence | |
| chain link and wire, construction | 8-12 |
| materials | 9-16 |
| Fertile mulch amendment | 9-14.4(4) |
| Fertilizer | |
| application, landscaping | 8-02.3(8)B |
| material specifications | 9-14.3(1) |
| Festoon outlet | 9-33.2(5) |
| Field applied coatings for water main, wax coating | 7-11.3(8), 9-30.1(4)F |
| Field office for engineer's staff - see Section 1-07.29 of the Project Manual | |
| Field tests | |
| backfill compaction control | 2-11.3(2) |
| bolted connections, steel structures | 6-03.3(33) |
| concrete pavement smoothness | 5-05.3(12) |
| flow control systems | 7-16.3 |
| illumination and electrical | 8-30.3(9) |
| irrigation system | 8-03.3(9) |
| sewer and storm drain | 7-17.3(3) |
| test piles | 6-05.3(10) |
| traffic signal system | 8-31.3(15) |
| water main, final flush and | 7-11.3(16)J |
| water main, hydrostatic pressure | 7-11.3(11) |
| water main, taste and odor | 7-11.2(2), 7-11.2(3) |
| welding rebar | 6-02.3(24)E |
| welds, structural steel | 6-03.3(25)B |
| Filter blanket for riprap | 8-15.3(7) |
| Filter fabric – see "Geotextile" | |
| Final cleanup | |
| roadside and | 1-04.10 |
| quarry and pit site reclamation | 3-01.2(1)E |
| structures | 6-01.10 |
| Final inspection | 1-05.11 |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|---|-------------|
| Final payment for contract | 1-09.9(4) |
| Finishes, concrete structure surfaces, classes 1, 2, and 3 | 6-02.3(14) |
| Finishing | |
| asphalt treated base (ATB) | 4-06.3(6) |
| bridge roadway slabs | 6-02.3(10) |
| cement concrete pavement | 5-05.3(11) |
| concrete curb | 8-04.3(1)D |
| concrete driveway | 8-19.3(3) |
| concrete piles | 6-05.3(3)C |
| concrete sidewalk | 8-14.3(4) |
| concrete stairways, landings, and steps | 8-18.3(5) |
| concrete traffic and pedestrian barrier | 6-02.3(11)A |
| hot mix asphalt concrete pavement | 5-04.3(8) |
| monolithic curb and sidewalk | 8-14.3(10) |
| precast concrete panels | 6-02.3(28)E |
| prestressed concrete girders | 6-02.3(25)H |
| steel structural member edge finishing | 6-03.3(14) |
| steel structural members | 6-03.3(11) |
| Flexible guide posts | 9-17 |
| Flexible delineator posts | 8-10 |
| Floor, timber | |
| laminated | 6-04.3(15) |
| single plank | 6-04.3(14) |
| subfloor for concrete deck | 6-04.3(16) |
| Flow control structure | 9-05.13 |
| Flow control systems | 7-16 |
| Flow control systems to be owned or maintained by the City | 7-16.2 |
| Flushing and disinfection of water main | 7-11.3(16) |
| Fly ash, see "pozzolans" | |
| Follower, pile driving | 6-05.3(11)E |
| Force account | 1-09.6 |
| Force mains, sewer, hydrostatic test | 7-17.3(3)E |
| Forgings, steel | |
| material | 9-06.11 |
| steel structures, used in | 6-03.3(43) |
| Formwork | |
| concrete pavement, side forms | 5-05.3(7)B |
| shop drawings for concrete structures | 6-02.3(16) |
| structural systems and falsework | 6-02.3(17) |
| Formulas for | |
| carbon content, rebar suitable for welding | 6-02.3(24)F |
| hankinson formula, bolted timber connections | 6-02.3(17)J |
| leakage test, force main | 7-17.3(3)E7 |
| paints | 9-08.2 |
| pile driving, ultimate bearing | 6-05.3(12) |
| pile driving vibrations, distance limitation | 6-05.3(11)H |
| Foundations and preparation of | |
| data for structures | 6-01.2 |
| sewer and drainage structures | 7-05.3(1)B |
| flow control systems | 7-16.3(1) |
| miscellaneous pipe connections | 7-08.3(1) |
| pavement subgrade | 2-09 |
| pile driving, ultimate bearing | 6-05.3(12) |
| pole, pedestal, pedestrian pushbutton post, & signal controller | 8-32.3(2) |
| sewer & drainage pipe | 7-17.3(1) |
| side sewer | 7-18.3(2) |
| subsurface information | 1-02.4(2) |
| water mains | 7-11 |
| Fracture, aggregate (definition) | 9-00.1 |
| Frame and cover – see "Castings" | |

G

| | |
|---|--------------|
| Gaskets, pipe joint material | |
| flexible plastic gaskets | 9-04.5 |
| rubber gaskets | 9-04.4 |
| Gates, chain link & wire fence | 8-12, 9-16 |
| Geotextile, construction | 2-15, 9-37 |
| Girders | |
| prestressed concrete | 6-02.3(25) |
| steel plate | 6-03.3(21) |
| Glare screen | 8-25, 9-16.5 |
| Gradations, mineral aggregate types | 9-03 |
| Grade adjustment, castings | |
| adjust to finished grade | 7-20 |
| hydrants | 7-14.1 |
| new catch basin | 7-05.3(2)C |
| new inlet | 7-05.3(2)D |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|--|------------------------|
| new maintenance hole | 7-05.3(1)L |
| new water main | 7-12.3(3) |
| Grade requirements, timber and lumber | 9-09.2 |
| Grates – see "Castings" | |
| Gratuities | 1-07.19 |
| Gravel backfill | 9-03.10 |
| Gravel borrow | 2-10.2(2), 9-03.12 |
| Ground granulated blast furnace slag (slag), see "pozzolans" | |
| Ground rods and clamps, electrical | 9-31.7 |
| Grounding and bonding, illumination and electrical | 8-30.3(7) |
| Grounding and bonding, traffic signal | 8-31.3(10) |
| Grout – also see "Mortar" and "Epoxy resin" | |
| Grout, <u>non-shrink</u> cement applications | |
| cut-in tee on sewer pipe | 7-17.3(2)C3 |
| deck bulb tee girder, placing | 6-02.3(25)O |
| electrical conduit – structure connection | 8-33.3(2)A |
| flow control structures | 7-16.3(2) |
| handrail mounting | 8-18.3(4) |
| maintenance hole steps | 7-05.3(1)M |
| metal poles & pedestals, under base plate | 8-32.3(1)B |
| mix designs | 9-04.3(2) |
| parking meter post | 8-21.2 |
| pipe connection, catch basin and inlet | 7-05.3(2)B, 9-12.3(3) |
| pipe connection, existing maintenance hole | 7-05.3(1)O, 9-12.3(3) |
| pipe connection, flow control structure | 7-16.3(2), 9-12.3(3) |
| pipe connection, precast maintenance hole | 7-05.3(1)K, 9-12.3(3) |
| signals & lighting poles & pedestals | 9-33.1(7) |
| sewer and drainage structures | 9-12.3(3) |
| Grout, <u>other than non-shrink cement</u> applications | |
| anchor bolts and bridge bearings | 6-02.3(20) |
| anchor bolts, placing | 6-02.3(18), 6-03.3(35) |
| anchoring rebar and rod in concrete holes | 6-02.3(20) |
| beam guardrail anchors | 9-16.3(5) |
| cast-in-place prestressed concrete tendons | 6-02.3(26)H |
| concrete pavement spall repair | 5-05.3(19) |
| curb dowel, epoxy grout | 8-04.2, 8-04.3(4)A |
| expansion joint, concrete structure | 6-02.3(13) |
| guy-wire anchor, wire fence | 8-12.3(3)B |
| jet-set for direct burial parking meter posts | 9-28.2(1) |
| patching concrete after concrete removal | 6-02.3(34)A1 |
| post, chain link fence | 8-12.3(2)A |
| post, wire fence and gates | 8-12.3(3)A |
| steel bearing plate, placing under | 6-03.3(36) |
| wire mesh slope protection | 9-16.4(6) |
| Grubbing | 2-01.3(2) |
| Guarantees and warranties | 1-05.10 |
| Guaranty, bid | 1-02.7 |
| Guaranty, bid (defined term) | 1-01.3 |
| Guaranty, bid, return of | 1-03.5 |
| Guardrail | |
| construction | 8-11 |
| non-weathering steel | 9-16.3 |
| weathering steel | 9-16.8 |
| Guide Posts, flexible | 9-17 |

H

| | |
|---|----------------------|
| Hammer, pile driving | 6-05.3(1), 6-05.3(9) |
| Hand holes in structural steel | 6-03.3(19) |
| Handholds | |
| in precast concrete cones | 7-05.3(1)F |
| steps, ladders and | 7-05.3(1)M, 9-12.2 |
| Handholes | |
| electrical | 8-33.3(4), 9-34.6 |
| in pedestal | 9-33.5 |
| in pole, aluminum | 9-33.3 |
| in pole, steel | 9-33.2(5) |
| Handrail | 8-18.3(4) |
| Hankinson formula, reference for bolted timber connections | 6-02.3(17)11 |
| Haul | 2-06 |
| Health and safety | |
| electrical | 1-05.2(2) |
| hazardous waste sites – see Section 1-07.29 of the project manual | |
| in general | 1-07 |
| High strength bolts | |
| holes in steel for | 6-03.3(27) |
| material specifications | 9-06.4(2) |
| Holes | |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|--|--------------|
| drilling in steel eyebars for pins | 6-03.3(22) |
| drilling in steel for high strength bolts | 6-03.3(27) |
| drilling in steel pins and rollers | 6-03.3(24) |
| high strength bolts in structural steel | 6-03.3(27) |
| pins and rollers, structural steel | 6-03.3(24) |
| punched, reamed, sub-punched | 6-03.3(27) |
| timber structures, bolts, dowels, rods, lag screws | 6-04.3(5) |
| weep, for concrete slab riprap | 8-15.3(5) |
| weep, drainage of substructure | 6-02.3(22) |
| Holiday detection | |
| multi-layered polyethylene coating for water main | 9-30.1(4)B |
| thermoplastic coating for water main | 9-30.1(4)C |
| Hydrant retaining wall | 7-14.3(6) |
| Hot mix asphalt..... | 5-04 |
| Hydrants | 7-14, 9-30.4 |
| Hydroseeding | 8-01.3(5) |
| Hydrostatic test for force main | 7-17.3(3)E |

I

| | |
|--|-------------------|
| Illuminated sign, overhead interior | 8-31.3(6) |
| Illumination - see "Lighting / illumination" | |
| Incompetent workmen | 1-05.13(1) |
| Increased or decreased quantities | 1-04.5 |
| Indemnification - see "Insurance" | |
| Inlets | |
| adjustment to finished grade | 7-20.3(2) |
| connections | 7-08.3(5) |
| construction requirement | 7-05.3(2) |
| drop inlet and grate inlet | 9-12.12 |
| Inspection | |
| final, of work | 1-05.11 |
| work and materials, of | 1-05.6 |
| Inspector - see "Assistant" | |
| Insurance | 1-07.18 |
| workers benefits | 1-07.18(7) |
| indemnification | 1-07.18(6) |
| Intent of contract | 1-04.1 |
| Interconnect cable | 8-31.3(8), 9-32.7 |
| Interior illuminated sign, overhead | 8-31.3(6) |
| Interlocking concrete pavers | 9-14.9 |
| Irrigation system | 8-03, 9-15 |
| Irrigation valves | 9-15.7 |
| Items of work and units of measurement | 1-01.2(2) |

J

| | |
|--|-------------------|
| Jet-set cement for direct burial parking meter post | 9-28.2(2)B |
| Job shack - see "Field office" | |
| Joints, concrete structure | |
| compression seals, and expansion joints | 6-02.3(13) |
| construction | 6-02.3(12) |
| Joints, irrigation system, pipe | 8-03.3(5) |
| Joints, pavement, sidewalk, driveway, and related | |
| curb and gutter, concrete | 8-04.3 (1) F |
| curb, extruded | 8-06.3(4) |
| driveway, concrete | 8-19.3(3) |
| pavement, hot mix asphalt | 5-04.3(10) |
| pavement, concrete | 5-05.3(8) |
| sidewalk, concrete | 8-14.3(6) |
| Joints, sewer and drainage | |
| connections, at catch basin, inlet, maintenance hole | 7-08.3(3) |
| drain pipe | 7-01.3(3) |
| materials, various type pipe applications | 9-05 |
| miscellaneous pipe connections | 7-08.3(3) |
| sewer and drainage, gasketed | 7-17.3(2)D-E |
| sewer and drainage, hand mortared & on curves | 7-17.3(2)B2 |
| side sewer | 7-18.3(3) |
| structure, maintenance hole | 7-05.3(1)I |
| Joints, water mains | |
| bond cable | 9-30.7 |
| ductile iron | 7-11.3(6) |
| electrolysis, joint bonding | 7-11.3(19) |
| restrained | 9-30.2(6) |
| Joint and crack sealing materials | 9-04 |
| Junction box, drainage | 7-05.3(3), 9-12.8 |
| Junction and terminal boxes, electrical | 9-32.9(5) |

K (none)

L

| | |
|---|-----------------------|
| Labor and Industries, State Department of | |
| flagging | 1-10.3(1)A |
| safety rules and standards | 1-07.1(2) |
| subcontracting | 1-08.1(2) |
| wages | 1-07.9 |
| workers benefits | 1-07.18(7) |
| Labor prevailing wage rates | 1-07.9(1) |
| Laboratory (defined term) | 1-01.3 |
| Ladders, steps, and handholds for maintenance holes | 7-05.3(1)M, 9-12.2 |
| Laminated floor, timber structures | 6-04.3(15) |
| Landscape construction | |
| construction requirements | 8-02 |
| materials | 9-14 |
| tree root pruning..... | 1-07.16(2), 8-02.3(7) |
| tunneling or trenching, and tree roots | 1-07.16(2) |
| Landslide prone areas, flow control structures | 7-16.2 |
| Lane markers and traffic buttons | 8-08, 9-21 |
| Laws, to be observed | 1-07.1 |
| Lead, certified on-site erosion control | 1-01.3, 1-05.13(2) |
| Lead, on-site electrical | 1-01.3, 1-05.2(2) |
| LED – light emitting diode | |
| pedestrian signal | 9-32.2 |
| vehicular traffic signal | 9-32.1(1) |
| Legal relations and responsibilities to the public | 1-07 |
| Licenses, permits and | 1-07.6 |
| Lighting / illumination | 8-30, 9-31 |
| Liquidated damages | |
| amount of – see agreement form in the project manual | |
| contract time overrun | 1-08.9 |
| defined term | 1-01.3 |
| Load limits | 1-07.7 |
| Locator, underground facility / construction notification requirement | 1-07.17(1), 1-07.28 |
| Log of test borings, subsurface information | 1-02.4(2) |
| Logs of soil borings – see project manual | |
| Lumber | |
| formwork and falsework for concrete structures | 6-02.3(17) |
| material requirements | 9-09 |
| timber structures, construction requirements | 6-04 |
| Luminaire | 8-30.3(2), 9-31.1 |
| Luminaire arm - see "Bracket arm" | |

M

| | |
|---|-------------|
| Machinery, contractor's equipment and | 1-05.9 |
| Maintenance, during suspension of work | 1-08.7 |
| Maintenance holes | |
| adjusting to finished grade | 7-20 |
| construction requirements..... | 7-05.3(1) |
| material specifications | 9-12 |
| Manufacturers certificate of compliance | 1-06.3 |
| Marking on pavement | |
| construction under traffic | 1-07.23(1) |
| designations and construction requirements | 8-22 |
| removal | 2-02.3(3)J |
| temporary traffic control | 1-10.3(3)L |
| Materialperson (defined term) | 1-01.3 |
| Materialperson, prompt payment to | 1-09.11 |
| Materials | |
| acceptance | 1-06.2 |
| American-made requirements - see Section 1-06.5 in the Project Manual | |
| found on project site, use of | 1-04.9 |
| inspection of work and | 1-05.6 |
| on hand, payment for | 1-09.8 |
| Measurement and payment | 1-09 |
| Measurement of quantities | 1-09.1 |
| Mechanical splices, rebar | 6-02.3(24)F |
| Mediation | 1-04.4(4) |
| Mesh | |
| for wire fence | 9-16.2(7) |
| wire, for concrete reinforcement | 9-07.7 |
| Mineral aggregates | 9-03 |
| Mobilization, payment for | 1-09.7 |
| Mobilization, payment for force account | 1-09.6(6) |
| Moisture cured urethane paint | 9-08.2 |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

Monument cases (frame and cover)8-13, 9-22
Mortar for
 edge support wall9-04.3(1)
 hand mortared concrete culvert pipe joint9-04.3(1)
 sewer and drainage structures9-12.3
 water valve chamber brick and block9-30.3(9)E
 water valve chamber plaster-coating9-30.3(9)I
 waterproofing cement concrete surfaces6-08, 9-11.3
Mulches and mulch amendments9-14.4

N

Natural drainage system construction7-21
Navigable streams affected by structures6-01.6
Noise pollution1-07.5(4)
Non-discrimination requirements, equal employment opportunity and1-07.11
Noncollusion, bidder requirement1-02.8
Normal temperature, bridge drawings dimensions6-01.13
Notice – see "Written notice"
Notice to proceed (NTP) and prosecution of the work1-08.4
Notifications relative to contractor activities1-07.28

O

Odor and taste testing for water mains7-11.2(2) and (3)
"One call" underground facility locate service1-07.17(1), 1-07.28
On-site lead, certified erosion control1-05.13(2)
On-site lead, electrical1-05.2(2)
Opening
 bids, public contracts1-02.12
 concrete pavement to traffic5-05.3(17)
 of sections to traffic1-07.25
Operational testing and O&M manuals1-05.11(3)
"Or equal"1-06.1
Oral agreements1-05.17
Outlet traps9-12.11
Overbreak2-04.3(1)E
Overhead interior illuminated sign8-31.3(6), 9-32.5
Overhead METRO trolley lines, construction near, notification requirement1-07.28
Overhead power lines & tree trimming - construction notification requirement1-07.28
Overtime
 contractor employees1-07.9(1)D
 force account, labor1-09.6(2)
 owner employees, reimbursement for1-08.1(4)
Overweighing / underweighing and pay adjustment1-09.2(5)
Overweight loads, over bridges and culverts1-07.7
Owner, rights of the1-03.1(4)
Owner's right to correct defective or unauthorized work1-05.8

P

Paint
 formulas9-08.2
 materials9-08.1
 moisture cured urethane paint (formula no. 18)9-08.2
Painting6-07
 painting hydrants7-14.3(8), 9-30.5(7)
 shop painting steel members6-03.3(30)
Parking meter post installation8-21.3(1)C3
Parking meter post, material specifications9-28.2(2)
Parking pay station8-21.3(1)A4
Parking restriction - construction notification requirement1-07.28
Patented devices, materials and processes1-07.20
Pavement, hot mix asphalt5-04
Pavement, Portland cement concrete5-05
Pavement removal2-01.3(3)J
Pavement marking8-22, 9-29
Pavement marking removal2-02.3(3)J
Pavers, interlocking concrete9-14.9
Pay - see "Wages"
Payment, measurement and1-09
Payroll reports1-07.9(2)
Pedestal, signal9-33.5
Pedestrian control and protection1-07.23(2)
Pedestrian signal heads8-31.3(3)C, 9-32.2
Perforated drain pipe7-01, 9-05
Performance evaluation program, contractor1-05.13(2)
Permits and licenses1-07.6
Personal liability of officers and employees of owner1-07.26

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|--|--------------------------|
| Piles and piling | 6-05, 9-10 |
| Pins and rollers, structural steel | 6-03.3(24) |
| Pin nuts, adjusting | 6-03.3(34) |
| Pipe | |
| material - irrigation | 9-15 |
| material - sewer and drainage | 9-05 |
| material - structural plate, arch, and underpass | 9-05 |
| material – water main | 9-30 |
| pipe installation - miscellaneous pipe connections | 7-08 |
| pipe installation - drains | 7-01 |
| pipe installation - sanitary sewer and storm drain | 7-17 |
| pipe installation - sewer cleanout | 7-19 |
| pipe installation - side sewer | 7-18 |
| pipe installation - water main | 7-11 |
| Pipe and fittings for water mains | 7-11, 9-30 |
| Pipe bedding, controlled density fill (CDF) – see "Controlled Density Fill" | |
| Plan, contractor required submittal – also see "Submittal" | |
| construction stormwater and erosion control plan (CSECP)..... | 8-01.3(2)A |
| falsework & formwork – temporary footing & mudsill bearing test | 6-02.3(17)D2 |
| falsework & formwork support system – pile bearing test | 6-02.3(17)D1 |
| interconnect cable, old to new | 8-31.3(8)A |
| jacking irrigation piping | 8-03.3(4) |
| prestress concrete girder erection | 6-02.3(25)O |
| reclamation | 3-03.2(2) |
| reclamation, borrow and waste sites..... | 3-03.2(2)A |
| removal of falsework and formwork | 6-02.3(17)N |
| repair, rejected pole | 8-31.3(1)A |
| structural steel erection..... | 6-03.3(7)B |
| structural steel marking..... | 6-03.2 |
| temporary traffic control..... | 1-10.2(5) |
| temporary water pollution/erosion control | 1-07.15 |
| traffic signal controller modification..... | 8-31.3(2)A |
| weed control..... | 8-02.3(12) |
| Plans – see "Drawings" | |
| Plant materials | 9-14.6 |
| Planting, landscape – see "Landscape construction" | |
| Plastic covering, clear | |
| construction requirement | 8-01.3(8) |
| material specification | 9-14.5(4) |
| Plastic foam (ethafoam) | 9-05.10, 9-30.2(9) |
| Plastic lane markers and traffic buttons | 8-08, 9-21 |
| Plastic waterstop | 9-24 |
| Plate girders, steel | 6-03.3(21) |
| Platform scales | 1-09.2(3) |
| Plugging existing pipe | 2-02.3(5)B |
| Poles, signal and electric | |
| aluminum | 9-33.3 |
| and traffic signal system | 8-32 |
| back guy assemblies | 9-33.8 |
| construction requirements | 8-32.3 |
| foundations | 8-32.3(2) |
| general pole requirements | 9-33.1 |
| pedestals, steel and aluminum | 9-33.5 |
| shop drawing submittal requirement | 8-32.1(3) |
| steel | 9-33.2 |
| traffic sign installation on | 8-21.3(1)B |
| wood | 9-33.4 |
| Pollution, prevention of environmental & preservation of public natural resources..... | 1-07.5 |
| Portland cement and pozzolans | 9-01 |
| Posts | |
| beam guardrail, non-weathering | 9-16.3(2) |
| beam guardrail, weathering | 9-16.6(3) |
| blockout in new concrete sidewalk for | 8-14.3(3) |
| chain link fence and gate | 8-12.3(2)A |
| flexible delineator | 8-10 |
| flexible guide | 9-17 |
| glare screen | 8-25.3(3), 9-16.5(3) |
| handrail in concrete stairway | 8-18.3(4) |
| metal bridge railing | 9-06.14 |
| parking meter | 9-28.2(2) |
| pedestrian pushbutton | 9-33.6 |
| project identification sign | 8-27.2(5) |
| roadside sign structure | 9-06.13 |
| sign, wood | 8-21.3(2), 9-28.2 |
| silt fence, temporary | 8-01.3(10) |
| street name sign | 9-28.2(3) |
| wire fence and gate | 8-12.3(3), 9-16.2(2)-(3) |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

wood post lumber specifications9-09

Pozzolans5-05.3(1)

Pre-award information1-03.1(3)

Precast concrete piles6-05.3(3) and (7)B

Precast traffic curb and block traffic curb8-07, 9-18

Precedence, order of contract components1-04.2

Preconstruction conference1-08.1(2)A

Preliminary critical path schedule1-08.3(1)

Premolded joint filler

 for concrete pavement joints5-05.3(8), 9-04.1

 for concrete structure joints6-01.12

Preservation of public natural resources1-07.5

Preservative treatments for timber9-09.3

Prestressed concrete girders6-02.3(25), 9-19

Prestressing reinforcement9-07.10

Prevailing wage rates1-07.9(1)

Prevention of environmental pollution1-07.5

Private property

 notification requirement, construction access limitations and entry onto1-07.28

 real property rights1-07.24

Private testing requirements, laboratory and individual1-06.5

Production from quarry and pit sites and stockpiling3-01

Professional engineer, submittal prepared by1-05.3(12)

Progress estimates and payment1-04.7, 1-09.9

Progress schedule to be furnished by contractor - see "Critical path schedule"

Prompt payment to subcontractors and Materialperson1-09.11

Property, protection and restoration of1-07.16

Proposal – see "Bid"

Prosecution and progress1-08

Process, dispute resolution1-04.4

Protection and restoration of property1-07.16

Protection of utilities – see "Utilities and similar facilities"

Protective Systems2-07

Pruning and staking of plant material8-02.3(7)

Public convenience and safety1-07.23

Public officers and employees of owner, no personal liability of1-07.26

Public opening of bids1-02.12

Q

Qualifications of bidders1-02.1

Quarry and pit sites, production from and stockpiling3-01

Quantities

 increased or decreased1-04.5

 measurement of1-09.1

Quick coupling valves, irrigation9-15.7(3)

R

Railings, bridge and pedestrian6-06

Railings for concrete stairways and landings – also see "Handrails"8-18.2, 8-18.3(4)

Railroads, relations with the – see section 1-07.31 of the project manual

Real property1-07.24

Rebuild existing catch basin7-05.3(2)F

Rebuild existing maintenance hole7-05.3(1)Q

Recycled materials

 aggregates for hot mix asphalt5-04.2(1), 9-03.6

 ballasting and crushed surfacing4-04.2

 substitution with recycled aggregates4-01.2

Reinforcing steel (also called "rebar")9-07

Rejection of bids1-02.13, 1-02.14

Relief of responsibility for completed work1-07.13(2)

Relief of responsibility for damage by public traffic1-07.13(3)

Removal of

 defective work and unauthorized work1-05.7

 falsework and forms, structural concrete6-02.3(17)N

Remove, abandon, or relocate structures and obstructions2-02

Rented equipment, payment for force account work1-09.6(4)

Repainting existing steel structure6-07.3(10)

Responsibility for work and damage, contractor's1-07.13

Retainage1-09.9(2)

Retaining walls – also see "Rock facing"

Retaining walls for hydrants7-14.3(6)

Right-of-way (defined term)1-01.3

Rights of the owner1-03.1(4)

Riprap8-15

Roadside cleanup1-04.10

Roadside planting – see "Landscape construction"

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|--|-----------------------|
| Roadway | |
| classification of excavation | 2-04 |
| cut slope treatment | 2-04 |
| ditches | 2-04 |
| embankment construction | 2-04 |
| excavation and embankment | 2-04 |
| rock cuts | 2-04 |
| Rock drilling safety requirements | 1-07.21 |
| Rock facing | 2-13, 9-03.15 |
| Rubber gasketed joint applications | |
| ABS composite pipe | 9-05.11 |
| concrete pipe | 9-04.4(1) |
| ductile iron sewer and storm drain | 9-05.2 |
| maintenance hole, precast | 7-05.3(1)I, 9-12.3(1) |
| material specifications | 9-04.4 |
| pedestrian push button assembly | 9-32.3 |
| water main, insulating couplings | 9-30.2(5)A |
| water main, non-restrained ductile iron pipe | 9-30.1(1) |

S

| | |
|---|-----------------------|
| Safety observer, electrical – see "Electrical safety observer" | |
| Safety Rules and Standards | 1-07.1(2) |
| Safety systems for trench excavation | 2-07 |
| Safety watch, construction in electrical vault – see "Electrical safety observer" | |
| Sales tax, state | 1-07.2 |
| Salvage of usable materials | 2-02.3(7) |
| Samples and sampling of materials | |
| acceptance | 1-06.2 |
| inspection of work and material | 1-05.6 |
| Sand drainage blanket | 9-03.11(2) |
| Sand/silt ratio | 9-00.6 |
| Sanitation, contractor requirements | 1-07.4 |
| Sanitary sewer spill, notification requirement | 1-07.28 |
| Sanitary sewers - see "Storm drain and sanitary sewer" | |
| Sawcutting, planing, and grinding byproducts, pollution control | 1-07.5(2) |
| Sawing and line drilling | 2-02.3(6) |
| Scales, weighing equipment | 1-09.2 |
| Schedule, critical path | 1-08.3(1) |
| Scope of payment | 1-09.3 |
| Scope of work | 1-04 |
| Screw threads, standard | 6-03.3(26) |
| Seal, foundation, placing concrete in | 6-02.3(6)C |
| Seals, copper | 9-06.10 |
| Seeding | |
| dates to seed | 8-02.3(14)A |
| erosion control | 8-01.3(5) |
| lawn installation | 8-02.3(14) |
| Selected material | 2-10 |
| Service connection transfers, water | 7-15 |
| Sewer cleanouts | 7-19 |
| Sewer, sanitary spill - notification requirement | 1-07.28 |
| Sewers, sanitary and combined - see "Storm drain and sanitary sewer" | |
| Shear | |
| allowable stresses in formwork and falsework | 6-02.3(17)B |
| boards, erosion control | 8-01.3(11), 9-14.8 |
| connectors, welded | 9-06.12 |
| hydrant shear block | 7-14 |
| keys at concrete construction joints | 6-02.3(12) |
| Shop drawings | |
| defined term | 1-01.3 |
| general submittal requirements | 1-05.3(10) |
| Shoring and cofferdams, structure excavation | 2-04, 2-08 |
| Shoulder, ballast | 4-04.3(10), 9-03.7(2) |
| Shutdown of water main or service - construction notification requirement | 1-07.28 |
| Side sewers | 7-18 |
| Sidewalk, close or restrict access during construction – notification requirement | 1-07.28 |
| Sidewalks | |
| cement concrete | 8-14 |
| pervious cement concrete | 5-06 |
| Sieve analysis for aggregate, methods | 9-03.13 |
| Sign, overhead interior illuminated | 8-31.3(6), 9-32.5 |
| Sign posts, timber | 8-32.3(1)C |
| Signal controller - see "Traffic signal controller" | |
| Signal system, traffic – construction requirements | 8-31 |
| Signal system, traffic – material requirements | 9-32 |
| Signs and posts, street and traffic | 8-21, 9-28 |
| Site conditions, differing | 1-04.6 |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|--|------------------------------|
| Site, examination of bid documents and | 1-02.4 |
| Site reclamation – quarry, pit | 3-03 |
| Slag, see “Pozzolan” | |
| Sleeve | |
| for irrigation pipe | 9-15.3 |
| for parking meter post | 9-28.2(2) |
| for water main – ductile iron pipe fittings | 9-30.2(1) |
| for water main – heat shrink joint | 9-30.1(4)E |
| for water main – insulating flange kits | 9-30.2(5)B |
| for water main – joint bond cable | 9-30.7 |
| for water main – thermite weld adapter | 9-30.8(2) |
| Slope protection | |
| concrete | 8-16 |
| wire mesh | 8-29 |
| Slump test | |
| pavement concrete consistency | 5-05.3(4)C |
| structure concrete consistency | 6-02.3(4)C |
| Smoothness | |
| asphalt concrete pavement surface | 5-04.3(11) |
| concrete pavement surface | 5-05.3(12) |
| Soils..... | 9-14.1 |
| Source of supply and quality of materials | 1-06.1 |
| Specifications, coordination with contract | 1-04.2 |
| Spill prevention and control | 1-07.15(1), 1-07.28 item 10) |
| Stairway, cement concrete | 8-18 |
| Stakes, construction | 1-05.5 |
| State sales tax | 1-07.2 |
| Steel structures | |
| construction requirements | 6-03 |
| materials | 9-06 |
| Steel reinforcing bar ("rebar") | 9-07 |
| Stepped slope construction | 2-04 |
| Steps, cement concrete | 8-18 |
| Steps, handholds & ladders for sewer & drainage structures | 7-05.3(1)M, 9-12.2 |
| Storm drain and sanitary sewer pipe construction requirements | 7-17 |
| Storm drain and sanitary sewer – pipe materials | |
| pipe gaskets – flexible plastic | 9-04.5 |
| pipe gaskets - rubber | 9-04.4 |
| pipe materials | 9-05 |
| Structural backfill, Controlled density fill (CDF) – see “Controlled density fill” | |
| Structural steel and related materials | 9-06 |
| Structure excavation | 2-04.3(5) |
| Structures - general requirements | 6-01 |
| Subcontracting requirements | 1-08.1(2) |
| Subcontractor / bidder list | 1-02.9(3) |
| Subcontractors, prompt payment | 1-09.11 |
| Subgrade preparation | 2-09 |
| Submittal, bid | 1-02.9 |
| Submittal requirements..... | 1-05.3 |
| Submittals, contractor required | 1-05.3 |
| Subsealing | 5-01 |
| Substantial completion date | 1-05.11(1) |
| Substantial completion (defined term) | 1-01.3 |
| Substitution | |
| "or equal" | 1-06.1 |
| shop drawings requirements | 1-05.3(6) |
| structural steel sections | 6-03.3(8) |
| Subsurface information | 1-02.4(2) |
| Subsurface drain | 7-01 |
| Superintendents, labor, and equipment, contractor | 1-05.13 |
| Supplemental contract (defined term) | 1-01.3 |
| Support system, trench excavation | 2-07 |
| Support wall and edge wall | 8-17 |
| Surfacing, ballasting and crushed | 4-04 |
| Surplus material, disposal | 2-04 |
| Survey, construction stakes | 1-05.5 |
| Suspension of work | 1-08.6 |

T

| | |
|--|----------------------|
| Tack coat, asphalt paving | 5-04.3(4)B4 |
| Taste and odor testing for water mains | 7-11.2(2), 7-11.2(3) |
| Tax, state sales | 1-07.2 |
| Tee, cut-in on existing or new sewer/drainage pipe | 7-17.3(2)C3 |
| Television inspection with audio assessment..... | 7-17.3(3)G |
| Temperature, normal for bridge drawing dimensions..... | 6-01.13 |
| Temporary concrete barrier | |
| construction requirement | 6-10.3(5) |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|--|------------------------|
| for traffic control | 1-07.23(1) |
| Temporary erosion and sediment control | 1-07.15, 8-01 |
| Temporary traffic control | 1-07.23, 1-10 |
| Temporary water service connection | 7-11.3(9)D, 7-11.3(9)E |
| Temporary water pollution/erosion control | 1-07.15 |
| Terminated or deleted work | 1-09.5 |
| Termination of contract | 1-08.10 |
| Test piles | 6-05.3 (10) |
| Thermoplastic powder coating for water main | 9-30.1(4)C |
| Three edge bearing test, concrete pipe | 9-05.2(2)A |
| Tie bars, pavement | 5-05.3(10), 9-07.6 |
| Timber and lumber materials..... | 9-09 |
| Timber structures | 6-04 |
| Time, contract | |
| defined term | 1-01.3 |
| extensions and delays | 1-08.8 |
| for completion | 1-08.5 |
| Time to execute agreement form | 1-03.3(2) |
| Topsoil and playfield soil | 8-02.3(2), 9-14.1 |
| Traffic buttons and lane markers | 8-08, 9-21 |
| Traffic control during construction | 1-07.23, 1-10 |
| Traffic control for traffic signal construction | 8-31.3(1)A |
| Traffic curb, precast and block | 8-07, 9-18 |
| Traffic signal controller assembly | 8-31.3(2) |
| Traffic signals - see "Signal controller" | |
| Traps, outlet | 9-12.11 |
| Treated timber, preservative treatment | 9-09.3 |
| Treatment, protective - aluminum pipe in contact with Portland cement concrete | 9-05.7(1) |
| Tree, relocate | 8-02.3(22) |
| Tree root pruning and excavation | 8-02.3(23) |
| Tree trimming and overhead wires – notification requirement | 1-07.28 |
| Trench backfill, controlled density fill (CDF) – see "Controlled density fill" | |
| Trench excavation, | |
| utilities | 2-04.3(6) |
| safety systems | 2-07.3(2) |
| support and safety systems | 2-07.3(3) |
| Trestle ends, embankment at bridge and..... | 2-10 |
| Trimming and cleanup | 2-14 |

U

| | |
|---|-----------------|
| Unauthorized work, removal of | 1-05.6, 1-05.7 |
| Unavoidable delay | 1-08.6, 1-08.8 |
| Uncovering work, payment for | 1-05.6 |
| Underground utility clearances - see "Clearances with utilities" | |
| Underground utilities locate (one call locate) – notification requirement | 1-07.28 |
| Underpass, drainage | 7-07 |
| Underweighing / overweighing & pay adjustment | 1-09.2(5) |
| Urethane paint, moisture-cured | 9-08.2 item 18. |
| Usable materials, salvage of | 2-02.3(7) |
| Use of buildings or other structures | 1-04.8 |
| Use of explosives | 1-07.22 |
| Use of materials found on the project site | 1-04.9 |
| Utilities and similar facilities | 1-07.17 |
| required clearances | 1-07.17(2) |
| Utilities notifications requirements for various types constructions | 1-07.28 |

V

| | |
|--|--------------------|
| Valves for irrigation | 9-15.7 |
| Valves for water mains | 7-12, 9-30.3 |
| Vault, electrical & electrical safety observer, notification requirement | 1-05.2(2), 1-07.28 |
| Vibratory rollers | 5-04.3(3)C |
| Vitrified clay pipe | 7-17.3, 9-05.5 |

W

| | |
|---|------------|
| Wage rates, prevailing | 1-07.9(1) |
| Wages | 1-07.9 |
| Wall | |
| curb wall, edge wall, and support wall | 8-17 |
| retaining wall for fire hydrants | 7-14.3(6) |
| Warm mix asphalt..... | 5-04.3(1)A |
| Warranty and guaranty | 1-05.10 |
| Waste management | 1-07.3 |
| Wasting excavated material | 2-04 |
| Watch, electrical safety – see "Electrical safety observer" | |
| Water | |
| for irrigation | 9-25.2 |

2017 Edition City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

| | |
|---|-----------------------|
| for mixing concrete | 5-05.3(2), 9-25.1 |
| for ready mix concrete | 6-02.3(4), 9-25.1 |
| Water main and related - construction requirements | |
| clearances with other utilities | 1-07.17(2)A |
| coatings | 9-30.1(4) |
| hydrants | 7-14 |
| materials | 9-30 |
| pipe installation, pressure and taste testing, connections, electrolysis monitoring | 7-11 |
| salvage of removed water main and related materials | 2-02.3(7)B |
| trench excavation, bedding, and backfill | 7-11 |
| valves | 7-12 |
| Water quality, environmental construction requirements | 1-07.5(2) |
| Water pollution / erosion control, temporary construction controls | 8-01, 1-07.15 |
| Water valves | 9-30.3 |
| Watering as part of various constructions | 2-07 |
| Waterproofing | 6-08, 9-11 |
| Waterstop, plastic | 9-24 |
| Wave equation analysis, piling | 6-05.3(9) |
| Wax coating, water main | 9-30.1(4)F |
| Weather limitations | |
| bituminous surface treatment | 5-02.3(9) |
| concrete pavement construction | 5-05.3(14) |
| placing structural concrete | 6-02.3(6)A |
| suspension of work | 1-08.6 |
| Weep holes | |
| concrete slab riprap | 8-15.3(5) |
| concrete structures | 6-02.3(22) |
| Weighing equipment | 1-09.2 |
| Welds | |
| reinforcing steel | 6-02.3(24)E |
| structural steel | 6-03.3(25) |
| Wheelchair ramps – see “Curb ramps” | |
| Wheel guards and railings, timber | 6-04.3(13), 6-06.3(1) |
| Wire, cold drawn for reinforcing | 9-07.9 |
| Wire fence | 8-12, 9-16.2 |
| Wire mesh slope protection | 8-29 |
| Wiring, fusing and splicing, electrical | 8-30.3(5), 9-31.5-6 |
| Withdrawal or modification of bid | 1-02.10 |
| Work | |
| changes | 1-04.3 |
| completion | 1-05.12 |
| contractor’s responsibility for damage and | 1-07.13 |
| defective and unauthorized | 1-05.7 |
| delays, time extensions and entitlement & compensation | 1-08.8 |
| differing site conditions | 1-04.6 |
| force account payment | 1-09.6 |
| increased or decreased quantities | 1-04.5 |
| inspection of | 1-05.6 |
| samples and sampling | 1-06.2 |
| suspension | 1-08.6 |
| time for completion | 1-08.5 |
| Workers benefits - see "Insurance" | |
| Working hours | 1-08.1(3) |
| Written notice, method of serving | 1-05.15 |

X, Y, Z (none)

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