

City Of Seattle  
SUPPLEMENT  
to the  
1984 STANDARD SPECIFICATIONS  
for  
Road, Bridge, and Municipal  
Construction  
(Division 2 through 9)



1986

EDITION

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Prepared By  
SEATTLE ENGINEERING DEPARTMENT  
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Examined and Approved  
by the  
BOARD OF PUBLIC WORKS  
October 31, 1986

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#### FOREWORD

The 1986 City of Seattle Supplement prepared by the Seattle Engineering Department for the Board of Public Works contains modifications to the 1984 Standard Specifications for Road, Bridge and Municipal Construction which was prepared jointly by the Washington State Department of Transportation and the American Public Works Association, Washington State Chapter. These 1984 WSDOT/APWA Standard Specifications for Road, Bridge and Municipal Construction together with the 1986 City of Seattle Supplement and the Traffic Control Manual for Instreet Work constitute the 1986 City of Seattle Standard Specifications for Road, Bridge and Municipal Construction. These City of Seattle Standards shall be used with the City of Seattle Standard Plans, 1986 Edition.

For all public work projects administered by the Seattle Engineering Department or sponsored by other departments and agencies working within the jurisdiction of the Seattle Engineering Department, the 1985 Supplement contained herein; the 1984 Standard Specifications for Road, Bridge and Municipal Construction; the City of Seattle Standard Plans, 1986 Edition; the Traffic Control Manual for Instreet Work; the laws of the State of Washington; the charter and ordinances of the City of Seattle; and the Project Manual for the specific project shall constitute the contract for the project and shall be considered as a whole.

The City of Seattle Standard Specifications for Road, Bridge and Municipal Construction and the City of Seattle Standard Plans, 1986 Edition shall apply whenever any public or private work is performed within the street rights of way of the City of Seattle including work performed by private parties at their own expense under authority granted by ordinance of the City Council or permit of the Board of Public Works. All requirements of the City of Seattle Standard Specifications shall apply to such work in the same manner as though the work were being performed under Board of Public Works contract with the exception of those requirements or conditions pertaining to payment for the work performed or to withholding or receiving money due the Contractor. All matters relating to financing of such work shall be between the permittee and the Contractor, and the City shall not enter into such matters.

For the readers convenience the Table of Contents includes two page number columns. When a page number is listed in the "1984 WSDOT" column only (1) the specification requirements for that section title can only be found in the 1984 Standard Specifications for Road, Bridge, and Municipal Construction published by the Washington State Department of Transportation. When a page number is listed in the 1986 Supplement column only (2) the specification requirements for that section can only be found in this 1986 Supplement. When a page number is listed in both the "1984 WSDOT" and "1986 Supplement" column (3) specification requirements may be found in both the 1984 Standard Specifications for Road, Bridge and Municipal Construction and this 1986 Supplement (see example below).

Example:

#### Section 2-02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

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Specification requirements included in this 1986 Supplement supercede the specification requirements found in the 1984 Standard Specification for Road, Bridge and Municipal Construction.

Specification requirements found in the Project Manual of a specific project supercede the specification requirements found in both the 1984 WSDOT Standard Specification and the 1986 Supplement.

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## DIVISION 2

### EARTHWORK

#### SECTION 2-01- CLEARING, GRUBBING AND ROADSIDE CLEANUP

Delete Section 2-01 in its entirety and replace with the following:

##### 2-01.1 DESCRIPTION (New Section)

Clearing work shall consist of removing and disposing of trees, vegetation or other unwanted materials from the ground surface. Grubbing work shall consist of removing and disposing of such materials from below the ground surface. Roadside cleanup shall consist of work done to give the roadside an attractive finished appearance.

##### 2-01.2 DISPOSAL (New Section)

Unless otherwise specified in the Project Manual, waste sites shall be provided by the Contractor. Borrow sites shall be operated in such a manner as to meet the grading, safety and health requirements of the State, county and local political subdivision. Sites, operations, or results of such operations, which create a definite nuisance problem, or which result in damage to public or private properties will not be permitted.

Copies of permits for borrow and waste sites, and reclamation plans for pits shall be furnished to the Engineer by the Contractor.

The Contractor shall submit to the Engineer at the pre-construction conference a list of waste and borrow sites the Contractor proposes to use during the course of construction. The list shall identify, in addition to each location, the estimated quantities and type of material to be wasted at, or removed from, each site. Should additional or alternate sites become necessary during the life of the contract, the locations and preceding information for each site shall be submitted to the Engineer for approval, prior to their use.

Waste and borrow sites and their operation shall be at all times subject to the Engineer's approval. No waste or borrow site shall be utilized by the Contractor until the proper grading permits and property owner agreements have been obtained by the Contractor and copies submitted to the Engineer. Sites utilized by the Contractor without a legal grading permit, an agreement from the property owner, and approval of the Engineer will be considered unauthorized.

Waste and borrow sites located within the City limits of Seattle are subject to the rules and regulations set forth in Seattle Grading and Drainage Control Ordinance (Ord. No. 108080 as amended by Ord. No. 111043, or as otherwise provided in the Seattle Municipal Code 22.800) and shall require a grading permit issued to the property owner by the Director of Construction and Land Use.

Waste and borrow sites located outside the City limits of Seattle but within unincorporated King County, shall be subject to the rules and regulations set forth in the King County Grading Ordinance (Ord. No. 1488). Sites may also be subject to rules and regulations of a local governmental authority if located within their jurisdiction.

Surplus material shall not be wasted within the public rights of way without a grading permit and, if within the City limits of Seattle, a street use permit issued by the Director of Engineering.

Upon completion of the work and before final acceptance and payment, the Contractor shall clean up all properties and sites on which the Contractor has operated. The Contractor shall perform all operations necessary to put the sites in a neat, clean and orderly condition.

Final cleanup shall be in accordance with the requirements specified in the Grading Ordinance, permits, property agreements and other contract documents. Upon completion of grading operations at any site for which a written agreement between the Contractor and property owner is required, the Contractor shall obtain and furnish to the Engineer a release from all damages, duly executed by the property owner, stating that the restoration of the property has been satisfactorily accomplished. Retainage withheld from the Contractor's payments will not be released until all such property owner releases have been furnished to the Engineer. Should the release be, in the opinion of the Owner, arbitrarily withheld, then the Owner may, in its sole discretion, accept that portion of the work involved and cause final payment to be made.

All costs and expenses involved in securing, operating and maintaining any waste or borrow site (including final cleanup and any erosion or anti-pollution controls required in the permits, property owner agreements, grading regulations, and other contract documents will be considered as incidental to

the contract and such costs and expenses shall be included in the contract prices for the various pay items shown in the Bid Form.

### 2-01.3 CONSTRUCTION REQUIREMENTS (New Section)

#### 2-01.3(1) CLEARING (New Section)

Clearing shall consist of removing and disposing of all unwanted material from the surface including, but not limited to, trees, brush, down timber and rotted wood, rubbish, etc.; removing building sheds, fences, and other obstructions interfering with the work when removal and disposal of such surface obstructions are not specifically provided for in Section 2-02; and protecting from all harm any trees, bushes, shrubs, or other existing improvement which are to remain. Only those trees marked for removal on the Drawings or designated by the Engineer will be removed by the Contractor.

All trees shall be felled within the area to be cleared. Where the tree limb structure interferes with utility wires, or where the tree to be felled is in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.

All buildings, fences, lumber piles, trash, and obstructions, except utility poles, within the area to be cleared shall be removed and disposed of by the Contractor.

The refuse resulting from the clearing operation shall be disposed by the Contractor. In no case shall refuse material be left on the project site, shoved onto abutting private properties, or be buried in embankments or sewer trenches on the project site. Debris shall not be deposited in any stream or body of water, or in any street or alley, or upon any private property except by written consent of the private property owner.

#### 2-01.3(2) GRUBBING (New Section)

The work shall consist of removing and disposing of all unwanted vegetative matter from below the surface including, but not limited to, stumps, roots, buried logs and timber, etc.; and removing and disposing of drains, culverts, wood catch basins, foundations, stairways, steps, and such other obstructions interfering with the work when removal and disposal of such underground obstructions are not specifically provided for in Section 2-02.

All stumps, roots, foundations and planking embedded in the ground within the limits described herein shall be removed to a minimum depth of two feet below subgrade or two feet below original ground, whichever is lower. Disposal requirements for grubbing shall be the same as those described for clearing.

#### 2-01.3(3) LIMITS OF CLEARING AND GRUBBING (New Section)

The limits of clearing and grubbing shall be as indicated on the Drawings or in the Project Manual.

#### 2-01.3(4) ROADSIDE CLEANUP (New Section)

From time to time or as may be ordered by the Engineer and immediately after completion of the work, the Contractor shall at his own expense clean up and remove all refuse and unused materials of any kind resulting from the work. Upon failure to do so within 24 hours after request by the Engineer, the work may be done by the Owner and the cost thereof be charged to the Contractor and deducted from his final estimate.

All cleanup shall be performed as specified in the various sections of these Specifications.

Final cleanup shall be in accordance with 1-04.11.

#### 2-01.3(5) PROTECTION OF EXISTING IMPROVEMENTS (New Section)

Existing utilities and existing trees, shrubs and other landscape items designated to remain, shall be protected from damage as specified in Section 1-07.16 and 1-07.17.

### 2-01.4 MEASUREMENT (New Section)

Measurement for "Clearing", "Grubbing", or "Clearing and Grubbing" will be by lump sum or by square foot as indicated in the Bid Form. If there are no such items on the Bid Form, then no measurement will be made.

### 2-01.5 PAYMENT (New Section)

Payment will be made for such of the following bid items as are included in the Bid Form:

- (1) "Clearing", lump sum or square foot.
- (2) "Grubbing", lump sum or square foot.
- (3) "Clearing and Grubbing", lump sum or square foot.

The lump sum or unit contract price for "Clearing", "Grubbing", or "Clearing and Grubbing" shall include all costs to complete the work as specified.

If the Bid Form does not include a pay item pertaining to the work of "Clearing", "Grubbing", or "Clearing and Grubbing", then the work specified shall be considered as incidental to the construction of the project and all costs incurred by the Contractor shall be included in the prices bid for other items of the construction.

Roadside cleanup shall be considered as incidental to the construction of the project and no separate payment will be made.



## SECTION 2-02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

## 2-02.1 DESCRIPTION

Supplement this section with the following:

Work in this section shall also consist of removal, salvage, disposal, and abandonment of selected existing items of improvements listed in the Bid Form, and located within an improved street right of way or area of existing improvements, where care must be exercised to prevent damage to existing utilities or portion of improvements that are to remain.

## 2-02.2 MATERIALS (New Section)

Materials shall meet the requirements of the following sections of these Specifications:

Non-structural concrete . . . . . 5-06  
Aggregates . . . . . 9-03.16

Concrete for plugging outlet pipes shall be Class 5 (3/4) meeting the requirements of Section 5-06.

Concrete for filling inlets shall be Class 6.5 (1-1/2) H.E.S. meeting the requirements of Section 5-06.

Backfill material for filling structure voids and structures (other than inlets) shall be Mineral Aggregate Type 9 or Type 17 meeting the requirements of Section 9-03.16; selected material excavated on the project site; or such other material as designated by the Engineer.

## 2-02.3 CONSTRUCTION REQUIREMENTS

## 2-02.3(1) GENERAL REQUIREMENTS

Delete the last paragraph and replace with the following:

The Contractor shall dispose of surplus or waste material per Section 2-01.2. The Contractor shall not under any circumstance dispose of surplus or waste material within a wetland as defined in Section 2-03.3(7). Costs of disposal shall be included in the bid prices for other work.

Supplement this section with the following:

The removal of street improvements shall be conducted in such a manner as not to damage utilities or any portion of the improvement that is to remain in place. Any damage will obligate the Contractor at his own expense, to repair, replace or otherwise restore such damage to the satisfaction of the Engineer.

## 2-02.3(3) REMOVAL OF PAVEMENT, SIDEWALKS AND CURBS

Delete this title and section and replace with the following:

## 2-02.3(3) REMOVAL OF EXISTING STREET IMPROVEMENTS - CITY OF SEATTLE (New Section)

## 2-02.3(3)A REMOVE NON-RIGID PAVEMENT AND UNTREATED ROADWAY SURFACES (New Section)

Non-rigid pavements shall be streets, driveways, alleys, sidewalks or other surfaces constructed from a bituminous mix, or any combination of bituminous mixes or surfaces treatments, upon an earth or granular base. Untreated roadway surfaces shall be oil mat, crushed rock, and gravel surfaces. Untreated roadway surfaces shall not be considered pavements.

Removal of non-rigid pavements and untreated roadway surfaces shall be considered part of the work of excavation. Removal shall be to the neat line trench width with the following exceptions:

- (a) Open cuts which straddle the edge of roadway shall be removed to the neat line or 2 feet from the edge of roadway, whichever is greater;

- (b) Removal shall be to the edge of roadway if the strip remaining between the edge of roadway and neat line is less than 2 feet in width.

Non-rigid pavement shall be pre-cut prior to removal by use of an asphalt cutting wheel, sawcutting, or line drilling at the Contractor's option to ensure a neat straight line. Cutting shall be completely through the non-rigid pavement.

If the Contractor's work and equipment causes damage beyond the cut line, replacement of asphalt shall be to the width directed by the Engineer. The cost of this asphalt replacement shall be at the Contractor's own expense.

## 2-02.3(3)B REMOVE ASPHALT OVERLAY (New Section)

When removing an asphalt overlay from a rigid base pavement the Contractor shall use methods and equipment that will not structurally damage the existing rigid base. The methods and equipment shall be subject to the Engineer's approval.

## 2-02.3(3)C REMOVE RIGID PAVEMENT (New Section)

Rigid pavements are streets, driveways, alleys, and other rigid slabs greater than 4 inches in thickness, constructed from concrete, brick, cobblestones, or any combinations of these materials, with or without an asphaltic overlay.

Rigid concrete pavement shall be removed to the maximum pay width shown on the Standard Plan, or beyond, subject to the following requirements:

- (a) Pavement shall be removed to any longitudinal joint, crack, or edge of pavement that is less than 3 feet from the neat line trench area.
- (b) Pavement shall be removed to any transverse joint or crack that is less than 5 feet from the neat line trench area.
- (c) Minimum restoration shall be full panel replacement if one or more of the following conditions exist:
  - (1) On any panel less than 3 years old.
  - (2) On any panel where the cut removes (or requires removal of) more than half of the panel.
  - (3) On any panel in a primary lane of a street in the Central Business District where the cut measure more than 24 square feet.
- (d) In areas of asphalt pavement over rigid base, the following requirements shall apply:
  - (1) If joints or cracks show through the asphalt paving, then all of the requirements extending pavement removal beyond neat lines shall apply.
  - (2) If no joints or cracks are visible, or their location cannot be determined, no additional removal beyond the trench neat line area will be required.
  - (3) The existing asphalt surfacing abutting the trench line or cut shall be "stepped back" a minimum of 4 inches to completely expose the rigid base.

After removal and before restoration, the Contractor shall trim the edges of the remaining pavement leaving clean vertical faces.

Rigid pavement shall be line drilled full depth or saw cut at the Contractor's option, except when sawing is specifically required on the Drawings. No sawing or line drilling is required where pavement removal extends to a full depth joint or crack.

After line drilling or saw cutting the pavement, the Contractor shall not proceed with pavement removal until he has demonstrated to the satisfaction of the Engineer, the method he will use to break and remove the concrete pavement without damaging the existing utilities, or pavement that is to remain in place. A backhoe may be used to remove broken concrete only after the concrete portion that is to be removed is clearly broken away from the pavement that is to remain in place.

Use of a "headache ball" to break concrete pavement will not be permitted.

**2-02.3(3)D REMOVE CATCH BASIN, SANDBOX, VALVE CHAMBER, MANHOLE, OR INLET (New Section)**

The Contractor shall excavate and completely remove the structure including casting and outlet trap, concrete encasement, and bricks, as applicable to each removal item listed in the Bid Form.

Connecting pipes shall be plugged by filling with Class 5 (3/4) concrete for a minimum length of 12 inches. Backfill shall be with selected material, Mineral Aggregate Type 17, or other mineral aggregate as designated by the Engineer. Backfill material shall be compacted to meet the requirements of Section 7-17.3(3)A.

**2-02.3(3)E REMOVE CURB, CURB AND GUTTER (New Section)**

Curb removal shall be classified as Class A or Class B. Class A is removal by cutting the curb horizontally and preserving the slab or base material below the curb. Class B is removal by cutting the base vertically at the face of the curb and removing the curb with the base material.

Except as otherwise specified, removal of curb placed on top of rigid pavement or base shall be Class A, and removal of full depth curb shall be Class B. Removal of curb for construction of curb ramps, driveways, and monolithic curb and sidewalk shall be Class B irrespective of the type of curb to be removed.

Curb shall be sawcut at the neat line limits of removal, or removed to the nearest joint at the Engineer's option.

**2-02.3(3)F REMOVE SIDEWALK (New Section)**

For removal purposes, all concrete slabs that average 4 inches or less in thickness shall be considered as sidewalk removal.

Cement concrete sidewalk shall be removed by sawcutting at the nearest scribe marks beyond the neat line limits subject to the following requirements:

- (a) Removal shall be extended to a through joint or to the edge of the sidewalk if within 4 feet of a neat line.
- (b) The minimum width of new or remaining concrete walk shall be as follows:
  - (1) 2 feet when sidewalk is or will be supported on each side by properly placed concrete walk or other improvement that will prevent the sidewalk from shifting.
  - (2) 4 feet when sidewalk is or will be bounded by earth planting strip.

The depth of saw cut shall be a minimum of 2 inches. Saw cuts shall leave straight edges and vertical faces. No diagonal cuts in sidewalk will be allowed.

A concrete walk that is to remain in place will be protected from equipment damage by using planking or with rock free 8 inch blanket of excavated soil.

Where sidewalk adjacent to a sidewalk opening is in poor condition, removal shall be extended to the nearest through joint or scribe mark as may be directed by the Engineer.

Pavement breakers shall be approved by the Engineer before use.

After construction of adjacent curbs and pavement, the Contractor will be required to remove any additional sidewalk necessary to provide proper connections and grades, as determined by the Engineer.

Asphalt sidewalk shall be removed to the limits designated by the Engineer.

**2-02.3(3)G REMOVE ELECTRICAL AND TRAFFIC CONTROL DEVICES (New Section)**

The Contractor shall submit a written schedule for removing the existing traffic systems to the Engineer for approval prior to proceeding with the removal.

The Contractor shall notify the Engineer 3 working days prior to any removal of traffic signals in which no traffic signal devices are to be reinstalled. Within 3 working days after the removal the Contractor shall again notify the Engineer, in writing, stating the location, exact date and time of the actual removal.

The Contractor shall remove equipment from the span wire before the span wire is disconnected from the poles. Existing span wire shall not be cut without first releasing the tension in the span.

**2-02.3(4) ABANDON CATCH BASIN, MANHOLE, OR INLET (New Section)**

As applicable to each abandon item, the Contractor shall remove the casting and debris; dewater; break down the structure to a depth of the cone sections, or 4 feet below the surface, whichever is greater, and plug the outlet pipe with concrete Class 5 (3/4) for a minimum length of 12 inches; and fill the remaining structure and void with mineral aggregate or concrete as specified below.

Catch basins and manholes shall be filled with Mineral Aggregate Type 9 or Type 17 compacted to 95% of maximum dry density per Section 2-03.3(14)D; old Type 164 inlets shall be filled with Class 6.5 (1-1/2) H.E.S. concrete.

For cement concrete pavement, the surface of the concrete shall match the grade of the existing pavement and shall be brush finished.

**2-02.3(5) ABANDON AND FILL PIPE (New Section)**

Pipes designated on the Plans to be filled and abandoned shall be filled with light weight foamed concrete having an air dry density of 20-30 pcf and minimum compressive strength of 20 psi. At each end of the pipe, the pipe shall be plugged with Class 5 (3/4) concrete for a minimum length of 12 inches.

**2-02.3(6) SAWING AND LINE DRILLING (New Section)**

When sawing rigid pavement, driveway, or sidewalk, the depth of saw cut shall be 2 inches or half the depth of pavement, driveway, or sidewalk, whichever is greater. All mortared decorative or special pavement (e.g. brick, cobblestone, paver block, etc.) shall be sawcut full depth along a neat line with intent of salvaging as many units as possible.

Curb shall be saw cut full height and width.

Asphalt shall be saw cut full depth.

When line drilling, spacing of drilled holes center to center shall be 6 inches maximum. Holes shall be perpendicular to the surface and shall penetrate completely through the pavement.

**2-02.3(7) SALVAGE (New Section)****2-02.3(7)A GENERAL (New Section)**

Unless otherwise indicated, all castings, pipe and other material of recoverable value taken from the discarded facilities shall be carefully salvaged and delivered to the Owner in good condition and in such order of salvage as the Engineer may direct. Materials and things deemed of no value by the Engineer shall be removed by the Contractor and become his property to be disposed of as he wishes.

All castings removed from the existing utilities which are not to be re-used elsewhere on the project, and which in the opinion of the Engineer are suitable for salvage, shall have excess concrete and dirt removed and shall be delivered to the location designated by the Engineer. Contact the Engineering Department Warehouse Supervisor for coordination.

All costs for delivering salvaged material shall be considered to be included in the prices for various bid items comprising the improvements.

**2-02.3(7)B WATER MAINS AND APPURTENANCES (New Section)**

The Contractor shall excavate and completely remove hydrants, valves, and any other item specified in the Bid Form, using care not to damage those items to be salvaged. Cast iron watermain designated for removal shall be disposed of by the Contractor. Backfill shall be with selected material, Mineral Aggregate Type 17, or other mineral aggregate as designated by the Engineer. Backfill material shall be compacted to meet the requirements of Section 7-17.3(3)A.

**2-02.3(7)C ILLUMINATION, SIGNALS, AND ELECTRICAL (New Section)**

Electrical and traffic items to be salvaged shall include the following:

- (a) High pressure sodium luminaires, lamps and photo cells.
- (b) Aluminum bracket arms.
- (c) Aluminum lighting poles.
- (d) Wood and steel lighting poles.
- (e) Traffic poles, including joint lighting and traffic poles.
- (f) Mast arms.
- (g) Pedestals.
- (h) Traffic signal controller assemblies and cabinets.
- (i) Signal heads.
- (j) Illuminated signs.
- (k) Handholes.
- (l) Junction and Terminal boxes.
- (m) Traffic signs - overhead.
- (n) Traffic sign.
- (o) Designated signal appurtenances.
- (p) Miscellaneous channelization items.

Items (a) through (d) shall be delivered by the Contractor to City Light South Service Center at 4th Avenue South and South Spokane Street. Call 625-3344 prior to delivery of wood poles, or 625-3635 prior to delivery of metal poles, high pressure sodium luminaires, lamps, photo cells, and aluminum bracket arms.

Items (e) through (p) shall be returned to Seattle Engineering Department Traffic Shops at 1010 8th Avenue. Call 625-4103 prior to delivery.

**2-02.3(7)D REINSTALLING SALVAGED ELECTRICAL MATERIAL (New Section)**

When salvaged electrical equipment is to be reinstalled, the Contractor shall furnish necessary materials, hardware and equipment required to install the equipment in the new installation. Any new hardware required to complete the reinstallation shall be of the same quality and type as hardware required in these specifications for all other new work.

**2-02.3(8) STREET SADDLES AND STEEL PLATES (New Section)**

When backfilling operations cannot be completed by the end of the working day, street saddles or steel plates meeting the requirements below may be used to temporarily cover the excavation.

**2-02.3(8)A STREET SADDLES (New Section)**

Saddle board shall be made of 4-inch roughcut, construction grade timbers with no warp. Saddle iron flanges shall be 6 inches wide by 8 inches long. They shall be made of 3/4-inch steel and have chamfered edges. The support iron shall be of adequate size so that there is no significant deflection with traffic. At any time the saddle iron flanges do not get full bearing on the roadway surface, shims shall be used. Saddle boards and irons may be bolted together providing hoist equipment is provided to the Seattle Engineering Department for their removal.

Saddle irons and boards shall be firmly wedged on sides and ends. The boards shall be flush with the roadway surface. All holes shall be cut to provide a good fit, with no excessive openings. Saddle

boards shall be notched to receive the irons or scabbing shall be added to the sides of the board so that the board is flush along the pavement opening. There shall be no more than 3 feet of unsupported board between irons. Saddle boards and irons shall be used only on those streets which have a concrete or other surface which can safely support them.

**2-02.3(8)B STEEL PLATES (New Section)**

Steel plates shall have a minimum of 12 inches bearing on all sides of a cut and shall be anchored by driving steel pins on all corners or alternate method if approved by the Engineer.

Flanges or angle irons will be welded to the underneath side conforming basically to the size of the street opening. Where the street surface is uneven, plates will be bedded on MC250 asphaltic mix.

Steel plates shall be capable of carrying a minimum of H20 loading.

All steel plates or saddles located in pedestrian crosswalks or within three feet of pedestrian crosswalks shall have their edges shimmed with cold mix asphalt. The shims shall be striped with Omaha orange paint or substitute approved by the Engineer. The paint stripes shall be a nominal two inches wide and no more than 16 inches on center.

Any pedestrian crosswalk containing steel plates or saddles may be closed at the discretion of the Engineer.

**2-02.4 MEASUREMENT (New Section)**

Measurement for "Remove (Item)" will be by the square yard, linear foot, each, or lump sum as indicated for each removal item in the Bid Form.

Measurement for saw cutting will be by the linear foot along the slope of the surface cut.

During trench excavation, measurement for removal and sawing of street improvements will be based on the removal and replacement limits indicated on Standard Plan No. 284 as modified by the extended limits provided for in Section 2-02.3(3)C and 2-02.3(3)E, or the limits designated by the Engineer.

Measurement for "Abandon (Item)" will be by each. Abandon pipe will not be measured.

Measurement for "Abandon and Fill Pipe" shall be by the actual number of linear feet of pipe filled with lightweight foamed concrete.

**2-02.5 PAYMENT**

Delete this section and replace with the following:

Payment will be made at the unit contract prices bid for such of the following bid items as are included in the Bid Form:

- (1) "Remove (Item)," per square yard.
- (2) "Remove (Item)," per linear foot.
- (3) "Remove (Item)," each.
- (4) "Remove (Item)," lump sum.
- (5) "Saw Cement Concrete, 2 Inch Minimum Depth," per linear foot.
- (6) "Saw Asphalt Concrete, Full Depth", per linear foot.
- (7) "Abandon (Item)," each.
- (8) "Abandon and Fill Pipe", per linear foot.
- (9) "Removal of Structures and Obstructions", lump sum.

The unit contract price for "Remove (Item)" shall include all costs for the work required to completely remove and dispose of or salvage the item as applicable.

Removal of non-rigid pavement over granular base will be measured and paid as "Common Excavation" in accordance with Section 2-03, with the following exceptions:

- (a) When excavating through non-rigid pavement over granular base to install underground improvements, the costs of removal of non-rigid pavement shall be considered as incidental to the bid item cost of installing the new improvement.
- (b) Removal of non-rigid pavement over granular base on street improvement projects shall be paid as "Remove Pavement" if the average thickness of the pavement as determined by the Engineer is greater than 6 inches.
- (c) When the special provisions are amended to make removal of non-rigid pavement incidental to a particular bid item within the project. No separate payment will be made.

Removal of non-rigid pavement without removal of any underlying cement concrete base will be paid as "Remove Asphalt Overlay."

Removal of rigid pavement greater than 4 inches in total thickness will be paid as "Remove Pavement." Removal of rigid pavement 4 inches or less in total thickness will be paid as "Remove Cement Concrete Sidewalk."

All minor utility structures, such as meter boxes, handholes, inlets, sandboxes, pipe, identified as removal on the construction drawings and located within the excavation area of the trench neat line or within the structure excavation neat lines shown on the drawings, shall be considered as incidental to the bid price for installation of pipe or structure excavation. Removal of catch basin and manhole shall be paid for at the unit price bid for their removal.

Removal of cast-in-place curb will be paid as "Remove Curb," regardless of whether removal is Class A or Class B. All costs for removing other types of curb, such as traffic curb, shall be included in the prices bid for the various bid items shown in the Bid Form, and no separate payment will be made. All costs for removal of curb when underlying pavement is being removed shall be considered incidental to "Remove Pavement," and no separate payment will be made.

Removal of traffic buttons or traffic islands shall include all costs to restore the surface if required. If there is no specific bid item listed for the removal of existing traffic buttons or lane markers, the cost shall be considered incidental to the various bid items comprising the improvement.

Removal of traffic sign posts shall include all costs for the removal of the post, traffic sign, mounting hardware and restoration of the surface where sign posts were removed.

The unit contract price for "Remove Pavement Markings" shall include costs of all the work required to remove pavement markings as indicated in the Drawings or as directed by the Engineer, and to restore surface if required.

The unit contract price for "Remove Luminaire" and "Remove Luminaire and Bracket Arm" shall be full compensation for removal of the existing luminaire, or luminaire and bracket arm and its ballast, wiring and appurtenances.

The lump sum payment for "Remove Signalization (Location)" shall be full compensation for all labor, material and equipment required to complete the removal, disposal, and salvage work as specified and shown on the Drawings, and shall include salvaging, stockpiling and delivering equipment as determined by the Engineer; and shall include disposal of removed items not salvaged.

The unit contract price for "Remove Pole, Metal," shall be full compensation for all labor, material and equipment to remove and salvage the pole.

The unit contract price for "Remove Pole, Wood" shall include costs of all the work required to remove and salvage the pole, and to backfill and compact the void left after pole removal.

The unit contract price for "Remove Foundation, (Type)" shall include costs of all work required to remove and dispose the foundation, and to backfill and compact the void left after removing the foundation.

Removal of items not listed in the Bid Form shall be considered as incidental to the construction, and the costs thereof shall be included in the various items comprising the improvement. No separate payment will be made.

The unit contract price for sawcutting shall include all costs for the work required to saw cut concrete, or asphalt only at the locations indicated specifically on the Drawings, Specifications, or

designated by the Engineer. No payment will be made for sawcutting concrete or asphalt which is done at the option of the Contractor.

No payment will be made to abandon pipe or other subsurface items identified on the Drawings and for which no work is required. Plugging the exposed or open ends of pipes to be abandoned shall be considered incidental to the installation of new pipe.

The unit contract price for "Abandon (Item)" shall include all costs for the work required to abandon the utility structure as specified.

The unit contract price for "Abandon and Fill Pipe", per linear foot shall be full compensation for all labor, materials, and equipment including plugging the pipe where indicated on the Drawings, furnishing and filling the pipe with lightweight foam concrete and, incidental work necessary to complete the work specified.

All costs for furnishing, placing, and compacting backfill material after removing or abandoning utility structures shall be considered incidental to "Remove (Item)" or "Abandon (Item)" for each structure, and no separate payment will be made.

All costs for salvaging and cleaning castings, electrical components, or other items, and delivering to the Engineer shall be considered to be included in the prices bid for the various items comprising this improvement.

All costs for furnishing and installing Street Saddles and Steel Plates to cover street excavations shall be considered to be incidental to the various bid items requiring the excavation.



## SECTION 2-03 - ROADWAY EXCAVATION AND EMBANKMENT

## 2-03.1 DESCRIPTION

Delete this section and replace with the following:

This work shall consist of excavating and grading the roadway; excavating below grade; removing and replacing slide material; furnishing, placing, temporarily stockpiling, and compacting select or other backfill material; removing and disposing of unsuitable or excess material; and all work necessary for the construction and completion of cuts, embankments, slopes, roadway ditches, side street approaches, alley and alley approaches, driveways and driveway approaches, sidewalks and planting areas, and such subsidiary work described in this section and not otherwise provided for separately in other sections of these Specifications.

This work shall be performed in reasonably close conformity with the lines, grades, and cross sections indicated in the Contract Documents or established by the Engineer.

## 2-03.1(1) CLASSIFICATION (New Section)

Roadway excavation shall be classified as common excavation, solid rock excavation and unsuitable foundation excavation. Trench excavation shall be as specified elsewhere.

Solid Rock Excavation shall consist of the removal and disposal of solid rock, i.e. ledge rock that requires systematic drilling and blasting for its removal and also boulders exceeding 1/2 cubic yard in volume. Hard pan, hard clay or glacial till shall not be classified as solid rock excavation. Sandstone, siltstone, shale or other sedimentary rocks which are soft, weathered or extensively fissured shall not be classified as solid rock excavation. Soft rock is defined as one which has a modulus of elasticity of less than 200,000 psi.

Unsuitable Foundation Excavation shall consist of the removal and disposal of unstable material including, but not limited to, peat, muck, swampy or other unsuitable materials such as buried logs and stumps, but only when the removal is as specified in Section 2-03.3(14)E or 2-03.3(14)F and such methods are specified in the Special Provisions and included in the Bid Form, or are specifically ordered in writing by the Engineer. Removal of soft or spongy spots in the prepared subgrade shall be considered excavation below grade pursuant to Section 2-03.3(3).

Common Excavation shall consist of all other material not classified as solid rock excavation, unsuitable foundation material excavation, or excavation which is considered to be incidental to other contract bid items in the contract. The widening of roadway cuts and ditches and excavation below the designated subgrade when ordered by the Engineer shall be considered as common excavation.

## 2-03.1(2) PROTECTION OF EXISTING IMPROVEMENTS (New Section)

In addition to the requirements of Section 1-07.16 and 1-07.17 the Contractor shall insure that mineral aggregates, debris from the work area, and materials from roadway excavation, are prevented from entering existing manholes. Manholes in the vicinity of roadway excavations or material stock piles shall have shields placed over the manhole channel. Shields shall remain in place until excavation and grading operations are complete. Within 24 hours thereafter, any material which has collected on the shields and the shields shall be removed. Removal shall be such that no debris or material falls into the channel.

## 2-03.3(2) ROCK CUTS

Delete paragraph 4 ("Controlled Blasting") and replace with the following:

Controlled blasting: No blasting will be permitted until the Contractor submits and obtains the approval of the Engineer for a blasting plan outlining how drilling, loading, and shooting will be done.

See Section 1-07.22 Use of Explosives.

## 2-03.3(3) EXCAVATION BELOW GRADE

Supplement this section with the following:

Roadway excavation shall be to the depths indicated on the Drawings and staked by the Engineer except where excavation below grade is designated in the field by the Engineer. Excavation below grade shall be the same classification of excavation as that above.

Excavation below grade required to remove a portion of the subgrade made unsuitable by the Contractor's operations or failure to adequately protect the subgrade shall be at the Contractor's expense.

## 2-03.3(7) DISPOSAL OF SURPLUS MATERIAL

Delete this section and replace with the following:

Material obtained from all excavation within the project boundary shall not be wasted unless the excavated material is designated by the Engineer as unsuitable for use in embankment construction, trench backfill, or for other purposes. If an undue amount is wasted, the Contractor shall secure and furnish borrow at the Contractor's own expense.

Excess material shall not be disposed of within a wetland area. Wetlands are defined as those areas inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Disposition of surplus material from trench excavation shall be as specified in Section 2-03.3(10).

Material which is surplus to the needs of the project or determined to be unsuitable by the Engineer shall be wasted in accordance with Section 2-01.2.

## 2-03.3(8) WASTING MATERIAL

Delete this section and replace with the following:

If the Contractor wastes excavated material deemed suitable by the Engineer for embankments or other backfills, and material is later needed for embankments or fills, the Contractor shall at the Contractor's expense replace the wasted material with material meeting the Engineer's approval.

## 2-03.3(9) ROADWAY DITCHES

Supplement this section with the following:

All ditches shall be constructed as shown on the Drawings and shall be graded to direct the flow of the water to catch basins, culverts or channels.

## 2-03.3(10) SELECTED MATERIAL

Delete this section and replace with the following:

Selected material shall be considered as that material designated by the Engineer as suitable for selected fill applications, which is obtained from the excavation or widening of the roadway prism, or any other excavation within the street right of way, including trench excavation. Selected material shall be used first before new borrow material is imported for construction of project embankments, finishing the top portion of the subgrade, structure backfill, or such other backfill applications the Engineer may designate.

Selected material shall be used for any of the following purposes as determined by the Engineer:

- (a) Embankment construction
- (b) In lieu of Mineral Aggregate (Type) meeting the requirements of Section 9-03
- (c) Trench backfill
- (d) Planting soil
- (e) Other selected uses as determined by the Engineer

Excavated material which is in excess to the needs of the project shall be disposed of per Section 2-01.2.

Selected material shall be placed and compacted in accordance with the requirements for the type of work for which the material is being used.

Material deemed suitable by the Engineer for embankments and other uses shall be hauled to, and placed in, the nearest embankment or other fill, or temporarily stockpiled for later use.

If necessary, stockpiling of selected material shall be at locations approved by the Engineer. Thereafter, such material shall be removed from stockpile and used when needed.

Excavated material stockpiled for use as selected materials shall be protected from contamination by other materials and from damage by weather by covering with waterproof sheeting or such other means as the Contractor deems necessary. Materials stockpiled and later found unsuitable by the Engineer shall be disposed of and replaced with material acceptable to the Engineer.

#### 2-03.3(12) OVERBREAK

Delete paragraph 3 of this section and replace with the following:

If the Engineer approves, the Contractor may use overbreak:

- (a) To complete an embankment when the excavated material unexpectedly falls short of the amount required. The City will pay the roadway excavation contract price for the volume of material the overbreak replaces. However, no payment will be made if overbreak is used when other material is available within the neat lines of the roadway prism.
- (b) To replace borrow excavation originally planned for an embankment. The City will pay for overbreak used this way at the unit contract price for roadway excavation.

#### 2-03.3(13) BORROW

Delete this section and replace with the following:

Borrow is imported material obtained from sources other than the roadway prism, trench excavation, or other excavation on the project. When insufficient suitable native excavated material is available, borrow shall be used to construct embankments, subgrade, shoulders, or other roadway components to the neat lines shown on the Drawings. Sources of borrow material shall be approved by the Engineer.

Borrow shall be classified as "Unclassified Borrow" or "Borrow (Type)".

- (a) "Unclassified Borrow" shall be an imported soil which meets the suitability requirements set forth in Section 2-03.3(14).
- (b) "Borrow (Type)" shall be an imported soil which meets the suitability requirements set forth in Section 2-03.3(14), and in addition shall meet all gradation and other requirements listed in Section 9-03.16 for the type of Mineral Aggregate specified (e.g., "Borrow, Type 17", etc.).

#### 2-03.3(14) EMBANKMENT CONSTRUCTION

Supplement this section with the following:

In the order of priority, material used for embankment shall be:

- (1) Selected material obtained from Common Excavation and Trench Excavation
- (2) Borrow of the type specified

Selected excavated material shall be used for the construction of all required project embankments per Section 2-03.3(10).

Excavated material will be considered suitable for general fill applications which do not require a material meeting specific Mineral Aggregate specifications found in Section 9-03 if it:

- (a) Is capable of attaining the degree of compaction specified in Section 2-03.3(14)C;
- (b) Is within plus or minus 3 percent of optimum moisture content as determined in accordance with ASTM D698;

- (c) Is free from deleterious material and does not contain more than 5% total by volume of organic material; clay; frozen lumps; and rocks, concrete, asphalt, or other debris and rubble having a dimension greater than 6 inches;

Embankment material which contains less moisture than required for proper compaction with the compacting equipment being used shall be watered in the amount ordered by the Engineer. Compaction of embankment material which contains excessive moisture shall not be started until the moisture content is reduced to the maximum amount specified above. All costs and expenses involved in drying embankment materials shall be considered incidental to the various unit contract prices.

#### 2-03.3(14)A ROCK EMBANKMENT CONSTRUCTION

Delete paragraph 8 and replace with the following:

When practical, and as approved by the Engineer, the Contractor shall save the finer granular material from excavations or borrow pits for use in topping rock fills. If selected materials suitable for topping are available on site payment for such material will be made per Section 2-03.5. If such materials are not available on site, payment will be made for imported materials at the unit contract price for such other Mineral Aggregate as may be included in the Bid Form or ordered by the Engineer. If the Bid Form does not include mineral aggregates then payment will be as provided in Section 1-09.4.

#### 2-03.3(14)C COMPACTING EARTH EMBANKMENTS

Delete paragraph 1 and replace with the following:

This section describes 3 methods (A, B, and C) for building earth embankments. The Contractor shall use Method C unless the Special Provisions or other sections of these Specifications require another method.

#### 2-03.3(14)D COMPACTION CONTROL TESTS

Delete this section and replace with the following:

In-place density will be determined by one or more of the following methods:

- (a) ASTM D1556, Test for Density of Soil  
In-place by the sand cone method
- (b) ASTM D2167, Test for Density of Soil  
In-place by the rubber balloon method
- (c) ASTM D2922, Test for Density of Soil  
In-place by the nuclear method

Laboratory densities may be determined by one of the following methods:

- (a) ASTM D698, Moisture-Density Relations of Soils and Soil-Aggregate Mixtures.
- (b) ASTM D4253, Maximum Index Density of Soils using a Vibratory Table.

ASTM D698 will be used for computing the maximum density of all fill soils except for those granular soils yielding, in the opinion of the Engineer, an unsatisfactory moisture-density curve. In that case the maximum density will be determined by the method specified in ASTM D4253.

The Contractor shall excavate pits for density sampling at locations designated by the Engineer. Density sampling will be performed by Owner forces.

Degree of compaction in trench backfill shall be as specified in Section 7-17.3(3)A. All other fills and earth embankments shall be as specified in Section 2-03.3(14)C.

#### 2-03.3(14)E UNSUITABLE FOUNDATION EXCAVATION

Supplement this section with the following:

Materials excavated from the roadway or channel change prisms will not be classified as unsuitable foundation excavation as defined by Section 2-03.1(1) unless the removal is accomplished by dragline



operation or by special excavation methods requiring different equipment from that used for roadway excavation, as determined by the Engineer.

#### 2-03.3(14)H VERTICAL SAND DRAINS

Delete Item No. 3 and replace with the following:

3. Materials removed in excavating the holes shall be disposed of to and outside the limits of the working platform if they are suitable as a blanket adjacent thereto; otherwise the materials shall be disposed from the area by the Contractor.

#### 2-03.4 MEASUREMENT

Delete this section and replace with the following:

Excavation of the class specified will be measured by the cubic yard in its original position by cross sectioning. 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 roadway material which has become unsuitable because of the Contractor's neglect, negligence or method of operation.

Borrow will be measured by the ton at the point of delivery in accordance with Section 1-09.1.

Unsuitable foundation excavation will be measured by the cubic yard in its original position by cross sectioning.

Vertical sand drains will be measured by the vertical foot from the top of the working table to the bottom of the holes.

Sand borrow for drainage blanket will be measured by the cubic yard or by the ton as indicated on the Bid Form, provided that moisture in excess of 8 percent will be deducted in ascertaining the pay quantities when measured by the ton.

Embankment compaction will be measured by the cubic yard of embankment material compacted pursuant to Section 2-03.3(14)A or Method B or C in Section 2-03.3(14)C. Quantities will be computed based upon measurements taken to the neat lines of the staked cross section and no allowance will be made for settlement.

When existing material in a cut section is stabilized by scarifying, aerating and compacting, measurement for the embankment compaction will be based upon the length and width of cut section compacted and a maximum depth of 6 inches.

#### 2-03.5 PAYMENT

Delete this section and replace with the following:

Compensation for the cost necessary to complete the work described in Section 2-03 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Common Excavation," per cubic yard.
- (2) "Solid Rock Excavation," per cubic yard.
- (3) "Unclassified Borrow," per ton.
- (4) "Borrow (Type)" per ton.
- (5) "Embankment Compaction," per cubic yard.
- (6) "Unsuitable Foundation Excavation," per cubic yard.
- (7) "Vertical Sand Drains," per vertical foot.
- (8) "Sand Borrow for Drainage Blanket," per ton or per cubic yard.

The unit contract price for "Common Excavation" and "Solid Rock Excavation" shall include the costs for all work described in Section 2-03 and not otherwise provided for hereinafter. When excavation below

the designated subgrade elevation is ordered by the Engineer, that portion of the excavation 3 feet or less below subgrade will be considered as "Common Excavation." If the Engineer orders excavation more than 3 feet below subgrade that portion below subgrade will be paid as extra work per Section 1-09.4. Payment for such types and classes of excavation listed above shall be full compensation for excavating, loading, hauling, stockpiling, placing as backfill, or otherwise disposing of the material as shown on the Drawings, as specified herein, or as directed by the Engineer.

Excavation or embankment work required to bring the subgrade in sidewalk areas to the level of the top of the sidewalk will be paid per Section 2-03.5. Excavation of the subgrade to the depth of the sidewalk will be paid per Section 8-14.

Where earthwork is required and a bid item is not provided in the Bid Form, all costs for excavation shall be included in the prices bid for the various bid items shown in the Bid Form, and no separate payment will be made.

Where solid rock is encountered on a project for which a pay item 'Solid Rock Excavation' is not included in the Bid Form, then the work and materials involved in the excavation of the solid rock shall be considered as Extra Work and be paid for in accordance with provisions in Section 1-09.

The unit contract price for "Unclassified Borrow" or "Borrow (Type)" shall include all costs required to excavate, haul, stockpile, and place the material as shown on the Drawings, or as directed by the Engineer. Compaction of borrow material will be paid as "Embankment Compaction."

The unit contract price for "Embankment Compaction" shall include all costs for the work necessary to compact embankments per Section 2-03.3(14) and earth embankments by Methods B or C per to Section 2-03.3(14)C.

Compaction of approved on-site excavated native material used for backfill and compaction of borrow shall be paid as "Embankment Compaction" per cubic yard, as indicated above.

The unit contract price for "Unsuitable Foundation Excavation" shall include all costs for the excavation or displacement of unsuitable foundation material only by the methods set forth in Section 2-03.3(14)E and 2-03.3(14)F. Costs shall include disposal of the unsuitable material, and leveling the upheaved material outside of the embankment slopes when the unsuitable material is displaced. Replacement material will be paid separately.

The unit contract price for "Vertical Sand Drains" shall be full compensation for furnishing all labor, tools, equipment and materials necessary for excavating the drain holes and for selecting, loading, hauling and placing the material.

All costs for excavation, backfill, and recompaction of sampling pits shall be considered incidental to the various bid items in the Bid Form and no separate payment will be made.

Density testing by Owner forces will be performed at no charge to the Contractor for the first test series at a designated location. The Contractor will be charged the actual costs the Owner incurs for retesting required due to failure to achieve required densities. Such charges will be deducted from monies due or to become due the Contractor on monthly estimates.

Payment for overbreak material used in lieu of borrow will be made either at the unit contract price for the class of roadway excavation which is applicable or the unit contract price for the type of borrow specified, whichever proves to be most economical to the Owner.

The unit contract price for "Sand for Drainage Blanket" shall include all costs for processing, hauling, and placing the material.

**SECTION 2-04 - HAUL****2-04.1 DESCRIPTION**

Delete this section and replace with the following:

This work consists of transporting excavated material from its original site to its final resting place on the project or at a waste site.

**2-04.3 CONSTRUCTION REQUIREMENTS (New Section)**

Off-highway earthmoving equipment shall not haul on or across any street not being improved in the contract.

**2-04.4 MEASUREMENT**

Delete this section and replace with the following:

Haul work will not be measured.

**2-04.5 PAYMENT**

Delete this section and replace with the following:

All costs for the work described in Section 2-04 will be considered incidental to excavation. All costs for haul shall be included in the costs associated with the excavation.

**SECTION 2-05 - SLOPE TREATMENT****2-05.4 MEASUREMENT**

Delete this section and replace with the following:

Slope treatment work will not be measured.

**2-05.5 PAYMENT**

Delete this section and replace with the following:

All costs for the work described in Section 2-05 will be considered incidental to excavation.

## SECTION 2-06 - SUBGRADE PREPARATION

## 2-06.1 DESCRIPTION

Delete this section and replace with the following:

This work shall consist of the preparation of subgrade for new and existing streets, alleys, driveways, sidewalks or other public places, upon which surfacing is to be placed, or the preparation of the surfaced roadbed, either new or existing, upon which cement concrete pavement is to be placed. All work shall be in accordance with the Contract Documents and in reasonably close conformity with the lines, grades, and typical cross sections indicated in the Drawings or as established and staked by the Engineer.

## 2-06.3(1) SUBGRADE FOR SURFACING

Delete item 6 of paragraph 1 and replace with the following:

6. Compact the subgrade to a depth of 6 inches. Compaction shall achieve 95 percent of maximum density determined by tests described in Section 2-03.3(14)D. Compaction shall be to a width of at least 1 foot beyond the pavement edge or to a width that will accommodate the paving equipment without visible distortion of the subgrade. All portions of the surface on the subgrade which are inaccessible to large compactor units shall be thoroughly compacted with smaller compactor units or mechanical tampers. If the underlying material is too soft to permit proper compaction of the subgrade the Contractor shall, at the Engineer's option, loosen, aerate, and compact or excavate, remove, and replace the subgrade material until compaction can be obtained.

Supplement paragraph 1 with the following items:

9. Underground work in the area of the subgrade shall be completed and properly backfilled and compacted before subgrade work is started. This shall include contract work and work performed by the Owner or others.
10. If the underlying subgrade is soft, spongy, or yielding and will not permit proper compaction, the Contractor shall stabilize the subgrade per Section 2-06.3(3).
11. Where normal crown sections are being constructed, stakes will be set at convenient offsets at intervals not to exceed 50 feet and at closer intervals where necessary, such as at street and alley intersections. It shall be the responsibility of the Contractor to set centerline grades which may be needed except in cases where the street grades are warped or otherwise do not conform with the typical section, in which case the Engineer will set the stakes.
12. When ordered by the Engineer, the Contractor shall sprinkle the subgrade with water in such quantities as directed.
13. Grade and line, throughout the stages of constructing the subgrade, shall be secured from the reference stakes. The subgrade shall be maintained in the finished condition until the first course of surfacing is placed upon it.

## 2-06.3(2) SUBGRADE FOR PAVEMENT

Delete paragraph 2 and replace with the following 6 paragraphs:

Profile grade is the point of gradient or vertical curve at the position indicated on the Roadway Section. Before any paving material is placed, the subgrade shall be brought to the proper line, grade, and cross section and shall be so maintained until the concrete is placed, except that extra depth of subgrade for increased thickness of the pavement, for pavement anchors, for pavement headers, and for increased thickness at the edges of the pavement may be removed just before the concrete is placed.

The subgrade shall be brought to a firm unyielding surface by rolling the entire area to a width of at least 1 foot outside the edge of the pavement with a compacting unit meeting the requirements of Section 2-06.3(3). All portions of the surface on the subgrade which are inaccessible to the compactor shall be thoroughly compacted with a mechanical tamper.

If directed by the Engineer, The full width of the roadway shall be kept well sprinkled with water before and during process of rolling the subgrade. The subgrade shall be rolled both before and after the forms are set.

When the pavement is to be constructed over an old roadbed composed of gravel and macadam, the old gravel or macadam shall be scarified and the material shall be uniformly spread and rolled until thoroughly compacted.

The subgrade shall be thoroughly wetted down with water from 12 to 48 hours before the concrete is to be placed, and shall be thoroughly wet just before the concrete is placed. The work of saturating the subgrade shall be started and continued at the direction of the Engineer.

The elevation of the subgrade from 1-1/2 feet inside of the edge of the proposed pavement (or form) to 1 foot outside of the edge of the pavement (or form) shall be brought to an elevation that is not more than 1 inch above or below the elevation for the finished subgrade over this area before stakes will be set for the forms.

## 2-06.3(3) SUBGRADE STABILIZATION (New Section)

When the density of the native earth in any area of the roadway section is determined by the Engineer to be less than the density requirement for whichever method of compaction is specified for the earth embankment, or where the nature or condition of the earth existing below the designated subgrade is such that, in the judgement of the Engineer, it may impair the stability of the subgrade, the Contractor shall stabilize the subgrade by whichever of the following methods is designated by the Engineer:

- (a) Thoroughly loosen the earth to a depth of 6 inches by scarifying, aerating or watering as applicable, and compact to the required density, or;
- (b) Excavate below grade to the limits and depth designated by the Engineer. As directed by the Engineer, the excavated material shall be stockpiled temporarily for use as backfill, used in adjacent embankments, or, if unsuitable, wasted and replaced with selected material or other designated backfill material. If deemed necessary by the Engineer, the earth remaining in the bottom of the excavation shall be loosened to a depth of 6 inches by scarifying, aerating or watering as applicable, and compacted to the required density. The excavated area shall then be backfilled with the previously excavated and stockpiled material, with selected material, or with such other mineral aggregate backfill as may be ordered by the Engineer. Backfill material shall be placed and compacted in successive layers in accordance with the method of compaction required for embankments under the provisions of the contract. Excavation below grade as set forth above shall be classified the same as the excavation above grade.

## 2-06.3(4) MAINTENANCE AND PROTECTION OF SUBGRADE (New Section)

Once prepared, the subgrade for surfacing shall be maintained in a finished condition until the first course of surfacing has been placed. The Contractor shall maintain the subgrade by blading and rolling as frequently as may be necessary. All cuts, ruts, and breaks in the surface of the subgrade shall be repaired prior to placing surfacing, treated base, or paving materials.

The Contractor shall take whatever steps are necessary to protect the prepared subgrade from inclement weather, the Contractor's operations, and public traffic prior to the placement of crushed surfacing, gravel base, pavement, etc. These steps shall include, but are not limited to, the use of plastic sheeting to protect the subgrade from inclement weather, planking to protect the subgrade from the Contractor's equipment, and the placing of paving materials or base materials from an adjacent lane in lieu of operating equipment over the prepared subgrade. Traffic detours shall be in accordance with Section 1-07.

Hauling over finished subgrade shall be limited to that which is essential for construction purposes. Equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires. Equipment used for hauling over the prepared subgrade which, in the opinion of the Engineer, causes undue damage to the subgrade or to the underlying materials shall be removed from the work upon request of the Engineer. If ordered by the Engineer, the Contractor shall plank the subgrade before hauling materials or operating equipment over it.

During extended periods of seasonal inclement weather in which the Engineer deems it impractical or infeasible to protect the prepared subgrade with plastic sheeting or planking and where the Contractor is required to operate equipment over the prepared subgrade in order to construct a crushed surfacing base course, treated base, or finished pavement, the Engineer may order the use of a ballast material to stabilize and protect the subgrade prior to paving. Stabilization shall be by Method B of Section 2-06.3(3) except the roadway ballast shall be either Mineral Aggregate Type 2 or Type 14, whichever is designated by the Engineer. Roadway ballast shall be used for subgrade stabilization only when specifically authorized by the Engineer.

**2-06.3(5) EQUIPMENT (New Section)**

The trimming machine shall be equipped with automatic controls with sensors for both sides of the trimmer capable of sensing grade from outside reference lines and providing the automatic signals which operate the trimmer to maintain the desired grade and transverse slopes. The trimmer shall provide a smooth, uniform surface without chatter or ripples.

Equipment used shall be subject to the Engineer's approval.

**2-06.5 MEASUREMENT AND PAYMENT**

Delete this title and section and replace with the following two sections:

**2-06.4 MEASUREMENT**

Preparation of the subgrade is incidental to the various items included in the contract and therefore no measurement is required.

Subgrade stabilization by Method A in Section 2-06.3(3) will be measured by the cubic yard of embankment compaction in accordance with Section 2-03.

Subgrade stabilization by Method B in Section 2-06.3(3) will be measured by the cubic yard of the same class of excavation as that above grade, in accordance with Section 2-03.

The imported mineral aggregate of the type specified when ordered by the Engineer, used in lieu of select native material, will be measured in accordance with Section 1-09.1.

**2-06.5 PAYMENT**

Unless otherwise specified, all costs for the subgrade preparation shall be included in the prices bid for the various items included in the contract and no separate payment will be made.

Subgrade stabilization by Method A in Section 2-06.3(3) will be paid as embankment compaction in accordance with Section 2-03.

Subgrade stabilization by Method B in Section 2-06.3(3) will be paid as excavation of the same class as the excavation above grade, in accordance with Section 2-03.

Mineral aggregate backfill of the type ordered by the Engineer used in lieu of select native material will be paid as mineral aggregate in accordance with Section 4-01.5.

Water used in subgrade preparation shall be considered as incidental to the construction in accordance with Section 2-07.

**SECTION 2-07 - WATERING**

Delete Section 2-07 in its entirety and replace with the following:

**2-07.1 DESCRIPTION (New Section)**

This work consists of furnishing, hauling, and applying water for compacting embankments, constructing subgrade, placing of crushed surfacing, dust control, testing and as the Engineer requires.

**2-07.1(1) SOURCE OF WATER SUPPLY AND REGULATIONS PERTAINING TO HYDRANT USE (New Section)**

Within the Seattle Water Department service area the source of water to be used on a project is subject to approval by the Seattle Water Department. When the source of water is to be a hydrant, a hydrant use permit must be obtained from, and use fees paid to the Water Service Section of the Seattle Water Department.

The Contractor will use only those sources approved or hydrants designated by SWD and in strict accordance with the requirements of City of Seattle Ordinance 65877 and the conditions of the permit.

**2-07.3 CONSTRUCTION REQUIREMENTS (New Section)**

The Contractor shall apply water upon streets by means of tank trucks equipped with spray bars. Spray controls shall ensure that the water flows evenly and in the amounts required by the Engineer. The Engineer may direct that the Contractor apply water at night or early in the morning to reduce evaporation losses.

Where hauled water is required, the tank truck and/or trailer shall meet all safety and licensing regulations and shall be provided with a pump of such size and capacity as to provide for a discharge equivalent to that required for hydrant settling water.

When the source of water is hydrants within the work area, the Contractor may, with approval of the Engineer, apply water by means of a hose and double check valve directly connected to the hydrant. Contractor shall furnish hose, equipment, or tank truck necessary to do the required watering, and strictly comply with the provisions of the permit.

**2-07.4 MEASUREMENT (New Section)**

Water work described in Section 2-07 will not be measured.

**2-07.5 PAYMENT (New Section)**

Water shall be obtained at the Contractor's expense. Providing and applying water shall be considered incidental to the various pay items comprising the improvement. No separate payment will be made.

## SECTION 2-08 - ROCK FACING (New Section)

## 2-08.1 DESCRIPTION (New Section)

This work shall consist of constructing, rebuilding, and relocating rock facings 6 feet or less in height used for erosion control or the containment of cuts and embankments. Rock facings shall be constructed, rebuilt, or relocated at the locations and to the limits indicated on the Drawings or designated by the Engineer. Work shall be performed in accordance with these Specifications and the Standard Plans.

## 2-08.2 MATERIALS (New Section)

Materials shall meet the requirements of the following sections of these specifications:

Rock Facing Material . . . . . 9-03.17  
 Drainage Material, Mineral Aggregate Type 2 or 14 . . . . . 9-03.16

Crushed gravel with at least 90% or more having two or more fractured surfaces and which meets grading requirements of Mineral Aggregate Type 2 or 14, may be used in lieu of ledge rock.

## 2-08.3 CONSTRUCTION REQUIREMENTS (New Section)

## 2-08.3(1) ROCK FACING (New Section)

The subgrade elevation of the rock facing shall be as staked by the Engineer or, in the absence of such staked elevation, shall be established from the depth below existing ground level set forth in the table below. The Contractor shall use the rock sizes as set forth in this table and shall insure a distribution of rock sizes with the largest rocks on the bottom and progressively smaller rocks up to the top.

Facing Height (h)	Depth of Base Below Existing Grade (d)	Minimum Rock Size (Base)	Minimum Rock Size (Top)
2 feet	3 inches	2-man	1-man
4 feet	6 inches	3-man	2-man
6 feet	12 inches	4-man	2-man

Rock facings shall be constructed by interlocking the rocks so that each rock is in contact with at least two other rocks with each rock having a minimum of three bearing surfaces per rock. Each rock shall be laid with a flat surface on the face of the rock facing and with the long dimension horizontal. The top rocks shall slope backward from the face of the rock facing. Voids shall be kept to a minimum.

The face of the rock facing shall be built to a line as indicated in the Drawings and shall not vary more than 6 inches. The batter shall be one horizontal to four vertical. A 6-inch layer of drainage backfill shall be placed and compacted along the back slope of the facing between the vertical portion of the undisturbed bank and the back of the rock facing.

## 2-08.3(2) REBUILD ROCK FACING (New Section)

This work shall consist of dismantling an existing rock facing and reconstructing the facing in the same location. Reconstruction work shall be in accordance with the requirements of Section 2-08.3(1). Rock dismantled from the existing facing shall be used in reconstructing the rock facing. Additional rock ordered by the Engineer to complete the facing shall be furnished by the Contractor and shall meet the requirements of Section 2-08.2.

## 2-08.3(3) RELOCATE ROCK FACING (New Section)

This work shall consist of dismantling an existing rock facing and rebuilding a similar rock facing in a different location using the rock obtained from the dismantled facing. Work shall be in accordance with the requirements of Section 2-08.3(1). Additional rock ordered by the Engineer to complete the facing shall be furnished by the Contractor and shall meet the requirements of Section 2-08.2.

## 2-08.4 MEASUREMENT (New Section)

Measurement for "Rock Facing" and "Relocate Rock Facing" will be by the square foot of rock face for the new rock facing or the relocated rock facing. Measurement for "Rebuild Rock Facing" will be by the square foot based on measurement of the existing rock facing before dismantlement. Measurement will include that portion of the rock facing constructed below the existing ground elevation.

Mineral aggregate of the type specified for drainage backfill will be measured by the ton in accordance with Section 1-09.1.

## 2-08.5 PAYMENT (New Section)

Compensation for the costs necessary to complete the work described in this section will be made at the unit contract prices bid only for the bid items listed or referenced below:

- (1) "Rock Facing," per square foot.
- (2) "Rebuild Rock Facing," per square foot.
- (3) "Relocate Rock Facing," per square foot.

The unit contract price for "Rock Facing," shall include all costs for the work required to furnish and place the rock, including excavation of the facing foundation.

The unit contract price for "Rebuild Rock Facing" or "Relocate Rock Facing," shall include all costs for the work required to dismantle and reconstruct the rock facing as specified using the existing rock and including temporary stockpiling of the rock and such excavation as may be necessary for rebuilding or relocating the rock facing.

Costs required to import and place additional rock in order to rebuild the rock facing to original condition shall be included under this item. No additional payment will be made.

Additional new rock facing area ordered by the Engineer during rebuilding or relocation of an existing rock facing will be paid in accordance with Section 1-09.4.

Payment for mineral aggregate of the type specified for drainage backfill will be made in accordance with Section 4-01.5.



## SECTION 2-09 - STRUCTURE EXCAVATION

## 2-09.1 DESCRIPTION

Delete this section and replace with the following:

This work shall consist of excavation, removing, and disposing of all formations, debris, and materials, natural or manmade, irrespective of nature or condition, encountered within the limits hereinafter defined which are necessary for the construction of footings, bases, or other foundation work required to support pump stations, headwalls, water tanks, transmission towers, bridges, retaining walls, cribbing, sign support structures, and other similar structures, all in accordance with the Contract Documents and in reasonably close conformity with the lines, grades, and dimensions indicated therein or staked by the Engineer. This work shall further consist of stockpiling, hauling, and placing suitable excavated material in fill areas, and disposing of excess or unsuitable soil.

This work shall also include the construction and subsequent removal of shoring and cribbing, or cofferdams, along with necessary pumping, sealing, and dewatering of the excavated area, the furnishing, stockpiling, placing and compacting of select excavated or imported material over and around the completed structure.

Excavation for roadways, sewers, storm drains, water mains and their appurtenances, manholes, inlets, catch basins, conduits, utility structures, and such other related miscellaneous work are covered elsewhere in these Specifications and shall not be considered as structure excavation.

## 2-09.3(1)A STAKING, CROSS SECTIONING AND INSPECTION

Supplement this section with the following:

When any foundation excavation is completed, the Contractor shall notify the Engineer, and no concrete or other permanent structural material shall be placed therein until permission to proceed is given by the Engineer.

## 2-09.3(1)D DISPOSAL OF EXCAVATED MATERIAL

Delete this section and replace with the following:

The material obtained from structure excavation shall be used for backfilling over and around the structures after they are complete. Material not required for this purpose shall be used in the construction of embankments, stockpiled per Section 2-03.3(10) or if deemed unsuitable by the Engineer per Section 2-03.3(14), wasted per Section 2-01.2. Material which meets the requirements for Mineral Aggregate Type 17 shall be selectively stockpiled for use as wall or abutment backfill.

## 2-09.3(1)E BACKFILLING

Delete paragraph 1 and replace with the following:

Openings made for structures shall be backfilled with selected material from the structure excavation or from other excavations. In general, selected backfill material from the excavation shall be as defined in Section 2-03.3(10).

The second paragraph is revised to read:

**Alternative Source.** When material from structure excavation is unsuitable for use as backfill, the Engineer may: require the Contractor to obtain material elsewhere; require the Contractor to substitute selected material in accordance with Section 2-03.3(10); or require the Contractor to use other material covered by the contract, if such substitution involves work that does not differ greatly from what would otherwise have been required. The Contractor shall provide backfill material as provided in Section 1-04.4 if neither selected materials nor other contract materials are available.

Supplement this section with the following:

Spaces excavated and not occupied by abutments, piers, or other permanent structures shall be backfilled up to the surface of the surrounding ground with a sufficient allowance for settlement and the top surface of the backfill shall be neatly graded.

Special precautions shall be taken to prevent any wedging action against abutments and wing walls. If the excavation has sloping sides, the slopes shall be broken up by stepping or serrating to prevent wedge action before the backfill is placed. Fill placed around culverts, piers or underground utilities shall be deposited on both sides to approximately the same elevation at the same time.

Backfill for walls shall conform to the requirements for Mineral Aggregate Type 17, shall be placed in layers not to exceed 12 inches thick, and shall be compacted to 95% of maximum dry density. Compaction control tests shall be performed per Section 2-03.3(14)D.

Backfill for foundation shall conform to the requirements for Mineral Aggregate Type 2 or Type 14 per Section 9-03.16, and shall be placed in layers not to exceed 6 inches thick, with each layer being thoroughly compacted in accordance with Method C as described in Section 2-03.3(14)C before the next succeeding layer is placed.

If the material used in making the backfill is too dry to permit proper compaction sufficient water shall be added to allow satisfactory compaction results.

## 2-09.3(2) CLASSIFICATION OF STRUCTURE EXCAVATION

Delete this section and replace with the following:

Structure excavation will not be further classified into solid rock excavation or common excavation, nor into wet or dry excavation.

## 2-09.3(3) CONSTRUCTION REQUIREMENTS, STRUCTURE EXCAVATION, CLASS A

Delete title of this section and replace with the following:

## 2-09.3(3) STRUCTURE EXCAVATION

## 2-09.3(3)A PRESERVATION OF CHANNEL

Item No. 6 is revised to read:

Place riprap around the outside of cofferdams to repair local scour.

## 2-09.3(3)D SHORING, CRIBBING AND COFFERDAMS

The first sentence of the first paragraph is revised to read:

The Contractor shall provide drawings showing proposed methods and construction details of shoring, cribbing, or cofferdams in accordance with Section 6-02.3(16).

The fifth sentence of the first paragraph is revised to read:

The Contractor shall not begin construction until approval has been given by the Project Engineer.

Supplement this section with the following:

Cofferdams shall be classified as any watertight enclosure that surrounds the excavated area of the structure and which is used in conjunction with a concrete footing seal. Within the protection of the cofferdam the excavation is carried to the desired level and the concrete seal is poured, the enclosure is dewatered and the structure is constructed.

Excavation outside the cofferdam shall not continue below the elevation of the top of the seal, or if no seal is used, below the top of the footing, except with the written permission of the Engineer. If permission is given, it shall not relieve the Contractor of his obligation to anchor or otherwise hold the crib or cofferdam in place and secure it against tipping or displacement.

Cofferdams shall be constructed so as to protect green concrete against damage from sudden rising of the stream and to prevent damage to the foundation by erosion. No timber or bracing shall be left in the cofferdams or crib in such a way as to extend into the substructure without permission of the Engineer.

Calculations supporting the shoring design must be submitted with the shoring plans. The shoring plans shall contain details such as member sizes, plate thickness, weld details, bolted connections, etc. and shall be based on AASHTO specifications.



## 2-09.3(3)F DEWATERING (New Section)

When conditions are encountered which, in the opinion of the Engineer, make it impracticable to dewater the foundation pit before placing concrete, he may require the construction of a concrete foundation seal in accordance with Section 6-02.3(6)B "Placing Concrete in Water", and dewatering in accordance with Section 6-02.3(6)C, "Dewatering Concrete Foundation Seals".

## 2-09.3(4) CONSTRUCTION REQUIREMENT FOR TRENCH (OR OTHER EXCAVATIONS) 4 FT OR MORE IN DEPTH

The requirements of Section 2-09 shall apply to all types of excavation in so far as they do not conflict with the excavation requirements found in other sections of the Contract Documents for a specific kind of work (see Division 7).

If workers enter any trench or other excavation 4 feet or more in depth that does not meet the open pit requirements of Section 2-09.3(3)B, it shall be shored and cribbed. The Contractor alone shall be responsible for worker safety and the Owner assumes no responsibility. Shoring and cribbing or extra excavation for other classes of excavation shall be incidental to and included in the unit contract price for Bid Items requiring the excavation and shall include removal of the shoring and cribbing, or backfilling of the extra excavation. If select backfill material is required for backfilling within the neat line limits of the excavation it shall be required as backfill material for the extra excavation at the Contractor's expense.

## 2-09.4 MEASUREMENT

Delete this section and replace with the following:

The materials excavated will be measured in their original position by volume in cubic yards. The quantity measured for payment will include only the material excavated from within the neat line shown on the Drawings, regardless of whether the excavation is made within a cofferdam enclosure or in an open pit.

The vertical neat line limits for measuring the 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 (1) outside of vertical planes 1 foot outside of and parallel to the neat lines of a pile cap, footing, or seal, (2) more than 3 feet beyond the roadway side of a wing wall, and (3) more than 1 foot beyond the other sides and end of a wing wall.

The bottom limits for measuring the excavation for pile caps, footings, or seals will be the bottom elevation as shown in the Drawings or as otherwise established by the Engineer. In pile foundations, the material resulting from the swell due to driving piles will not be included in the measured quantity. The bottom limit for a wing wall will follow a line 1 foot below and parallel to the bottom.

The upper limit for measuring excavation will be the top surface of the ground, or the bed of the stream as it exists at the time the excavation is started. When the contract designates removal of the materials through a graded section above the structure excavation, and when there is a designated pay item in the contract for the excavation above the upper limit for structure excavation will be the lower neat lines of the designated grading section, as shown in the Drawings.

"Shoring & Cribbing or Extra Excavation", and "Cofferdam" shall be lump sum items and therefore no measurements are required.

Measurement for imported Mineral Aggregate, when ordered for backfill in lieu of native material by the Engineer, will be by the cubic yard based on the neat line excavation area shown on the Drawings for the depth designated by the Engineer.

Backfill for foundations, drains, and walls will be measured by the cubic yard per Section 1-09.1.

Measurement for concrete seal will be as specified in Section 6-02.4.

## 2-09.5 PAYMENT

Delete this section and replace with the following:

Compensation for the cost necessary to complete the work described in this section will be made at the unit contract prices bid only for the pay items listed below:

- (1) "Structure Excavation," per cubic yard.
- (2) "Shoring and Cribbing or Extra Excavation," lump sum
- (3) "Cofferdam," lump sum.

The unit contract price for "Structure Excavation," shall include all costs for all work specified in Section 2-09 and not provided for otherwise in this payment section which is necessary to complete excavation within the neat line limits specified. Any additional excavation outside of these limits will be considered as having been made for the Contractor's benefit, and shall be incidental to the various items comprising this improvement. All costs for preserving and protecting excavated materials to be used for backfilling structure excavation, and for disposal (including haul) of material obtained from structure excavation which is not used for backfill shall be incidental to and included in the unit contract price for "Structure Excavation".

Payment for structure excavation carried below the elevations shown in the Drawings, when ordered by the Engineer, will be made at the unit contract price per cubic yard for "Structure Excavation".

Whenever excavation is carried below the elevation shown on the Drawings without written approval from the Engineer, all costs for materials, labor and equipment necessary to bring excavation back to plan elevation, shall be borne by the Contractor. Replacement shall be made with concrete or other material acceptable to the Engineer.

The lump sum contract price for "Shoring and Cribbing or Extra Excavation" shall include all costs for the construction and subsequent removal of all shoring and cribbing.

No change will be made to the lump sum contract price for "Shoring and Cribbing or Extra Excavation" for increased depth, to and including a depth of 3 feet below the elevations shown in the Drawings. If depths greater than 3 feet below the elevations shown are required by the Engineer, allowance for extra costs will be made in accordance with Section 1-09.4.

It is the intent of these Specifications to make separate payment for shoring and cribbing only when the bid item "Shoring and Cribbing" is included in the Bid Form. Where no such bid item is included, the cost of any shoring and cribbing that may be required shall be considered as incidental to the unit contract price bid for "Structure Excavation" or other items requiring excavation as applicable.

The lump sum contract price for "Cofferdam" shall include all costs for the construction, dewatering and subsequent removal of the cofferdam and for all necessary labor, materials, tools and equipment for performing such work.

If the Contract Documents provide a bid item for cofferdam and should water conditions at the time of construction be such that in the opinion of the Engineer, seals are not required, the Engineer may specify that seals be omitted. In such case payment for cofferdam will be made at the lump sum price for "Cofferdams".

Payment for imported Mineral Aggregate backfill used shall be per Section 4-01.5.

Concrete seal will be paid as "Concrete (Class)(Use)" per Section 6-02.5.

## SECTION 2-11 TRIMMING AND CLEANUP

## 2-11.4 MEASUREMENT

Delete this section and replace with the following:

Work described in Section 2-11 will not be measured for payment.

## 2-11.5 PAYMENT

Delete this section and replace with the following:

The work of trimming and cleanup shall be incidental to the various bid items comprising the project. No separate payment will be made.

## PRODUCTION FROM QUARRY &amp; PIT SITES &amp; STOCKPILING

## SECTION 3-01 PRODUCTION FROM QUARRY AND PIT SITES

## 3-01.3 STATE FURNISHED MATERIAL SOURCES

Delete Section 3-01.3 and its subsections.

## 3-01.4 CONTRACTOR FURNISHED MATERIAL SOURCES

Delete Section 3-01.4 and its subsections and replace with the following:

In addition to the requirements of Section 1-06 the Contractor shall make all necessary arrangements for obtaining material from borrow sites, approved by the Engineer, in the quantities necessary for the work. Use of Mineral Aggregate will not be permitted until representative samples have been taken by the Engineer and tested, the source approved, and authorities granted for use of the aggregate.

## 3-01.4(1) MINERAL AGGREGATE (New Section)

The Contractor is to provide his own source of Mineral Aggregate (Type). The material shall be produced from sources approved by the Engineer in accordance with the requirements of Section 3-01. The grading and quality shall be as specified in Section 9-03.

Measurement and payment will be in accordance with Section 4-01.

## 3-01.5 MEASUREMENT

Delete paragraphs 3, 4, and 5.

## 3-01.6 PAYMENT

Delete paragraphs 2 and 3.

## SECTION 3-02 - STOCKPILING AGGREGATES

Delete Section 3-02 in its entirety.

## SECTION 4-01 - MINERAL AGGREGATES (New Section)

## 4-01.1 DESCRIPTION (New Section)

This section serves to unite the measurement and payment for all Mineral Aggregate.

## 4-01.2 MATERIALS (New Section)

Grading of all mineral aggregates shall meet the requirements of the Mineral Aggregate Table in Section 9-03.16.

## 4-01.4 MEASUREMENT (New Section)

Mineral aggregates of the types specified will be measured by the ton or by the cubic yard as specified on the Bid Form.

Measurement for payment of mineral aggregates shall be in accordance with Section 1-09.1.

## 4-01.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 4-01 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Mineral Aggregate, (Type)," per ton.
- (2) "Mineral Aggregate, (Type)," per cubic yard.

The unit contract price for "Mineral Aggregate, (Type)," shall include all costs of furnishing, hauling, stockpiling, placing, grading, and compacting the mineral aggregate.

Payment for roadway ballast will include all costs for removal and disposal of unsuitable material.

Payment for backfill for walls will be by the cubic yard in place as determined by the neat lines shown on the Drawings, or as ordered by the Engineer, except for the volume of pipes and gravel backfill for drains. Volumes of pipes 6 inches in diameter or less, drainage gravel placed around weep holes, and minor structural features will not be deducted.

Payment for backfill for foundations and for drains will be by the cubic yard in place as determined by the neat lines shown on the Drawings, or as ordered by the Engineer. Backfill for drains surrounding weep holes will be included in the unit contract price for concrete in place per Section 6-02.5, and therefore will not be measured.

## SECTION 4-02 - GRAVEL BASE

## 4-02.2 MATERIALS

Delete this section and replace with the following:

Materials shall meet the requirements in the following sections of the Specifications:

GRAVEL BASE	
Mineral Aggregate Type 17 . . . . .	9-03.10
Grading . . . . .	9-03.16

## 4-02.4 MEASUREMENT

Delete this section and replace with the following:

"Mineral Aggregate (Type)" for gravel base will be measured by the ton in accordance with Section 1-09.1.

## 4-02.5 PAYMENT

Delete this section and replace with the following:

Payment will be in accordance with Section 4-01.5.

## SECTION 4-04 - BALLASTING AND CRUSHED SURFACING

## 4-04.1 DESCRIPTION

Delete this section and replace with the following:

This work shall consist of constructing one or more courses of crushed aggregate material upon an existing roadway surface, or upon a subgrade properly prepared in accordance with the provisions of Section 2-06. The courses shall be constructed by spreading and shaping the aggregate material in such a manner that, with incorporation of a minimum amount of filler or keystone material, the courses will compact into a dense and unyielding mass to form a paving base in reasonably close conformity with the lines, grades, depth and cross sections indicated on the Drawings or established by the Engineer.

## 4-04.2 MATERIALS

Delete this section and replace with the following:

Materials shall meet the requirements in the following sections of the Specifications and the Mineral Aggregate Table in Section 9-03.16.

ROADWAY BALLAST	
Mineral Aggregate Type 2 . . . . .	9-03.9(3)
Mineral Aggregate Type 14 . . . . .	9-03.9(1)
SHOULDER BALLAST	
Mineral Aggregate Type 13 . . . . .	9-03.9(2)
BASE COURSE <sup>1</sup>	
Mineral Aggregate Type 2 . . . . .	9-03.9(3)
TOP COURSE AND KEYSTONE <sup>1</sup>	
Mineral Aggregate Type 1 . . . . .	9-03.9(3)
MAINTENANCE ROCK	
Mineral Aggregate Type 3 . . . . .	9-03.9(4)
SAND FILLER	
Mineral Aggregate Type 11 . . . . .	9-03.16
DUST PALLIATIVE SAND	
Mineral Aggregate Type 6 . . . . .	9-03.8(7)
DUST PALLIATIVE OIL	
OMS-2 . . . . .	9-02.1(6)

<sup>1</sup>Crushed gravel, Mineral Aggregate Type 1G and 2G may be used when confined under asphalt or concrete pavement as base course or trench backfill in lieu of crushed ledge rock Mineral Aggregate Type 1 and 2 when it meets the requirements set forth in 9-03.11.

If the Engineer approves the Contractor's request to change the type of mineral aggregate from that specified or orders such change then any additional compensation resulting from the substitution will be limited to the actual additional cost of the substituted mineral aggregate based upon invoices from the supplier. If the cost of the substituted mineral aggregate is lower than that of the mineral aggregate originally specified, then the difference in cost based upon invoices from the supplier will be deducted from monies due the Contractor.

## 4-04.3(1) EQUIPMENT

Supplement this section with the following:

The minimum amount and type of heavy equipment considered necessary for the proper execution of the work described herein shall be as follows:

- One heavy duty self-propelled grader, of an approved type, equipped with scarifier, broom, and not less than an 8-foot blade.
- One 10-ton self-propelled three-wheel roller, one vibratory roller, or one pneumatic-tired roller. Roller wheels may be weighted if necessary to secure specified weight per linear inch of tire width. Vibratory rollers shall meet the requirements of Section 5-04.

Other combinations and types of equipment may be substituted for the above if approved by the Engineer. Additional equipment shall be supplied if required by the Engineer. Such equipment includes, but is not limited to, bottom-dump hauling equipment with transfer spreading facilities; self-propelled spreading and leveling machines; and spreader boxes equipped with wheels or so constructed as to preclude any damage to the subgrade or underlying courses.

The equipment used for the work shall be subject to the Engineer's approval. Equipment shall be kept in good repair.

#### 4-04.3(4) PLACING AND SPREADING

Delete this section and replace with the following:

Unless indicated otherwise on the Drawings, in street areas to be paved with asphalt concrete pavement, crushed surfacing shall be placed to a compacted depth of 6 inches consisting of a 2 inch top course of Mineral Aggregate Type 1 placed on a 4 inch base course of Mineral Aggregate Type 2.

Spreading of the first course of surfacing or ballasting shall begin at points nearest to the point of loading and successive course shall begin at points farthest from the point of loading. Each course shall be constructed continuously from the beginning point of the course unless otherwise directed by the Engineer. The first course of surfacing or ballasting material shall be placed on all available subgrade before placing the succeeding course. If the Engineer deems it necessary, a succeeding course shall be placed over a section of a previously placed course before the final completion of that course.

Crushed surfacing, base course and top course shall be constructed in layers not to exceed 4 inches in depth. Ballast shall be constructed in layers not to exceed 6 inches in depth.

Each layer of surfacing and ballasting material shall be placed and spread by equipment approved for use by the Engineer. The surfacing and ballasting shall be spread by any method that will result in an even distribution of the material upon the roadway without perceptible separation in gradation. The material shall be spread and screeded to a depth and surface uniformity which will permit compaction to a reasonably true line, grade, depth, course, and cross section without further shaping.

Should there occur during any stage of the placing and spreading operation a separation of the coarser from finer materials causing, in the opinion of the Engineer, serious lack of uniformity in the grading, the Contractor shall immediately, upon request of the Engineer, make such changes in the method of handling the material as will prevent separation.

Unless otherwise approved by the Engineer, there shall be a distance of not less than 1 block nor more than 1/2 mile between the construction of any two courses of surfacing or ballast. Uniform gradations of mineral aggregates shall be used for surfacing on roadways.

Before placing any course, the preceding layer shall be properly bound up, and all floating or loose stone shall be removed from the surface.

Surfacing and ballasting materials shall not be placed upon subgrades covered with snow or which are soft, muddy, or frozen, or at times when the Engineer determines that the weather is such that satisfactory results cannot be obtained.

#### 4-04.3(5) SHAPING AND COMPACTION

Delete paragraph 2. and replace with the following:

Immediately following spreading and final shaping, each layer of the surfacing shall be compacted to at least 95 percent of the maximum density determined by the Engineer in accordance with Section 2-03.3(14)D before the next succeeding layer of surfacing or pavement is placed.

Supplement this section with the following:

When the thickness of a layer is less than 2 inches, density testing will not be required and the Engineer will determine the number of coverages required for the particular compaction equipment available. Each course of surfacing shall be compacted until the material does not creep under the compaction equipment before a succeeding course of surfacing material is applied. All compaction shall begin at the outer edges of the surfacing and continue towards the center.

#### 4-04.3(8) WEATHER LIMITATIONS

Supplement this section with the following:

The Owner shall not be liable for damages or claims of any kind or description by reason of suspending operations due to weather under directions of the Engineer.

#### 4-04.3(10) HOURS OF WORK

Supplement this section with the following:

See Section 1-08.11 for specific requirements for working overtime.

#### 4-04.3(12) APPLICATION OF DUST PALLIATIVE (New Section)

When required by the Drawings, in the Special Provisions, or when directed by the Engineer, completed crushed rock surfacing courses or roadways shall be given two or more applications of dust palliative oil to the limits specified. Dust palliative shall be OMS-2 and shall be uniformly applied by an approved pressure-type distributor at the rate of 0.3 gallons of emulsion per square yard of surface to be treated. Before succeeding applications of dust palliative are applied, the preceding application shall have thoroughly dried, as approved by the Engineer.

Dust palliative shall not be applied upon a wet surface nor when the temperature is below 60° F.

When directed by the Engineer, the Contractor shall furnish and place Type No. 6 sand on newly oiled streets to such limits as designated by the Engineer to prevent tracking of oil onto adjacent existing concrete pavement. Sand shall also be used where, in the opinion of the Engineer, the oil penetration is unsatisfactory.

#### 4-04.3(13) MAINTENANCE REQUIREMENTS AND CORRECTION OF SURFACE DEFECTS (New Section)

The surface of each layer of surfacing material shall be maintained reasonably true to line, grade, and cross section by blading, watering, and rolling until placing the next succeeding course or the final paving surface. Should irregularities develop in any surface during or after rolling, the irregularities shall be remedied by loosening the surface and correcting the defects. The entire area, including the surrounding surface, shall be rerolled until thoroughly compacted. The finished surface shall be true to the proper grade and crown before proceeding with the surfacing or final paving.

#### 4-04.3(14) RESURFACING OF OIL MAT AND GRAVEL STREETS (New Section)

The surface of existing oil mat and graveled streets shall be scarified and bladed to a minimum width of 21 feet until it has a uniform grade and cross section with a 3 inch to 5 inch crown at the center line. No attempt shall be made to apply oil to the street surface disturbed by construction operations without first scarifying and blading the entire roadway. Preparation work on the street surface shall produce a smooth, crowned surface, without residual ripples and ridges. All stones, lumps, broken concrete or asphalt, bricks, or other mineral matter which will not pass a 3 inch mesh shall be removed. Any and all wood, peat, or other organic matter shall also be removed, if required by the Engineer, prior to the application of the crushed surfacing. In shaping the existing surfacing, all material that may have been displaced by traffic or otherwise shall be bladed into the newly formed surfacing section.

Crushed Surfacing, "Mineral Aggregate, Type 1," shall be applied only after the newly formed street surface has been approved by the Engineer. Upon approval of the preparatory work, crushed surfacing shall be spread to a minimum depth of 2 inches by any method that will result in an even distribution of the material upon the roadway without perceptible separation in gradation. Where separation does occur, correction shall be made according to Section 4-04.3(4). During or after spreading operations, the newly spread crushed surfacing shall be shaped by blading to conform to the 2 inch depth and the required grade and cross section. Water for laying dust caused by grading operations, public travel, or for otherwise shall be applied in the amounts and places designated by the Engineer.

After final grading has been completed and approved by the Engineer, dust palliative oil shall be applied as specified in Section 4-04.3(12). Prior to opening the newly oiled streets to traffic, warning signs shall be placed at all routes leading to the freshly oiled roadways. These signs shall say "Fresh Oil," and shall be of a type approved by the Engineer and shall remain as long as may be required by the Engineer.

## 4-04.4 MEASUREMENT

Delete this section and replace with the following:

Crushed rock surfacing, top course and base course, ballast, and gravel base will be measured by the ton in accordance with Section 1-09.1.

Dust palliative oil shall be measured by the gallon.

## 4-04.5 PAYMENT

Delete this section and replace with the following:

Payment for crushed rock surfacing, top course, base course, ballast and gravel base shall be made in accordance with Section 4-01.5.

When included on the Bid Form, payment for dust palliative will be as follows:

- (1) "Dust Palliative," per gallon.

The unit contract price for "Dust Palliative" shall include all costs necessary to furnish and place dust palliative as specified.

## SECTION 4-06 - ASPHALT TREATED BASE

## 4-06.2 MATERIALS

Supplement this section with the following:

The asphalt binder shall be AR-4000W paving asphalt meeting the requirements of Section 9-02.

## 4-06.3(2) PREPARATION OF AGGREGATES

Delete paragraph 2 and replace with the following:

Aggregates for ATB shall be heated to a temperature between the limits of 350° F. and 375° F., or as designated by the Engineer.

## 4-06.3(6) SPREADING AND FINISHING

Supplement this section with the following:

The Contractor shall place the ATB in courses not exceeding 3 inches in thickness. When the total depth of ATB exceeds 3 inches, the ATB material shall be placed in two or more equal courses each not to exceed 3 inches in thickness.

## 4-06.3(6)A SUBGRADE PROTECTION COURSE

Delete paragraph 1 and replace with the following:

Unless otherwise ordered by the Engineer, the Contractor shall place the first course of ATB as a protection for the prepared subgrade as soon as possible after the subgrade has been completed.

## 4-06.3(8) ANTI-STRIPPING ADDITIVE

Delete this section and replace with the following:

When directed by the Engineer, an anti-stripping additive shall be added to the asphalt material in accordance with Section 9-02.4.

## 4-06.3(9) COMPACTION (New Section)

The method of compaction shall be as specified in Section 5-04.3(10).

## 4-06.4 MEASUREMENT

Delete this section and replace with the following:

Asphalt treated base will be measured by the ton in accordance with Section 5-04.4.

## 4-06.5 PAYMENT

Delete this section and replace with the following:

Compensation for the cost necessary to complete the work described in Section 4-06 will be made at the unit contract price bid for the pay item listed below:

- (1) "Pavement Base, Asphalt Treated (ATB)" per ton.

The unit contract price for "Pavement Base, Asphalt Treated (ATB)," shall include the costs for all work described in Section 4-06 and not otherwise provided for separately hereinafter necessary to construct the asphalt treated base on a prepared subgrade to the lines, grades, and cross sections required.

Payment for roadway excavation and subgrade preparation including excavation and disposal of unsuitable material shall be in accordance with applicable sections.



DIVISION 5  
SURFACE TREATMENTS AND PAVEMENTS

SECTION 5-02 - BITUMINOUS SURFACE TREATMENT

5-02.1 DESCRIPTION

Delete this section and replace with the following:

This work shall consist of constructing a single or multiple course, bituminous surface by treating existing crushed rock, screened gravel or bituminous roadway surfaces with asphalt and covering with a mineral aggregate thoroughly cemented to the roadway to obtain a wearing surface with good riding and nonskid qualities. The bituminous surface treatment shall be constructed in reasonably close conformity with the lines and cross sections shown in the Drawings or established by the Engineer.

Roadway surfaces shall be classified as treated or untreated roadway surfaces. A treated surface is defined as a paved surface consisting of asphalt concrete, cement concrete, brick, or seal coat. An untreated surface is defined as an unpaved surface which may consist of gravel, crushed rock or oil mat surfaces. Surfaces may be existing or new construction.

The method of treatment to be used on any particular project shall be bituminous surface treatment, Class B, unless otherwise specified.

5-02.2 MATERIALS

Delete paragraphs 2 and 3 and replace with the following:

The grade of asphalt shall be Cationic Emulsified Asphalt (CRS-2) meeting the requirements of Section 9-02.1(6).

Mineral aggregate for Bituminous Surface Treatment Class A or B shall be Mineral Aggregate Type 24, Chip Rock, meeting the requirements set forth in Section 9-03.

5-02.3(1) EQUIPMENT

Supplement this section with the following:

All equipment shall be maintained in good working order to ensure progress and quality of work.

The right is reserved for the Engineer to disapprove any equipment that, in the opinion of the Engineer, will not or does not accomplish the work satisfactorily.

Both the asphalt distributor and the self-propelled chip spreader shall be calibrated prior to their use to insure applications within the coverage limits specified. Adjustment of the asphalt distributor spray bar height shall be such as to obtain a triple lap of spray fans from bars with a 4-inch nozzle spacing and a double lap from bars having a 6-inch nozzle spacing.

The Contractor shall frequently check and adjust, if necessary, the height of the spray bar during asphalt application to insure the height above the pavement surface does not vary more than 1 inch as the truck load lightens.

5-02.3(2)A UNTREATED SURFACES

Delete this section. Refer to Section 5-04.3(5)B.

5-02.3(2)B TREATED SURFACES

Delete this section. Refer to Section 5-04.3(5)A.

5-02.3(3) APPLICATION OF ASPHALT

Delete this section and replace with the following:

Upon the properly prepared roadway surface, Cationic Emulsified Asphalt (CRS-2) shall be applied at the rate of 0.35 to 0.40 gallons per square yard (0.38 to 0.45 gallon per square yard in shaded areas) at a

BITUMINOUS SURFACE TREATMENT

5-02

distributor spraying temperature between 125°F and 185°F. The Engineer may vary the amount of asphalt to be applied that in his judgment will give the best results.

At any time during the progress of the work, the Engineer may order the use of other grades of asphalt materials in lieu of CRS-2 if, in the Engineer's judgment, the results contemplated by the specifications will thereby be better attained.

To ensure uniform distribution of asphalt prior to beginning work, the distributor bar shall be operated over a pit or vat. To avoid laps and ridges at transverse junctions of separate applications of asphalt, the Contractor shall spread sufficient building paper over the treated surface to make sure that the spray jets will be functioning normally when the untreated surface is reached.

The pattern of application of shots, and width and length of application of shots of asphalt material shall be such as to provide proper coverage of crushed material within the times specified, provide proper widths to such dimensions as to facilitate the most satisfactory coverage with crushed cover stone, and provide lapping of subsequent adjacent applications.

Asphalt shall be applied to spandrels of intersections and driveways immediately ahead of, or immediately behind the adjacent longitudinal street application.

Omissions (skips) by the distributor shall be immediately covered by hand patching with the same grade of hot asphalt.

Any one spread of asphalt shall cover no more area than can be covered with mineral aggregate within 3 minutes from the time of application; upon any part of the spread.

Unless otherwise directed by the Engineer, asphalt shall be spread toward the source of mineral aggregate to avoid injury to the freshly treated surface. No asphalt shall be spread until adequate supplies of mineral aggregate are on hand on the site.

Where earth curbs exist, the application of asphalt shall extend 4 inches beyond the gutter line. Where concrete curb and gutter exist, the application shall lap onto the gutter section, but shall not exceed 2 inches. Where concrete curb exists, the application shall be placed as closely as possible to the vertical surface without excessive splash onto the curb. Where concrete curb or curb and gutter exist, the distributor shall be equipped with a splash board designed to prevent spraying thereon.

All castings shall be covered with heavy building paper and weighed down with sand or crushed material.

Hand sprayers shall be used to apply asphalt around castings and wherever else cover is insufficient.

5-02.3(5) APPLICATION METHOD OF AGGREGATES

Delete this section and replace with the following:

Mineral aggregates shall be furnished and placed by the Contractor. Any method of handling the mineral aggregate which causes segregation of the various sizes of aggregate particles shall be corrected by the Contractor upon the request of the Engineer so that a uniform product will be incorporated in the work.

After applying the asphalt and at such time as the Engineer may direct, mineral aggregate shall be evenly applied to the roadway surface at a rate of 25 to 33 pounds per square yard. The quantity of aggregate to be applied shall be such that the asphalt will be uniformly covered and will not pick up under traffic. The aggregate shall be applied over the freshly spread asphalt by trailer-type or self-propelled spreader boxes of an approved design. The aggregate shall be applied so that trucks and spreader boxes will not travel on the fresh asphalt and it shall be spread in one operation for each application of asphalt. Spandrels of intersections, driveways, and bare spots shall be covered by hand spreading from trucks immediately behind the box application. Aggregate shall be spread in such a manner as to provide an 8-inch strip of asphalt exposed to provide a lap with the next application of asphalt.

The aggregate shall be damp when applied to the roadway. If the aggregate is dry and dusty, the Contractor shall dampen the aggregate by spraying with water.

As soon as the aggregate has been applied to the surface, the aggregate shall be well rolled with a pneumatic-tired roller. Places inaccessible to the pneumatic-tired roller, such as spandrels of intersections and private driveways, shall be rolled with a self-propelled smooth-wheel roller.

Where excess aggregate has been applied, it shall either be removed or be drifted uniformly over the adjacent roadway by using a motor patrol grader equipped with a wire broom mold board, subject to

approval of the Engineer. This type of brooming shall be held to a minimum, and where necessary it shall be very carefully performed so as not to disturb the mat in any way. Thin or bare spots in the spread of aggregate shall be corrected by hand spreading or by use of a grader as described above.

Rolling and brooming shall continue until the roadway is evenly covered and the aggregate is well compacted and "set" into the asphalt. This operation shall continue, as directed, until the asphalt has cured to the extent that it will not "pick up" under traffic. Primarily, all rolling will be performed with pneumatic rollers, except as otherwise described above, and the final rolling shall be performed with a self-propelled smooth-wheel roller.

During the maintenance period following the application of the Bituminous Surface Treatment, the Contractor shall perform brooming, spotting, and rolling as may be necessary to prevent "pick up" or other damage to the surface.

At any time during the progress of the work, the Engineer may order the use of a different aggregate grading in lieu of the mineral aggregate specified if in the Engineer's judgment the results contemplated by the specifications will thereby be better attained.

#### 5-02.3(7) PATCHING AND CORRECTION OF DEFECTS

Change "Section 5-02.3(2)A" in paragraph 1 to read "Section 5-04.3(5)B."

#### 5-02.3(8) PROGRESS OF WORK

Delete this section and replace with the following:

The Contractor shall so organize the work that the entire operation will progress in an orderly and expeditious manner or make progress satisfactory to the Engineer.

The sequence of operation for placing Bituminous Surface Treatments shall be as follows:

- (a) Apply asphalt emulsion on a properly prepared roadway surface.
- (b) Apply mineral aggregate by spreader boxes.
- (c) Roll with pneumatic-tired and/or self-propelled smooth-wheeled roller.
- (d) Allow a minimum of 48 hours set time.
- (e) Sweep with an approved road broom to pick up and remove excess aggregate. This work shall be accomplished in the early morning hours before the heat from the sun has warmed the pavement.
- (f) Maintain roadway surface for 5 calendar days by sweeping and patching as necessary on a daily basis, maintaining traffic signing, etc.

Ten (10) calendar days after the final application, the Contractor shall make a final sweep with a mechanical broom, using the pick up broom only, to clear off any remaining loose aggregates. Gutter brooms shall not be used. The Contractor shall dispose of the excess aggregates.

#### 5-02.3(11) ANTI-STRIPPING ADDITIVE

Delete this section and replace with the following:

When directed by the Engineer, an anti-stripping additive shall be added to the asphalt material in accordance with Section 9-02.4 of the Standard Specifications.

#### 5-02.4 MEASUREMENT

Delete this section and replace with the following:

"Asphalt (Grade)" will be measured by the gallon or ton before dilution in accordance with Section 1-09.1.

The measurement of aggregates shall be by the ton that is being placed in each truck, in accordance with Section 4-01.4.

#### 5-02.5 PAYMENT

Delete this section and replace with the following:

Compensation for the cost necessary to complete the work described in Section 5-02 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Asphalt, (Grade)" per gallon or ton.

The unit contract price for "Asphalt, Grade" per gallon or ton before dilution and "Mineral Aggregate (Type)" per ton shall include the costs for all work, specified in Section 5-02, necessary to construct a single or multiple course bituminous surface treatment.

"Anti-Stripping Additive" will be paid for as Extra Work per Section 1-09.4.

All costs for roadway preparation shall be paid in accordance with Section 5-04.5.

## SECTION 5-04 ASPHALT CONCRETE PAVEMENT

## 5-04.2 MATERIALS

Supplement this section with the following:

The grade of asphalt for tack coats shall be Cationic Emulsified Asphalt CRS-2 or STE-1 meeting the requirements of Section 9-02.

The grade of asphalt for sealing joints and other meet lines shall be STE-1 except when the paving to be sealed is outside the Seattle City Limits and under the jurisdiction of King County. In such case the asphalt for sealing meet lines and joints shall be AR 4000W. Asphalt for crack sealing shall be as specified in Section 5-04.3(5)C.

## 5-04.3(2) HAULING EQUIPMENT

Supplement this section with the following:

The asphalt concrete mixture shall leave the mixing plant at a temperature between 260°F. and 350°F. and when deposited on the road it shall have a temperature not less than 250°F. The exact temperature range within the above limits shall be as directed by the Engineer.

## 5-04.3(3) ASPHALT PAVERS

The second paragraph is revised to read:

The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Any bolt-on extensions over 1 foot in length on either side of the paver shall have the same equipment as the rest of the paver. Hydraulic extenders without screeds, augers, and vibration shall not be used in the traveled way.

## 5-04.3(4) ROLLERS

Supplement item 3 of this section with the following:

- (b) The minimum weight shall be 10 tons except for rollers used to compact areas inaccessible to a 10 ton roller (i.e., driveways, walkways, around castings, etc.).

## 5-04.3(4)A PLANERS (New Section)

Planing shall be by the cold planing method only. Equipment shall be of a type that has operated successfully on work comparable to that in the contract and shall be subject to the Engineer's approval prior to use. Equipment shall be maintained in good working condition while in use. The storage of equipment and volatile material shall be off-street and in compliance with Seattle Fire Department regulations.

Cold planers shall be milling type equipment capable of cutting at least a 5 foot chord to a depth of 4 inches in one pass. Smaller planers may be used for cutting around utility castings and making taper cuts for butt joints.

For mainline cold planing operations, the equipment shall have automatic controls with sensor for either or both sides of the equipment capable of sensing the proper grade from an outside reference line. The automatic controls shall also be capable of maintaining the desired transverse slope. The sensor shall be so constructed that it will operate from a reference line or multi-footed sled-like arrangement. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent.

## 5-04.3(4)B DISTRIBUTORS (New Section)

Distributors shall meet the requirements of Section 5-02.3(1).

## 5-04.3(4)C HEATER SCARIFIERS (New Section)

Equipment used to heater-scarify pavement shall be capable of heater-scarifying between 1,000 square yards and 1,500 square yards of pavement per hour. The heating unit shall have a minimum rating of 10,000 BTU's per hour. The heater-scarifier shall also be equipped with a leveling device to provide for an even distribution of loose material. The scarifier shall maintain continuous and undiminished pavement contact without damaging utility castings.

## 5-04.3(5) CONDITIONING OF EXISTING SURFACE

Delete this title and section and replace with the following:

## 5-04.3(5) PREPARATION OF STREET SURFACES

Street surfaces shall be classified as treated and untreated surfaces. Treated surfaces shall be cement concrete, asphalt concrete, brick, seal coat or other bituminous surface treatments. Untreated surfaces shall be crushed rock, gravel, or oil mat surfaces.

The work of preparing existing street surfaces prior to the addition of one or more courses of asphalt concrete or other bituminous material shall be classified as "surface preparation" for treated street surfaces, and "roadway preparation" for untreated street surfaces.

## 5-04.3(5)A PREPARATION OF EXISTING SURFACES

Delete this title and section and replace with the following:

## 5-04.3(5)A SURFACE PREPARATION - TREATED SURFACES

When an existing treated surface is to be used as a base for one or more courses of new asphalt concrete or other surfacing, the treated surface shall first be swept, cleaned, and patched as follows:

- (a) Treated surfaces shall be swept with a power broom until free from dirt and other foreign matter. Hand brooms shall be used to clean omissions of the power broom. Fatty asphalt patches, grease drippings and other objectionable material shall be removed from the existing pavement.
- (b) Excess asphalt joint filler shall be completely removed and premolded joint filler shall be removed to at least 1/2-inch below the surface of the existing pavement.
- (c) In order to obtain a base having uniform grade and cross section, all surface irregularities in the existing treated surface shall be corrected prior to placement of the new asphalt concrete or other bituminous surface treatment. Correction shall be by patching and if necessary, preleveling unless planing or heater-scarifying is specified. Although patching and preleveling may be necessary after planing, such work, after planing, shall be performed only when specified in the contract documents or designated by the Engineer.

## 5-04.3(5)A1 PRELEVELING (New Section)

When a surface of the existing pavement or old base is irregular, it shall be brought to a uniform grade and cross section by preleveling, unless some other method of correction has been specified in the contract documents.

As soon as the existing surface has been thoroughly cleaned, holes and discontinuities in the surface and edges and edge breaks shall be patched. Asphalt used for patching shall be Class B Asphalt concrete mix, heated to the temperature specified in Section 5-02.3(3). Before placing the premixed patch material in the hole, the bottom and edges of the hole shall be tack coated. The patch material shall be thoroughly tamped or rolled.

Patching shall be accomplished prior to preleveling or installation of the first asphalt course, whichever is applicable. Preleveling of uneven or broken surfaces shall be accomplished by placing asphalt concrete of the class specified with a motor patrol grader, by hand-raking, by Miller box, or by such other method as may be approved by the Engineer. After placement, the asphalt concrete shall be compacted thoroughly.

In some cases spot planing to remove high areas caused by rutting, etc., shall be performed prior to preleveling. Locations to be planed prior to preleveling will be noted in the contract documents.

Preleveling materials shall be the same class of asphalt concrete as the wearing course except that when asphalt concrete Class G is being used to construct the wearing course overlay, asphalt concrete Class B may, upon approval of the Engineer, be used as an alternate for preleveling provided there is no increase in cost to the Owner for substituting the alternate mix.

#### 5-04.3(5)A2 PLANING BITUMINOUS PAVEMENTS (New Section)

When planing is specified, the surface of designated pavement or the top surface of subsurface courses shall be removed or reshaped by planing to remove irregularities and produce a prepared subgrade acceptable for receiving an asphalt concrete overlay. Planing shall be by the cold milling method unless heater planing is specifically designated. The planer shall not be used on the final wearing course of new asphalt concrete construction.

Planing operations shall be conducted in such a manner as will not tear, break, burn or otherwise damage the surface which is to remain. The finished planed surface shall be slightly grooved or roughened and shall be free from gouges, deep grooves, ridges, or other imperfections.

A tapered wedge cut shall be made longitudinally along curb lines sufficient to provide a minimum of 4 inches of curb reveal after placement and compaction of the final wearing course. A tapered wedge cut shall also be made at transitions to adjoining pavement surfaces (meet lines) where butt joints are indicated on the Drawings. Butt joints shall be cut in a straight line with vertical faces 2 inches or more in height and shall produce a smooth transition to the existing adjoining pavement.

After planing is complete or when designated by the Engineer, the planed surfaces shall be swept, cleaned, and if required by the contract documents or Engineer, patched and preleveled.

Temporary asphalt shims (MC 250) shall be placed around each utility casting protruding above the surface in the traveled roadway, or any other area which can be a safety hazard to vehicular traffic. These temporary shims shall be removed prior to laying the asphalt overlay.

#### 5-04.3(5)A3 HEATER-SCARIFYING (New Section)

When heater scarifying is specified, the surface of designated pavements shall be sufficiently softened by heating to permit scarifying to a minimum depth of 3/4 inch without damaging the remaining pavement. The scarified material shall, in one continuous operation, be thoroughly mixed by tumbling, uniformly redistributed and leveled by an oscillating or vibratory device followed by roller compaction while the material is still hot.

Scarification to a depth of not less than 3/4 inch shall provide 9 pounds of scarified material per square foot of scarified roadway.

After compaction, the material shall be rejuvenated by the application of a rejuvenating agent in the amount and at the rate designated by the Engineer. Subject to climatic conditions and directions from the Engineer the rejuvenating agent shall be applied within 30 minutes of rolling.

Heater scarifying shall produce a completed surface with a uniform grade and cross-slope varying not more than 1/4 inch from the lower edge of a 10-foot straightedge placed on the completed surface in any direction. Variances due to roadway crowns, designed grade changes, tapered cuts at butt joints and along curbs or gutter will be taken into consideration by the Engineer.

Excess material from heater scarifying shall be removed and disposed of by the Contractor.

The recycled pavement may be opened to traffic after application of the rejuvenating agent. However, if the processed surface is, in the opinion of the Engineer, contaminated or degraded by traffic, a tack coat of asphalt shall be applied at the ratio of 0.12 to 0.20 gallons per square yard (0.08 to 0.12 residual).

#### 5-04.3(5)A4 TACK COAT (New Section)

A tack coat of asphalt, applied at the rate of 0.02 to 0.08 gallons per square yard of retained asphalt, shall be applied by a mechanical distributor, approved by the Engineer and meeting the requirements of Section 5-02.3(1), to all surfaces on which any course of asphalt concrete is to be placed or abutted including prior to preleveling. The distributor equipment shall be capable of distributing asphalt uniformly over an area in controlled amounts and shall be equipped with hand operated spray equipment for use only on inaccessible and irregularly shaped areas. When asphalt concrete pavement Class D is being constructed, the tack coat shall be applied to the existing surface at a rate of 0.12 to 0.20 (0.08 to 0.12 residual) gallons per square yard.

Where the new asphalt concrete abuts a curb or gutter, cold pavement joint, trimmed meet line, or any metal surface, a thin tack coat of asphalt shall be applied on the vertical face of the abutting surface by hand painting prior to paving. The application on the contact surfaces shall be thin and uniform in order to avoid an accumulation of excess asphalt in puddles. The Contractor shall not apply the tack coat on vertical contact surfaces above the finished height of the asphalt concrete being placed.

Where it is necessary to remove sections of existing pavements, the removal shall be performed in accordance with Section 2-02.

#### 5-04.3(5)B PREPARATION OF UNTREATED ROADWAY

Delete this section and replace with the following:

Untreated roadway surfaces, including intersections and side street approaches which are to receive asphalt concrete pavement or other surfacing shall be shaped to a uniform grade and cross-section, conforming as nearly as possible to that which exists except:

- When new lines and grades are indicated in the contract documents or staked by the Engineer; or
- Where the height of the centerline crown relative to the gutterline or edge of roadway exceeds 2 percent X 1/2 of the roadway width; in which case the crown shall be corrected by excavation or scarifying and blading to a cross section having a crown of 2 percent X 1/2 width or such other crown as may be designated by the Engineer.

Lines and grades will not be set by the Engineer in Case (b) above. The basis for establishing final line and grade in such case shall be curbs, curbs and gutters, existing pavement, or pavement edges or other existing street improvements. Existing driveways shall be graded as necessary to provide a smooth transition to the final grade of the new pavement surface including such grading as may be necessary to permit driveway adjustment with Class B Asphalt.

Where curbs or curb and gutters are not required or existing, subgrade preparation shall be 2 feet greater than the final asphalt paving width indicated on the Drawings for that street (1 foot on each side) or to such other width designated by the Engineer. The radius at the edge of roadway or at intersections shall be a minimum of 20 feet.

The grade shall be shaped so that all frame castings for manholes, monument boxes, gate valve boxes, catch basins, etc. within the roadway section to be treated will extend above the prepared surface, such that the casting will be flush with the final surface.

Preparation work shall produce a subgrade with a smooth, crowned surface without ripples or ridges. All stones, lumps, broken concrete, asphalt, bricks or other mineral matter which will not pass a 2 inch mesh shall be removed and disposed of by the Contractor. Wood, peat, or other organic matter shall also be removed and disposed of by the Contractor.

Where existing asphalt or cement concrete pavement is being met with new asphalt surfacing, sufficient native material shall be removed to permit the forming of a butt joint.

Those areas and surfaces which are to be prepared for the placement of asphalt concrete pavement or other surfacing shall be considered subgrade for the new construction. The existing roadway shall be scarified, excavated, bladed, shaped, and compacted to remove irregularities and secure a uniform surface conforming to the existing street profile and to the desired cross section. Excavated native material deemed unsuitable by the Engineer shall be removed and disposed of by the Contractor. Excess native material deemed suitable by the Engineer shall be stockpiled by the Contractor or bladed to the roadway edge and used as needed for fill or shoulder restoration following completion of the paving. The scarified or excavated material shall be used to the fullest extent possible as sub-base material prior to the placement of new crushed rock.

During the operation of blading and rolling, water shall be applied in the amount and locations designated by the Engineer.

If there is a surplus of stockpiled material after construction is complete, the Contractor shall clean up the stockpile site and remove and dispose of the surplus material.

The Contractor shall patch with premixed materials any holes or other malformations that cannot be removed by blading. The premixed material shall be made of crushed surfacing top course or cover stone from existing stockpiles mixed on the roadway with the asphalt specified for the project, by such roadmix methods as designated by the Engineer. Small patches shall be thoroughly hand tamped and the



larger holes or areas shall be patched and rolled with a smooth-wheeled roller or a two-axle power patching roller.

After scarifying, excavating, blading, shaping, and, if required, placing crushed surfacing, the roadway subgrade shall be compacted in accordance with the requirements of Sections 2-06 and 4-04. The subgrade shall be brought to a firm, unyielding surface by compacting the entire area to a width of 1 foot outside the edge of pavement or to the curb or curb and gutter.

Soft, spongy, or yielding spots shall be removed, refilled with suitable, stockpiled material, and thoroughly compacted.

It is assumed that sufficient existing crushed rock material will be obtained from scarifying and excavation operations to provide a minimum of 2 inches of crushed rock sub-base for the asphalt paving, or that the subgrade, after scarifying, excavation, and shaping has been completed, will be acceptable as is, without the need for additional procured crushed rock (i.e. the depth of the existing crushed rock is at least 2 inches deep).

When, in the opinion of the Engineer, the sufficient roadway subgrade material is not available, the Contractor shall furnish, place, and compact a maximum of 2 inches of "Mineral Aggregate, Type 1" on the subgrade. The material shall not be placed unless specifically ordered in writing by the Engineer. "Mineral Aggregate, Type 1" will not be considered a major bid item.

The Contractor shall insure that a 2 inch minimum depth of native or procured crushed rock base is provided for the asphalt paving.

The full width of the roadway shall be sprinkled with water, when ordered by the Engineer, to alleviate dust and to keep the subgrade material moist as an aid to compaction.

Immediately before the prime coat of asphalt is applied, the roadway surface shall be stable and unyielding, dry to medium damp condition, free from irregularities and material segregation, and true to line, grade, and cross section.

In the event the compacted aggregates are of such gradation as to resist penetration of the asphalt, the Contractor shall loosen no more than the upper 1/2 inch of surface and relay without compaction immediately before the prime coat application. Following the application of aggregate on the prime coat, rolling shall be performed as specified above.

#### 5-04.3(5)B1 PRIME COAT TREATMENT (New Section)

Unless otherwise specified, a prime coat treatment of asphalt per Section 5-02.3(3) for existing gravel, crushed rock, or oil mat streets shall be required prior to being paved with asphalt concrete.

The prime coat shall be applied over the full length of the project, and asphalt concrete pavement shall not be placed until the prime coat has cured for a full 5 days.

The Contractor shall maintain the completed prime coat by blading or brooming until the asphalt concrete is placed. Should any holes, breaks, or irregularities develop in the roadway surface after the prime coat has been applied, they shall be patched or repaired in accordance with Section 5-04.3(5)B immediately in advance of placing the asphalt concrete pavement.

Immediately prior to tacking and placing the asphalt concrete pavement, the surface of the prime coat shall be swept clean of all dirt, dust, and other foreign matter.

In areas used as turnouts or which will receive heavy service, the Engineer may order a change in the subgrade elevation to provide a greater depth of pavement.

The Contractor shall prepare untreated shoulders and traffic islands by blading and compacting to provide a sound base for paving. The prime coat treatment shall be omitted and the asphalt concrete pavement shall be constructed on the prepared subgrade after tacking per Section 5-04.3(5)A4.

When prime coat treatment is not required, the Contractor shall prepare the untreated roadway as specified above except for the prime coat of asphalt and aggregate. The asphalt concrete pavement shall be constructed on the prepared subgrade and tacked per Section 5-04.3(5)A4.

#### 5-04.3(5)C CRACK SEALING

Item B is revised to read:

The sealant material shall conform to the requirements of Section 9-04.10 and shall be applied in accordance with the manufacturer's recommendations. The Contractor shall furnish the Engineer with a copy of these recommendations.

The cracks shall be completely dry before being filled with the rubberized asphalt. Filling shall be controlled to confine the material within the crack or joint. Any overflow shall be cleaned from the pavement surface and will be deducted from payment.

#### 5-04.3(5)D SOIL RESIDUAL HERBICIDE

Delete paragraph 1 and replace with the following:

Prior to installing asphalt driveways or sidewalks, the driveway and sidewalk subgrade shall be treated with one application of an approved soil residual herbicide. The soil residual herbicide to be used shall not damage or have a detrimental chemical reaction to the asphalt concrete. Application of the herbicide shall be by a uniform spray in accordance with the manufacturer's recommendations. Paving shall begin within 24 hours after application of the herbicide. Areas not paved within that time limit or that have been rained on shall be retreated at the Contractor's expense.

The Section number in the last paragraph shall be revised to read, "Section 8-02.3(2)A."

#### 5-04.3(6) HEATING OF ASPHALT MATERIAL

Supplement this section with the following:

The asphalt shall be heated to between 250 and 350 degrees Fahrenheit, the temperature within this range will be determined by the Engineer.

#### 5-04.3(7)A MIX DESIGN

Delete paragraph 2 and replace with the following:

The Contractor shall obtain the Engineer's approval prior to changing the source of asphalt cement during the production of asphalt concrete. Blending of asphalt from different sources will not be permitted.

#### 5-04.3(9) SPREADING AND FINISHING

Delete paragraph 1 and replace with the following 9 paragraphs:

Crushed surfacing shall be placed under asphalt concrete pavement per Section 4-04.3(4).

Unless otherwise specified on the Drawings, asphalt concrete pavement in all street areas shall be Asphalt Concrete Class B to a compacted thickness of 3 inches, installed in 2 equal lifts.

The asphalt concrete pavement shall be constructed in one course or multiple courses of equal depth. Courses shall not exceed the nominal compacted depth specified below for the particular class of asphalt concrete being used:

Asphalt Concrete Class E .....	0.25 foot (3 inches)
Asphalt Concrete Class B when used for Base Course .....	0.25 foot (3 inches)
Asphalt Concrete Class B and F .....	0.16 foot (2 inches)
Asphalt Concrete Class G .....	0.10 foot (1-1/2 inches)
Asphalt Concrete Class D .....	0.08 foot (1 inch)

Where the compacted depth of any asphalt concrete pavement exceeds the depth specified above for the particular class of mixture, the course shall be constructed in two or more equal layers.

When more than 1 course is necessary to meet the final paving grade, the first course shall include any widening of the existing roadway and preleveling of the existing pavement surface. The preleveling course or courses shall be constructed so that the final wearing course will have a uniform compacted depth and will conform to the finished grade and cross section elevations specified.



The final wearing course placed after a roadway surface has been planed, or planed and preleveled shall be constructed to a nominal compacted depth of 2 inches. Where heater scarifying has preceded placement of the final lift, the nominal compacted depth of the final wearing course shall be 1 inch minimum.

Construction of 1 course upon another shall not proceed until the underlying course has completely cooled and set.

Unless otherwise directed by the Engineer, the construction of each course of asphalt concrete pavement shall commence at the point farthest away from the mixing plant and progress toward the plant so that no hauling will be done over freshly placed pavement.

Any wearing course or other pavement course to be used for the driving surface will be evaluated by the Engineer to determine whether a fog seal is required. When the results of nuclear or core density testing show that a seal is needed, or when the surface course is asphalt concrete Class D, the Contractor shall apply a fog seal of CSS-1 at the rate 0.05 to 0.10 (0.03 to 0.05 residual) gallons per square yard. Unless otherwise approved by the Engineer, fog seal shall be applied prior to opening the roadway surface to traffic.

Delete the third paragraph.

#### 5-04.3(9)A UTILITY ADJUSTMENTS (New Section)

Utility appurtenances such as inlets, manhole covers and valve boxes shall be adjusted to finished grade prior to the construction of the final wearing course.

#### 5-04.3(10)B CONTROL

Delete this section and replace with the following:

For asphalt concrete Classes B, E, and F, where paving is in the traffic lanes and the specified compacted course thickness is greater than 0.10 foot, the acceptable level of compaction shall be 92 percent of the maximum density as determined by WSDOT Test Method 705. The level of compaction will be determined as the average of not less than 5 nuclear density gauge tests taken (after completion of the finish rolling) at randomly selected locations within each lot. The quantity represented by each lot will be no greater than a single day's production or approximately 400 tons, whichever is less.

Control lots not meeting the prescribed minimum density standard shall be removed and replaced with satisfactory material. At the option of the Engineer, non-complying material may be accepted at a reduced price.

Cores may be used as an alternate to the nuclear density gauge tests and shall be taken within 48 hours of the placement of the mix. When cores are taken by the Engineer at the request of the Contractor, the Owner shall be reimbursed for the coring expenses at the rate of \$50.00 per core.

Asphalt concrete Classes B, E, and F constructed under conditions other than listed above shall be compacted on the basis of a test point evaluation of the compaction train. The test point evaluation shall be performed in accordance with instructions from the Engineer. The number of passes with an approved compaction train as required to meet the maximum test point density shall be used on all subsequent paving.

Asphalt concrete Class D and preleveling mix shall be compacted to the satisfaction of the Engineer. In addition to the randomly selected locations for tests of the control lot, the Engineer reserves the right to test any area which appears defective and to require the further compaction of areas that fall below acceptable density readings.

#### 5-04.3(11) JOINTS

Delete this section and replace with the following two subsections:

##### 5-04.3(11)A LONGITUDINAL AND TRANSVERSE JOINTS (New Section)

The placing of the top or wearing course shall be as nearly continuous as possible, and the roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is discontinued for such length of time as to permit the mixture to become chilled. When the work is

resumed, the previously compacted mixture shall be cut back to produce a slightly beveled edge for the full thickness of the course.

Where a transverse joint is being made in the wearing course, strips of heavy wrapping paper shall be used. The wrapping paper shall be removed and the joint trimmed to a slightly beveled edge for the full thickness of the course prior to resumption of paving.

The material which is cut away shall be wasted and new mix shall be laid against the fresh cut. Rollers or tamping irons shall be used to seal the joint.

The longitudinal joint in any one layer shall be offset from the layer immediately below by not more than 6 inches nor less than 2 inches. All longitudinal joints constructed in the top layer shall be at a lane line or edge line of the travelled way. However, on one lane ramps which must remain open to traffic, a longitudinal joint may be constructed at the center of the lane subject to approval by the Engineer.

Immediately following the compaction of the top wearing course, meet line joints where the new asphalt concrete abuts existing asphalt concrete pavements, portland cement concrete pavements, oil mats, concrete curb and gutter, etc., shall be sealed with STE-1 asphalt per Section 5-04.3(11)B.

#### 5-04.3(11)B CONNECTIONS WITH EXISTING FACILITIES (New Section)

Where construction of new asphalt concrete pavement connects with an existing roadway surface, driveway, bridge, railway crossing, or other facility, the Contractor shall provide a smooth riding transition between the new and existing surface. Such work may require the modification of the existing roadway profile by burning, planing or milling in order to achieve the desired smooth riding transition or may require other adjustment of the connecting surface.

Where butt joints are required at the meet lines of new construction and existing surfaces, the existing abutting pavement shall be trimmed by chipping, planing, milling or such other method as may be approved in order to insure a minimum depth of 2 inches of compacted asphalt concrete at the point of connection. Meet lines shall be trimmed straight and the edges vertical. Waste material resulting from such trimming or chipping shall be disposed of by the Contractor. Butt joints will be required only at locations designated on the Drawings. Unless the existing roadway profile requires modification by planing, all other connections shall be made by shimming or feathering to provide the necessary smooth riding connection.

Where the transition is to be made by shimming or feathering, it shall be accomplished at the time the final course is being constructed by raking out the oversize aggregates of the asphalt concrete mix being used. The Contractor shall 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 case, asphalt concrete Class G shall be used.

Surfaces which will be in contact with the new asphalt shall be tacked in accordance with the requirements of Section 5-04.3(5)A4.

Meet lines shall be sealed while the new asphalt concrete is still warm by painting with Special Tack Coat (STE-1) asphalt and immediately covering the asphalt paint strip with clean, dry paving sand meeting the requirements of Section 9-03.8(7).

#### 5-04.3(13) SURFACE SMOOTHNESS

Delete the last paragraph and replace with the following:

Castings, such as inlets, manholes, valve chambers, meter boxes, monument cases, etc., shall be adjusted to finish grade prior to construction of the final wearing course.

#### 5-04.3(14) PLANING BITUMINOUS PAVEMENT

Delete this section. Refer to Section 5-04.3(5)A2.

#### 5-04.3(14)A HEATER PLANING

Delete this section. Refer to Sections 5-04.3(5)A2 and 5-04.3(5)A3.

**5-04.3(14)B COLD PLANING**

Delete this section. Refer to Section 5-04.3(5)A2.

**5-04.3(15) ASPHALT CONCRETE DRIVEWAYS**

Delete this section and replace with the following:

Asphalt driveways shall be constructed at the locations shown on the Drawings or as directed by the Engineer in accordance with Section 5-04.

Unless indicated otherwise on the Drawings, the Contractor shall complete the necessary earthwork and provide a 3 inch compacted Asphalt Concrete, Class B and 4 inch Mineral Aggregate, Type 1 driveway section to the limits shown on the Drawings or designated by the Engineer.

The subgrade shall be treated with soil residual herbicide in accordance with requirements of Section 5-04.3(5)D.

**5-04.3(17) PAVING UNDER TRAFFIC**

Delete this section and replace with the following:

When the roadway being paved is open to traffic the following requirements shall apply:

The Contractor shall keep intersections open to traffic at all times except when paving through the intersection. Such closures shall be kept to the minimum time required to place and compact the mixture and shall include advance warning to traffic of the intersection closure. Work shall be scheduled so that consecutive intersections shall not be closed at the same time. In hot weather the Engineer may require the application of water to the pavement to accelerate the finished rolling of the asphalt and to shorten the time required before reopening to traffic. Traffic shall not be allowed on newly placed asphalt until approval has been obtained from the Engineer. The installation of advance warning signs, detours, and the maintenance of traffic shall be as specified in Section 1-07.23 and the Traffic Control Manual for In-Street Work.

During paving operations, center line stripes shall be maintained throughout the project by applying temporary pavement marking tape each day to the roadway that was paved that day. Temporary centerline striping shall consist of placing strips of pressure-sensitive pavement marking tape at 10-15 foot intervals along the center line. Temporary marking tape shall be placed in sets of two 12-inch strips of yellow 4-inch wide 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 center line of the roadway. Additional temporary striping shall be installed wherever designated by the Engineer.

Temporary stop bars shall consist of a 12-inch wide stop bar made up of three parallel 4-inch strips of temporary pavement marking tape placed at locations designated by the Engineer. All other temporary pavement markings utilizing pavement marking tape shall be designated by the Engineer.

Pressure-sensitive pavement marking tape used on the wearing course prior to installation of permanent lane markers, traffic buttons, or permanent paint striping shall be removed from the pavement current with, or immediately subsequent to, the installation of permanent pavement markings. Damage to the pavement, resulting from removal of temporary marking tape, shall be repaired by the Contractor at the Contractor's expense.

Temporary pavement markings shall be maintained in servicable condition by the Contractor during the interval of time it is in use. Layout and marking in preparation for application and the application and removal of the temporary striping shall be the Contractor's responsibility. The Engineer will do the layout for permanent lane markings as specified in Section 8-22.3(1).

Temporary pavement marking tape shall meet the requirements of Section 9-29.4.

Within five days, weather permitting, after the preliminary layout of pavement marking control points has been completed by the Engineer, the Contractor shall install all permanent pavement markings. Installation shall be pursued vigorously thereafter until all permanent pavement markings and traffic channelization work is complete.

**5-04.3(19) SEALING OF DRIVING SURFACES**

Delete the last sentence of the paragraph.

**5-04.3(21) SHOULDERS (New Section)**

Shoulders, if required, shall be constructed to the lines, grades, and cross-sections specified. Material for building up shoulders shall be "Mineral Aggregate, Type 1" manufactured from crushed ledge rock.

**5-04.3(22) ASPHALT CONCRETE SIDEWALK (New Section)**

Asphalt walkways shall be constructed at the locations and to the width specified on the Drawings or as designated by the Engineer.

Asphalt walkways shall be constructed with a 4 inch section of compacted crushed rock and 2 inches of compacted Class B asphalt concrete. The subgrade shall be treated with a soil residual herbicide in accordance with the requirements of Section 5-04.3(5)D.

**5-04.4 MEASUREMENT**

Delete this section and replace with the following:

Measurement for asphalt concrete pavement of the class specified will be by the ton whether the asphalt concrete is used for pavement, sidewalk, driveway, shims, feathering, or preleveling. The net weight of asphaltic concrete materials being delivered to the job site shall be weighed in the transport equipment on a certified platform scale which automatically prints the net weight on a load ticket. Only load tickets from automatic printing platform scales will be acceptable. Alternately, the Contractor may use a commercial certified platform scale having an automatic weight printing capability. The engineer will periodically observe and check such weighing operations. The weigher shall record on the load ticket the weight and other required information such as time, date, truck number, etc. The tare weight of each truck shall be recorded at least daily and recorded on a tare sheet. Tare weight is the weight of a truck without a load.

Measurement will be based upon the actual quantity incorporated into the work as determined by the material load tickets received and approved by the Engineer on the day the material was delivered and incorporated into the work. Deductions will be made for any asphaltic material included in the measurement that is not incorporated into the work on the day delivered.

The Owner reserves the right to make random checks at independent weigh stations of the gross and tare weights of transport equipment hauling asphaltic concrete material to the job site. In the event these random checks result in net weights that are different by more than 1 percent of the smaller net weight, the Contractor shall, at the Engineer's option, thereafter utilize a certified scale of the Engineer's choice. If the random check indicates the Contractor's scales have been underweighing, no additional payment to the Contractor will be allowed for materials previously weighed and recorded. Should the random check indicate the Contractor's scales were overweighing (indicating more than true weight) by more than 1 percent of the smaller net weight, then all materials received subsequent to the last previous random check will be reduced by the percentage or error in excess of the 1 percent.

"Roadway Preparation" will be measured by the linear foot once along the centerline of the main roadway being prepared. All related intersections, side street approaches, and irregular shaped areas thereto will be incidental. Measurement shall be to the nearest whole linear foot.

Measurement for "Surface Preparation, Plane Bituminous Pavement" will be by the square yard and shall be based on the average depth, shown on the Drawings plus any additional depth up to 4 inch maximum, to cover removal of high spots and the extra depth required to provide a 4 inch reveal along the curb line as specified in Section 5-04.3(5)A2. Should the Drawings indicate or the Engineer order an area to be planed in excess of 4 inches, the square yard of surface planed will be increased by the actual area of surface planed in excess of 4 inches. If the Engineer directs an additional planing beyond the depth required above, the total quantity of planed surface will be increased to include area replaned. The Engineer will determine depth of planing during each planing operation.

Measurement for "Surface Preparation, Prelevel" will be by the ton of asphalt concrete placed for preleveling surfaces based on the actual quantity incorporated into the work as determined by the material load tickets received and approved by the Engineer on the day the material was delivered and placed.

Measurement for "Surface Preparation, Heater-Scarify" will be by the square yard of area actually heater-scarified to a minimum depth of 3/4 inch.

Measurement for "Plasticizing Rejuvenator" will be by gallon. Measurement of quantities will be based upon the actual quantities incorporated into the work.

Measurement for "Crack Sealing" will be by lump sum.

#### 5-04.5 PAYMENT

Delete this section and replace with the following:

Payment will be made for such of the following bid items as are included on the Bid Form:

- (1) "Pavement, Asphalt Concrete (Class)" per ton.
- (2) "Roadway Preparation," per linear foot.
- (3) "Surface Preparation, Prelevel," per ton.
- (4) "Surface Preparation, Plane Bituminous Pavement" per square yard.
- (5) "Surface Preparation, Heater Scarify" per square yard.
- (6) "Plasticizing Rejuvenator" per gallon.
- (7) "Crack Sealing," lump sum.

The unit contract price for "Pavement, Asphalt Concrete (Class)" shall include all costs for the work required to furnish, haul, place and compact the asphalt concrete mix as specified in Section 5-04, including asphalt for tack coat, fog seal and sealing joints and meet lines, sand for joints and meet lines, sweeping and other preliminary surface preparation, and such other work as may be necessary according to this section and not otherwise set forth as a separate bid item on the Bid Form.

Asphalt concrete driveways, sidewalks, shims, and feathers will be paid for as "Pavement, Asphalt Concrete (Class)," which will include costs for soil residual herbicide.

MC 250 use for temporary asphalt shim shall be measured and paid in accordance with Section 5-07.

If the Engineer orders a change in grade of paving asphalt, any additional compensation will be limited to the actual additional cost of the asphalt based on invoices from the supplier. If the cost of the substituted paving asphalt is lower, the difference in the cost and that of the original material specified, based on invoices from the supplier, shall be deducted from monies due the Contractor.

The unit contract price for "Roadway Preparation" shall include all costs for the work required to prepare the untreated roadway, including scarifying, blading, shaping, and compacting to remove irregularities and secure a uniform surface, and such other work as specified in Section 5-04.3(5)B, except prime coat treatment which shall be paid per Section 5-02.

The unit contract price for "Surface Preparation, Prelevel" shall include all costs for the work required to prelevel uneven or broken surfaces by placing asphalt, by spot planing or such other work as specified in Section 5-04.3(5)A herein.

The unit contract price for "Surface Preparation, Plane Bituminous Pavement" shall include all costs for the work required to prepare the surface as specified herein including milling and planing, reworking or recycling existing surfacings, removing and disposing of cuttings, extra planing for butt joints, and feathering meet areas in preparation for an asphalt overlay of either leveling course or wearing course.

The unit contract price for "Surface Preparation, Heater Scarify" shall include all costs for the work required to heat, scarify, crush, mix, redistribute, level and compact to a minimum depth of 3/4 inch of an existing bituminous surface as specified herein.

All costs for preliminary surface preparation work on treated surfaces as described in Section 5-04.3(5)A shall be considered incidental to the paving work.

The lump sum contract price for "Crack Sealing" shall include all costs for the work required to clean and fill the cracks and joints as specified in Section 5-04.3(5)C.

#### SECTION 5-05 - CEMENT CONCRETE PAVEMENT [WSDOT]

Except as otherwise noted in these Specifications, Section 5-05 shall not apply to City of Seattle contracts. Refer to Section 5-06 for specifications that apply to City of Seattle cement concrete pavement work.

## SECTION 5-06 CEMENT CONCRETE PAVEMENT - CITY OF SEATTLE (New Section)

## 5-06.1 DESCRIPTION (New Section)

The work shall consist of the construction of portland cement concrete pavements in streets and alleys, and alley curb wall and support wall at locations shown on the Drawings.

## 5-06.2 MATERIALS (New Section)

Materials shall meet the requirements of the following sections of these specifications:

Portland Cement . . . . .	9-01
Fine Aggregate . . . . .	9-03
Coarse Aggregate . . . . .	9-03
Water . . . . .	9-25
Reinforcing Bars . . . . .	9-07
Tie Bars . . . . .	9-07.3
Dowel Bars . . . . .	9-07.2
Joint Filler . . . . .	9-04.1
Curing Materials and Admixtures . . . . .	9-23
Joint Sealants . . . . .	9-04.2

The concrete mix for street pavement and alleys shall be Class 6 (1-1/2), unless otherwise specified in the Drawings or the Special Provisions.

## 5-06.2(1) CONCRETE MIXES INCORPORATING FLY ASH (New Section)

Concrete mixes incorporating fly ash may be utilized for all classes of concrete, unless otherwise noted in the Special Provisions. Mix proportions will be subject to approval by the Engineer and shall be in compliance with Section 9-23.9.

## 5-06.3 CONSTRUCTION DETAILS (New Section)

## 5-06.3(1) PROPORTIONING MATERIALS (New Section)

The class of concrete for non-structural uses refers to the nominal number of sacks of cement per cubic yard, although this designation does not constitute a guarantee of yield. The figure in parenthesis indicates maximum aggregate size. Example: Cl 5 (1-1/2) is a 5 sack mix with 1-1/2 inch maximum size coarse aggregate.

H.E.S. indicates high-early-strength cement and may be required by the Engineer for any of the classes of mix.

With approval of the Engineer, the Contractor may use high-early-strength cement in any of the mixes.

Air-entrained concrete shall be used, unless otherwise provided for in the Special Provisions.

The volume of air in freshly mixed concrete shall conform to that specified in the table which follows:

AIR CONTENT OF FRESHLY MIXED CONCRETE

Maximum Size of Coarse Aggregate (Inches)	Air Content Percent by Volume
1-1/2, 2 and 3	5 + 1
3/4 and 1	6 ± 1
3/8 and 1/2	7-1/2 ± 1

If the measured air content is found above or below the values contained in the table, the Contractor shall immediately make changes in mixing or materials as will be necessary to comply with the requirements for air content.

Fine and coarse aggregates shall be proportioned by weight except that if the project is small, volumetric proportioning may be used with permission of the Engineer. In proportioning, the unit of measure for cement will be by the 94 pound sack.

Weights of fine and coarse aggregate are based on a bulk specific gravity, saturated surface dry, of 2.67. When volume measurements are used, 1 cubic foot of sand shall be taken as equivalent to 100 pounds of sand, and 1 cubic foot of gravel shall be taken as equivalent to 105 pounds of gravel. Correction must be made for contained moisture in the aggregate and variation in specific gravity.

Concrete mixes shall be proportioned as specified in the table which follows. The weight of each size of aggregate is the estimated quantity to be used with one sack of cement. With approval of the Engineer, the proportion of aggregate may be altered to give better workability.

Class of Concrete	5 (3/4)	5 (1-1/2)	5.5 (1-1/2)	6 (1-1/2)	6.5 (1-1/2)	Reference Section
Sacks per Cubic Yard	5	5	5.5	6	6.5	—
Pounds dry Fine Aggregate No. 1	275	275	248	220	210	9-03.1(2)B
Pounds dry Fine Aggregate No. 2	291	291	248	220	210	9-03.1(2)B
Pounds No. 2 Coarse Aggregate	280	280	248	220	210	9-03.1(3)C
Pounds No. 4 Coarse Aggregate	166	166	150	132	120	9-03.1(3)C
Pounds No. 5 Coarse Aggregate	387	248	223	201	180	9-03.1(3)C

In adjusting concrete mixes, the following water-cement ratios shall not be exceeded:

Cement Sacks (Sacks Per Cubic Yard)	Maximum Water (Gal. per Sack)
4	8.2
5	6.5
5.5	6.0
6	5.5
6.5	5.1

## 5-06.3(2) CONSISTENCY (SLUMP REQUIREMENTS) (New Section)

Slump shall be measured in accordance with ASTM C143 "Method of Test for Slump of Portland Cement Concrete."

Water/cement ratio mix shall not produce a concrete slump of more than 2 inches. Where additional workability is required due to weather conditions or other variables, the Contractor may add, on approval of the Engineer, a water reducing agent to increase the slump up to 3-1/2 inches. The Engineer has the authority to reject any concrete mix with a slump greater than 3-1/2 inches.

## 5-06.3(3) EQUIPMENT (New Section)

Equipment shall conform to the requirements of Section 5-05.3(3) with the following exception: the requirements of Item (c) "Finishing Equipment" shall not apply.

## 5-06.3(4) HANDLING, MEASURING AND BATCHING MATERIALS (New Section)

Handling, measuring, and batching materials shall conform to the requirement of Section 5-05.3(4).

## 5-06.3(5) MIXING CONCRETE (New Section)

Mixing concrete shall conform to the requirements of Section 5-05.3(5).

## 5-06.3(5)A LIMITATIONS OF MIXING (New Section)

Limitations of mixing shall conform to the requirements of Section 5-05.3(5)A.

## 5-06.3(6) SUBGRADE (New Section)

Subgrade shall conform to the requirements of Section 2-06 with the following exception:



(a) The subgrade may be trimmed by equipment other than automatically controlled machine using reference lines.

After the forms have been securely set to grade and alignment, the subgrade between the forms shall be brought to true cross section by dragging a subgrade template as many times as may be necessary to secure a true subgrade. The finished subgrade shall be brought to an unyielding surface by rolling with compacting units meeting the requirements in Section 2-06.

Where thickened edges for pavements are required, such as shown on the Standard Plans, the subgrade shall be excavated and shaped to provide for the section shown.

Wherever possible, vehicles shall be kept off the finished subgrade. If vehicles must travel on the subgrade ahead of the paving, a power drag shall be carried immediately ahead of placing concrete. Irregularities in the subgrade caused by any equipment during the placement of concrete shall be smoothed out and compacted immediately ahead of placing the concrete.

No concrete shall be placed until the subgrade is approved by the Engineer. The subgrade as finally completed and approved shall be maintained by the Contractor at an optimum moisture content by wetting with water until the concrete is actually placed.

#### 5-06.3(7) FORMS (New Section)

Forms shall be as specified in Section 5-05.3(21) and in addition shall meet the following requirements.

Forms may be of wood or metal or any other material at the option of the Contractor, provided the forms as constructed result in a pavement of specified thickness, cross section, grade, and alignment as shown on the Drawings.

Forms shall be adequately supported to prevent deflection or movement and which will result in concrete pavement conforming with the Drawings and Specifications. The top of the forms shall not deviate more than 1/8 inch in 10 feet and the alignment of forms shall be within 1/4 inch in 10 feet. The forms may be removed the day after pouring if the concrete is sufficiently set to withstand removal without danger of chipping or spalling. When forms are removed before the expiration of the curing period, the edges of the concrete shall be protected with moist earth or sprayed with curing compound. All forms shall be cleaned, oiled and examined for defects before they are used again.

#### 5-06.3(8) PLACING AND SPREADING CONCRETE (New Section)

The concrete shall be placed upon the prepared subgrade or base between the forms to the required depth and cross section in a continuous operation between construction or expansion joints.

The concrete shall be thoroughly consolidated by mechanical vibration. Complete consolidation is required along all forms or adjoining pavements by such means as will prevent gravel pockets along the edges of the finished pavement. Any gravel pockets found after removing the forms shall be repaired by the Contractor.

When integral curb is being constructed with the pavement, fresh concrete for the integral curb shall be placed at such time as will enable the top section of the curb to be consolidated, finished, and bonded to the pavement slab while the concrete is plastic.

Where curb is required, and such curb is not being placed integrally with the pavement slab, dowels shall be placed in the pavement slab as detailed on the Standard Plans, or as specified in Section 8-04.

Prior to placing concrete around manholes, catch basins, valve chambers, etc., a temporary cover fitting below the rim of the ring casting shall be provided to prevent the concrete from flowing into them.

#### 5-06.3(8)A PLACING CONCRETE AT THROUGH JOINTS (New Section)

Concrete placement around through joints shall be such that the through joint assembly will not be disturbed and that it will remain in a straight line perpendicular to the subgrade, as shown on the Standard Plan. The concrete shall then be vibrated along the entire length of the joint to consolidate the concrete and leave no rock pockets anywhere at the joint. If any rock pockets are exposed, they shall be repaired.

#### 5-06.3(8)B PLACING CONCRETE WITH REINFORCING STEEL OR WIRE MESH (New Section)

Concrete shall be placed in two courses. The first course shall be struck off at the elevation established for reinforcing steel bar or wire mesh. Immediately prior to placing the reinforcement, the concrete shall be brought to a fairly even surface by means of a template conforming to the depth of the reinforcement. Reinforcement shall be placed on the bottom course before the concrete attains initial set. No more than 45 minutes shall elapse between mixing of the first course and placement of the second course.

Reinforcement shall be free of dirt, mill scale, oil, grease, or other foreign material that may impair bond. Steel, coated with rust, may be used if the oxidations are not deep or loose coated.

Successive mats of steel or wire mesh shall be securely lapped together and tied so that longitudinal bars will lap 40 diameters and wire mesh will lap 6 to 12 inches.

Reinforcement shall be laid as a continuous mat. Continuity shall be maintained between expansion joints. Steel shall terminate within four inches of the joint.

Concrete may be placed in one lift, provided a method acceptable to the Engineer is used to position and secure the reinforcement at the designated locations in the slab.

If the concrete is placed in two courses where reinforcement is used, all dirt, sand, or dust which collects on the base course shall be removed before the top course is placed.

#### 5-06.3(8)C SLIP FORM CONSTRUCTION (New Section)

At the option of the Contractor and with the approval of the Engineer, concrete pavement may be constructed by the use of slip-form paving equipment.

Slip-form paving equipment shall be provided with traveling side forms of sufficient dimensions, shape, and strength to support the concrete laterally for a sufficient period of time during placement to produce pavement of the required cross section; and the equipment shall spread, consolidate, screed, and float-finish the freshly placed concrete in such a manner as to provide a dense and homogeneous pavement.

The concrete shall be distributed uniformly into final position by the slip-form paver and the horizontal deviation in alignment of the edges shall not exceed the 1/2 inch from the alignment established by the Engineer.

Regardless of the method or machinery used to construct pavement, depressed curb for driveways and ramps shall be provided at those locations indicated on the Drawings or as required by the Engineer. When a slip-form paving machine is used for pavement construction, the Contractor shall block out the pavement area beneath areas where depressed curb is to be constructed. Such blocked out pavement areas, together with the depressed curb sections, shall then be constructed concurrently with the cement concrete item needing the depressed curb.

When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement, shall be equipped with protective pads on crawler tracks or rubber-tired wheels and shall be offset to run a sufficient distance from the edge of the pavement to avoid breaking or cracking the pavement edge.

After the concrete has been given a preliminary finish by the finishing devices in the slip-form paving equipment, the surface of the fresh concrete shall be checked with a straightedge to comply with the tolerances and finish specified in Section 5-06.3(12)C.

#### 5-06.3(9) COMPACTING CONCRETE (New Section)

All cement concrete pavement shall be vibrated. Vibration shall be by:

- (a) internal vibration, or
- (b) machine compaction.



**5-06.3(9)A INTERNAL VIBRATION (New Section)**

Internal vibration shall be performed in accordance with Section 6-02.3(9).

**5-06.3(9)B MACHINE COMPACTING (New Section)**

The machine used for compacting shall be self-propelled and designed to run on the side forms. Movable parts shall be capable of adjustment and they shall be adjusted so as to produce accurately the roadway sections shown on the Drawings. The machine shall be equipped with two reciprocating screeds. The tops of the forms shall be kept clean with a suitable device attached to the machine.

The travel of the machine on the forms shall be maintained true without lift, wobble or other variations which might prevent a precise strike off.

The machine shall be put in forward motion as soon as concrete is deposited on the subgrade. On the first pass, a roll of concrete shall be carried ahead of the screed. Screeds and tampers shall be operated so as not to disturb expansion joints and caps.

Machines shall be operated prior to placing longitudinal and transverse dummy joints.

Machines shall be operated at least twice and as many more times as may be necessary to compact concrete free from rock pockets, and to a section that can be finished properly.

Care must be exercised not to overwork the concrete and bring an excess of mortar to the surface.

**5-06.3(9)C COMBINED VIBRATION AND MACHINE COMPACTING (New Section)**

The combined vibration and compaction equipment shall be demonstrated to the satisfaction of the Engineer as being capable of consolidating the concrete across the full width of the pavement into a homogeneous mass, free of rock pockets, and without separation of mortar and aggregate.

The equipment shall consist of the machine described in Section 5-06.3(9)B, MACHINE COMPACTING, or an approved spreading machine to which is attached a vibrating unit composed of individual internal vibrators spaced not more than 29 inches apart. The vibrators shall be spaced equidistantly, and the distance from the side forms to the nearest vibrator shall not exceed 14 inches. The vibrators shall be carried behind and independent of the strike-off screed of the spreading machine, or ahead of and independent of the strike-off screed of the first compacting machine.

The vibrating unit shall not rest upon the side forms nor impart vibration to the strike-off screeds. The individual vibrators shall be attached to a frame in a manner which will permit adjustment of both the depth of penetration into the concrete and the angle of the vibrator with the horizontal.

The entire vibrating unit shall allow raising the vibrator tips completely clear of the concrete surface.

The vibrators shall be capable of vibrating at rates between 4,800 and 8,000 impulses per minute when inserted in the concrete. All vibrators shall be synchronized to vibrate at a frequency specified by the Engineer, within the limits established.

On the first trip over the freshly placed concrete the vibration equipment shall be submerged in the concrete to ensure adequate consolidation. Unless otherwise directed by the Engineer, the vibration equipment shall be operated on the first pass only. The vibration equipment shall not be operated when the machine is not in motion except when vibrating near an expansion joint.

After the first pass with vibration, one or more trips without vibration shall be made as described in Section 5-06.3(9)B MACHINE COMPACTING.

**5-06.3(9)D VIBRATING SCREED CONCRETE PAVEMENT CONSTRUCTION (New Section)**

The type of vibrating screed which the Contractor proposes to use, whether roller or beam, shall be subject to approval by the Engineer. Upon request by the Engineer a test section of pavement shall be placed for the purpose of demonstrating the capabilities of the screed to satisfactorily compact and strike off the concrete to the established grade and section.

Concrete shall be uniformly distributed between the forms and it shall then be compacted and screeded to the level of the top of the forms by means of the vibrating screed. Supplemental compaction by

mechanical vibration of the concrete adjacent to the forms will be required if the concrete cannot otherwise be adequately compacted.

The vibrating screed shall be operated over the freshly placed concrete in successive passes only a sufficient number of times to obtain maximum compaction. Over-vibration of the concrete, resulting in an excess of mortar at the surface of the pavement, will not be permitted.

After the final passages of the vibrating screed, the surface of the concrete shall be at the established pavement grade and cross section and shall be sufficiently smooth as to require only a very moderate amount of hand finishing for smoothness to meet approval of the Engineer.

**5-06.3(10) WATER (New Section)**

Water for pavement construction will be furnished as provided in Section 2-07.

**5-06.3(11) JOINTS (New Section)**

Transverse and longitudinal joints for street pavement may be contraction joints, construction or through joints as shown on the Drawings and as called for in these specifications. When the pavement abuts an existing pavement, the locations of the joints in the new pavement shall coincide with the joints in the existing pavement unless otherwise shown on the Drawings or specified in the Special Provisions.

**5-06.3(11)A FORMED CONTRACTION JOINTS (New Section)**

Formed contraction joints shall be constructed by imbedding a 1/4 inch thick preformed joint material. The depth of the formed joints shall be no less than 1/3 of the pavement thickness. The filler shall be cut to the exact sections of the joint. The length of the preformed joint filler shall extend to within 1/4 inch of both edges of any panel.

Transverse contraction joints (dummy joints) shall be placed after compaction and finishing of concrete have been completed and before initial set. A groove shall be cut into the surface at the location of the joint, using a tool provided with stops (tee iron) to prevent cutting the groove deeper than the planned depth of the joint filler. The joint filler shall then be forced into the groove until the top is flush with the pavement surface, with a deviation of not more than 1/8 inch below the surface. The joint filler shall be perpendicular to the surface and always in a straight line.

After the joint filler has been imbedded in the concrete, the surface of the pavement shall be finished against the filler strip with hand floats to restore the surface finish. While performing this operation, the filler strip must be maintained in a perpendicular position, true to alignment. After finishing the entire area the joint shall be true to grade and smoothness without any irregularities.

**5-06.3(11)B SAWED CONTRACTION JOINTS (New Section)**

Sawed contraction joints shall be constructed by sawing a vertical groove in the hardened concrete on an approved schedule after placing and before development of random cracks in the concrete slab. Transverse contraction joints shall be sawed before the longitudinal joints are sawed. Transverse joints shall be sawed at a maximum of 60 foot intervals or such other spacing as directed by the Engineer, as soon as the cut can be made without undue raveling of concrete. Intermediate joints shall be sawed thereafter.

Sawed longitudinal joints in general are not critical as to a specific time schedule after hardening of the concrete and may be delayed under favorable conditions before an incident of longitudinal random cracking begins. The Engineer shall direct the time schedule for sawing contraction joints.

Any scheduling for the sawing of joints that results in premature or uncontrolled cracking shall be revised immediately, under direction of the Engineer, by adjusting the time interval between placing of concrete and the sawing of joints. After the schedule has been approved, the sawing shall proceed as a continuous operation day and night until all joints have been completed.

Two or more sawing units may be required to accomplish the sawing in order to minimize random cracking. Standby equipment shall be on the job to ensure continuous sawing as specified regardless of any breakdown of equipment.

Where curing membrane is used, the area disturbed by sawing of joints shall be resprayed immediately upon completion of the sawing operation and care shall be exercised to prevent the curing compound from

getting into the groove. Joint sealing compound shall not adhere to concrete if curing compound is present.

The depth of sawed longitudinal or transverse contraction joints shall be a minimum of 1/3 of the pavement thickness.

The concrete saw shall be powered adequately to perform the required cutting. It shall cut a uniform groove to the required depth and not less than 1/8 inch nor more than 1/4 inch in width. The contractor will be expected to so arrange his schedule of sawing joints, including initial sawing, at the required intervals so that every possible effort is made to control cracking by the use of judiciously spaced and timed sawed joints. In the event random cracks occur, they shall be repaired to the satisfaction of the Engineer. The Contractor shall provide at least one standby saw in good working order to insure continuous sawing as specified regardless of any breakdown of equipment. An ample supply of sawblades shall be maintained at the site of work at all times during sawing operations. The contractor shall provide artificial lighting facilities for night sawing. All equipment required for sawing shall be on the job both before and continuously during concrete placement or formed, transverse contraction joints must be constructed every 60 feet. Sawing equipment shall be available immediately and continuously upon call by the Engineer on a 24 hour basis, including Saturdays, Sundays and other legal holidays.

After the curing period, sawed joints shall be cleaned and sealed with joint sealants meeting the requirements of Section 9-04.2(1). Excess sealing materials shall be cleaned off the surface of the pavement before opening to traffic. Sealing shall be per Section 5-05.3(8)B.

#### 5-06.3(11)C THROUGH JOINTS (New Section)

Through (expansion) joints are placed only where shown on the Drawings or where directed by the Engineer. The joint alignment must be at right angles to the pavement center line unless otherwise specified.

Longitudinal through joints shall be placed where shown on the Drawings or where required for concrete pavement between or along retaining walls, curbs or other structures.

Through joints shall be constructed with premolded material, 3/4 inch in thickness and conforming to Section 9-04.1(2). They shall extend from 1 inch below the subgrade to 1 inch below the top of the pavement. Transverse through joints shall extend the full width of pavement poured.

The joint material shall be held accurately in place during the placing and finishing of the concrete by a bulkhead, a holder, a metal cap or any other approved method. The joint must be perpendicular to the paved surface and the holder must be in place long enough to prevent sagging of the material, especially on streets having steep grades.

In multiple lane construction, the joints shall be matched so as to form a continuous alignment over all lanes.

Through joints shall extend continuously through all curbs, special care being exercised to preserve alignment perpendicular to the pavement in the curb section.

A wood filler strip or metal cap shall be placed on the top of the premolded joint filler to form the groove 1 inch deep, and it shall remain in place until after the finishing and the concrete is sufficiently set to resist sloughing into the groove. The joint filler must be stapled together at the ends to preserve continuity.

Immediately after removal of side forms, the edges of the pavement shall be carefully inspected and wherever the joint filler is not fully exposed, the concrete shall be chipped down until the edge of the filler is fully exposed for the entire depth.

#### 5-06.3(11)D SEALING THROUGH JOINTS (New Section)

After the pavement is cured, and before any traffic, the space left by the removal of the wood filler strip or the metal cap above the top of the expansion joint filler strip shall be thoroughly cleaned of all loose material. The groove 3/4 inch wide shall be completely free of any projecting concrete from the sides and the groove shall be continuous across the slab to each edge. It shall then be filled level with the pavement surface with joint sealant meeting the requirements of Sections 9-04.2(2).

The joint sealant material shall be heated and placed in complete accord with the manufacturer's instructions. Burned material will be rejected. The through joint groove shall be dry at the time of

pouring the sealing compound. No additional payment will be made for the sealing filler or its application and the cost thereof shall be included in the unit contract price per square yard for "Cement Concrete Pavement" of the required class and thickness.

#### 5-06.3(11)E CONSTRUCTION JOINTS (New Section)

Longitudinal construction joints shall be as shown on the Standard Plans. The Contractor shall install a keyway and thickened edge for longitudinal construction joints. Thickened edge shall not be required for pavement 12 inches thick or greater.

Transverse construction joints formed by placing a header board transversely across the subgrade shall be made at the end of each day's paving or when placing of standard mixed concrete is discontinued for more than 60 minutes or when placing of high early strength concrete is discontinued for more than 30 minutes. The header board shall be located to conform to the spacing for the transverse contraction joints (or an expansion joint) and shall be left in place until the paving is resumed. If the location of the header board is to be a contraction joint, then the header shall have fasteners to the concrete side a wedge-shaped strip of wood to form a key in the concrete. Thickened edge must be constructed at the construction joint header to provide ample depth of concrete above and below the keyway.

Where preformed contraction joints are used, the joint made by the construction joint header shall have a 2 inch strip of joint material imbedded against the hardened concrete when paving is resumed. Where sawed contraction joints are specified, the construction joint made by the header may be sawed and sealed, or may have a 2 inch strip inserted as specified above for preformed construction joints.

#### 5-06.3(11)F TRANSVERSE JOINT LOCATION (New Section)

Standard spacing of transversely formed contraction joints along straight sections of streets between through expansion joints or between intersections or other irregular areas, shall be at intervals of 15 feet across the full width of the pavement and at right angles to the center line of roadway. Where the spacing between through expansion joints are not in even multiples of 15 feet for transverse joints, the last several spaces approaching the expansion joint or header shall be varied by shortening the spaces, as directed by the Engineer. On horizontal curves the spacing of 15 feet shall be along the outer edge of the pavement and at right angles to the center line.

When paving adjacent to existing pavement, joints shall be placed to match joint locations in the existing pavement.

For intersections and other irregular areas, the arrangement of contraction joints shall be placed in accordance with standard intersection patterns, or as directed by the Engineer. The area of any one irregular pattern formed by contraction joints in intersections shall not exceed 225 square feet and the greatest dimensions thereof shall not exceed 16 feet.

When paving a second lane adjacent to the previously paved lane, the contraction joints shall be matched with the former, except on curves where the least dimension between transverse joints of the resultant panel would be less than 12-1/2 feet.

Where uncontrolled cracks are existing in the first lane, they shall be matched as nearly as possible in the second lane. Should the uncontrolled cracks in the existing paved lane be too frequent or in random locations and impossible to match with a uniform spacing in the second lane, then in that event the two lanes shall be completely separated by 3/8-inch joint material extending from the surface to one inch below the bottom of the concrete being placed. Reinforcing steel, or other approved joint material, may be required by the Engineer in lieu of the 3/16 inch joint material to control reflection cracks in the new pavement.

Where integral curb or doweled curb is placed along with the concrete pavement, premolded joint filler material shall be placed transversely across the full section of the curb in true alignment with the pavement joint, perpendicular to the pavement grade.

#### 5-06.3(11)G LONGITUDINAL JOINT LOCATION (New Section)

Standard locations for longitudinal joints, whether contraction or construction, shall be as listed below unless otherwise specified in the Drawings or Project Manual.

Width Curb to Curb	Joint Locations
25 Feet . . . . .	Center line
32 Feet . . . . .	Center line and 10 feet each side of center
36 Feet . . . . .	Center line and 10 feet each side of center
40 Feet . . . . .	Center line and 12 feet each side of center
44 Feet . . . . .	Center line and 11 feet each side of center
or match existing joint	

In the event the roadway is divided into two lanes, the construction joints shall be located on the center line of the roadway unless otherwise approved by the Engineer. In separate lane construction, a joint filler 3/16 inch by 2 inches shall be placed between the two lanes when the second lane is constructed.

#### 5-06.3(12) FINISHING CONCRETE (New Section)

The pavement surface shall be finished by hand and machine methods as necessary.

On all vertical curves at irregular intersections, modified tools shall be provided as necessary to secure a smooth, uniform contour and surface.

#### 5-06.3(12)A HAND FINISHING (New Section)

After the concrete has been struck off and consolidated, it shall be smoothed by longitudinal floating. Movement ahead shall be in successive advances of not more than 1/2 the length of the float. Floating shall continue until all irregularities are removed. Longitudinal floating shall follow compaction of the concrete by not less than 30 feet. Free water on the pavement shall be removed with the float or other suitable tool. After floating, the surface shall be scraped with a grout rod at least 10 feet in length with a long handle for operating at the edge of the pavement. The grout rod shall be operated to correct irregularities in the pavement surface and remove water and laitance. Contraction joints shall be placed after all floating has been completed in accordance with provisions of Section 5-06.3(11)A Formed Contraction Joints.

#### 5-06.3(12)B MACHINE FINISHING (New Section)

The finishing machine shall be of a type approved by the Engineer. The machine shall be adjustable to both crown and plane of the finished pavement surface. The screed shall oscillate longitudinally during its travel transversely across the pavement. It shall be operated in the forward direction so that the screed will pass over the same section of pavement at least 2 times during its transverse travel.

The finishing machine shall be moved over the pavement as many times as is necessary to give the pavement a smooth even textured surface, conforming to the exact crown and cross section specified on the Drawings.

The floating shall not be considered complete until all free water is removed from the surface.

The finishing operations shall be performed at a time and over such lengths of the pavement surface as existing conditions necessitate. All finishing operations are subject to strict control by the Engineer, and shall be performed to his satisfaction.

#### 5-06.3(12)C SURFACE SMOOTHNESS (New Section)

The surface smoothness shall be checked with a straightedge 10 feet long, mounted to a long handle to permit operation from outside the pavement. The straightedge shall be placed on the surface of the pavement parallel to the centerline and at intervals of no more than 5 feet across the full width of the pavement. At the conclusion of the finishing operation, the surface of the pavement shall not vary from a true surface when tested with a 10 foot testing straightedge, more than 1/8 inch in 10 feet on arterials, 1/4 inch in 10 feet on residential streets, 3/8 inch in 10 feet in alleys, and 1/2 inch in 10 feet in concrete bases.

The transverse slope of the finished pavement shall be uniform to a degree such that no variation greater than 1/4 inch is present when tested with a 10 foot straight edge laid in a direction perpendicular to the center line.

In no case shall the grade in the gutter be such that it will allow ponding of water. If the surface smoothness of the pavement after curing is found to exceed the tolerance permitted, the high spots shall be ground until they meet tolerance. If the surface tolerance cannot be met satisfactorily by grinding, the pavement shall be removed and be replaced in conformity with the Specifications at the expense of the Contractor.

#### 5-06.3(12)D EDGING (New Section)

Before the final finishing is completed and before the concrete has taken the final set, the pavement shall be edged as indicated below:

Location	Radius
Edge of pavement	1/2 inch
Contraction joints	1/4 inch
Through or Isolation Joints	1/2 inch

Particular attention shall be given to edge at the appropriate time. The concrete shall have attained a partial set and all free water shall have disappeared so that the edged joints will be clearly defined with no tearing or slump of the edges.

#### 5-06.3(12)E FINAL FINISH (New Section)

The pavement surface, after edging, shall be given a uniform, gritty texture true to grade and cross section. The final finish shall be accomplished by one of the methods described hereinafter, or as otherwise directed by the Engineer to achieve the specified surface texture.

**Burlap Finish:** A burlap drag having at least 3 feet of drag in contact with the pavement and the width of the pavement section shall be dragged forward over the pavement surface. The burlap drag shall be wet and clean when in use. The burlap shall not be left on the pavement surface between dragging operations.

**Brush Finish:** After edging, the pavement shall be brushed transversely with a fiber or wire brush of a type approved by the Engineer.

Before using either the drag or the brush, the concrete shall have set sufficiently so that the surface is not grooved or gouged in the finishing operation.

#### 5-06.3(13) CURING (New Section)

Immediately after the finishing operations have been completed and as soon as marring of the concrete will not occur, the entire surface of the newly placed concrete shall be covered and cured in accordance with one of the methods in the following subsections as the Contractor may elect.

Pavement edges which are exposed by the removal of the forms shall be protected by the immediate application of a curing medium of moist earth.

All curing materials shall be free of all substances which are considered to be harmful to portland cement. The curing medium shall be capable of preventing checking, cracking, and dry spots regardless of conditions existing at the time of placement. Concrete placement will not be permitted unless curing materials are on the job site and ready for immediate application. Failure to comply with all provisions of the curing procedures hereinafter specified will be sufficient reason to suspend all concrete operations.

When the curb section is to be placed separately, the surface of the pavement directly underneath the curb section shall be covered with a protective cover to protect that area from the curing agent when the pavement is sprayed.

#### 5-06.3(13)A CURING PERIOD (New Section)

Regardless of the curing method used, as described herein, the Contractor shall maintain such curing protection and shall protect the pavement from excess loss of moisture, rapid temperature change, rain, water, mechanical injury or any other cause for at least the minimum number of days listed below, exclusive of the day the concrete is placed, or for a greater length of time, as designated by the Engineer.



Portland cement 5 days  
High-early-strength cement 3 days

#### 5-06.3(13)B WHITE PIGMENTED CURING COMPOUND (New Section)

Application of white pigmented curing compound shall be per Section 5-05.3(13)B.

White pigmented curing compound shall conform to the requirements of Section 9-23.8.

#### 5-06.3(13)C WHITE POLYETHYLENE SHEETING (New Section)

Application of white polyethylene sheeting shall conform to the requirements of Section 5-05.3(13)C.

White polyethylene sheeting shall conform to the requirements of Section 9-23.1.

#### 5-06.3(13)D SPRINKLING SYSTEM (New Section)

The sprinkling system shall keep the entire surface of the concrete pavement continuously wet, 24 hours a day. Care shall be taken to avoid damage to the surface of the pavement during placement of the equipment. The water flowing off the pavement shall be wasted in a manner satisfactory to the Engineer.

#### 5-06.3(13)E WATERPROOF PAPER (New Section)

The set concrete shall first be wetted with a fine spray of water and then completely covered with a waterproof paper, lapping all joints at least 12 inches. The paper shall be weighted sufficiently to prevent displacement. All tears and holes shall be repaired promptly. The waterproof paper shall conform to the requirements contained in Section 9-23.4.

#### 5-06.3(13)F TRANSPARENT CURING COMPOUND (New Section)

The use of transparent liquid curing compounds shall be restricted to areas not exceeding 1,000 square yards.

The compound shall meet requirements contained in Section 9-23.3. Sufficient pigment shall be present so that the sprayed compound is easily discernible. The application and the curing shall be the same as for "White Liquid Membrane Curing Compound" in Section 5-05.3(13)B.

#### 5-06.3(13)G EMULSIFIED ASPHALT (New Section)

Concrete pavement when laid as a base for an asphalt wearing course shall be cured by spraying with an asphalt emulsion type SS-1 cut back with one or two parts of water for one part of asphalt emulsion. The amount of asphalt emulsion to be applied shall be as directed by the Engineer but not to exceed 0.10 gallon of retained asphalt per square yard.

#### 5-06.3(13)H CURING IN HOT WEATHER (New Section)

In periods of low humidity, drying winds, or high temperatures, a fog spray shall be applied to concrete as soon after placement as conditions warrant in order to prevent the formation of shrinkage cracks. The spray shall be continued until conditions permit the application of a liquid curing membrane or other curing media. The Engineer shall make the decision when the use of a fog spray is necessary.

#### 5-06.3(14) COLD WEATHER WORK (New Section)

Cold weather work shall conform to the requirements of Section 6-02.3(6)A.

To provide for cold weather curing and when ordered in writing by the Engineer, the Contractor shall provide a sufficient supply of straw, hay, grass, earth, blankets, or other suitable blanketing materials on the job.

If, during a period of concrete placement and curing, the temperature is expected to drop to 30 degrees Fahrenheit within 24 hours in the opinion of the Engineer, all concrete not already cured for at least 6 days shall be covered with an insulating material in a manner and to a depth which will prevent freezing of the concrete. The insulating material shall be such that it will not stain or injure the concrete. The curing period shall be extended as much time as the Engineer may determine the conditions justify.

Concrete damaged, by frost action or freezing shall be replaced at the Contractor's expense.

Also refer to the requirements of Section 5-06.3(5)A Limitation of Mixing.

#### 5-06.3(15) CONCRETE PAVEMENT CONSTRUCTION (New Section)

Unless designated otherwise in the Special Provisions, paving widths from 25 feet to 44 feet shall be paved in 2 operations, with compensation allowed for thickened edge on each side of the included longitudinal construction joint. Should the Contractor be allowed to pave in more than 2 operations for the above widths, thickened edge required due to installation of more than one construction joint shall be constructed at no additional expense to the Owner. When "hand" screeding methods are allowed, paving widths shall not exceed 12 feet.

Keyways shall be provided at all longitudinal and transverse construction joints.

Unless designated otherwise in the Special Provisions full width paving will be allowed only with the written permission of the Engineer.

Concrete shall not be placed in an adjacent lane sooner than 72 hours after finishing of the first lane. Whenever possible, the mixer shall be operated on the subgrade or on the shoulder adjacent to the lane being paved.

If the Engineer shall deem conditions to be such as to justify the operation of a mixer and trucks upon newly paved concrete because of lack of space elsewhere, he may give permission to do so, but only under the following restrictions:

- The concrete in the new lane shall have attained a compressive strength of 3000 pounds per square inch as determined by the Engineer.
- The surface of the new pavement shall be protected from scarring and abrasion by operating the mixer on mats, skids or other protective devices satisfactory to the Engineer. Any accumulation of concrete, sand, and gravel, or other debris deposited on the new pavement shall be completely removed as directed by the Engineer.
- Suitable cushioning material shall be placed on the bottom of the mixer skip so that the pavement is protected against severe local shocks when the skip is lowered to the pavement to receive a new charge of materials. Lowering the skip in a careless manner will not be permitted.
- The Contractor shall replace at his own expense any panels on the new pavement that are cracked or broken as a result of operating the mixer thereon.

A protective ramp shall be constructed at the pavement edge where vehicles may be driven on and off the pavement. The forms shall be left on the outside edge of the first lane at all turnouts until the pavement is opened to traffic.

When tie bars are specified, they shall be placed before the concrete is struck off during the last pass with the strike-off screed whether hand or machine operated. If the tie bars impede the flow of traffic, the tie bars shall be protected from traffic by bending down and back against the side form. Prior to placing the adjacent lane, the tie bars shall be straightened.

A metal plate 3 inches wide by 1/8 inch thick and at least 5 feet in length shall be placed on the completed pavement in the adjacent lane near the common joint with the lane to be paved, and the concrete shall be struck off from the plate, whether by machine or hand placement.

All roadways, shoulders, and subgrade in use by the Contractor shall be kept adequately dampened to prevent the accumulation of dust upon the freshly placed concrete.

## 5-06.3(16) BARRICADES AND SAFEGUARDS (New Section)

See Section 1-07.23 and the Traffic Control Manual for In-Street work.

## 5-06.3(17) OPENING PAVEMENTS TO TRAFFIC (New Section)

The Contractor shall not open newly constructed cement concrete pavement to traffic until the concrete has attained a compressive strength of 3000 pounds per square inch, as determined by the Engineer.

Streets with curbs shall not be opened until the curb has cured for at least 72 hours and has attained 2500 psi strength. If the curb has not attained the above-mentioned 2500 pounds per square inch strength, the Contractor shall place form lumber on the pavement 2 feet away from the curb, or place standard barricades and maintain them to the satisfaction of the Engineer. Such curb protection shall remain in place as long as may be necessary for protection of the curb.

Streets shall not be opened to traffic until the smoothness criteria specified in Section 5-06.3(12)(C) have been met.

## 5-06.3(18) CLEANUP (New Section)

Before final acceptance, cleanup of pavement area shall be required according to Section 1-04.11.

## 5-06.3(19) CEMENT CONCRETE ALLEY, ALLEY RETURN, AND DRIVEWAY (New Section)

Cement concrete pavement for alleys shall conform to all requirements of Section 5-06 and Standard Plan No. 403.

For driveways and alley returns, refer to Section 8-19.

## 5-06.3(19)A CURB (New Section)

Curb for alley and street pavement shall be constructed in accordance with Section 8-04.

## 5-06.3(20) CONCRETE BASE PAVEMENT (New Section)

Cement concrete pavement, which is intended as a base for an asphalt wearing course, shall conform to all requirements of Section 5-06 with the following exceptions:

- (a) The surface tolerance shall be 3/8 inch in 10 feet.
- (b) The surface of the concrete base, if hand compacted, may be struck off with only one strike-off rod.
- (c) Contraction joints shall be constructed as follows:
  - (1) A weakened plane shall be made in the plastic concrete every 15 feet or to match existing cracks as designated by the Engineer.
  - (2) The plane shall be weakened with a joint cutter to a minimum depth of 2 inches.
  - (3) Bulging caused by the joint cutter shall be corrected by floating lightly.
  - (4) Joint material shall be placed completely through the curb at the point where the weakened plane intersects the curb.
- (d) Liquid curing compounds which leave a waxy film on the concrete shall not be used for curing concrete base pavement. If cured with a liquid curing compound, it shall meet the requirements of Section 9-23.2 for the clear type and the rate of coverage shall be at least one gallon per 125 square feet; or emulsified asphalt SS-1 or CRS-1 meeting the requirements of Section 9-02.1 applied at a rate between 0.15 gallon and 0.25 gallon per square yard of surface.

## 5-06.3(21) EXTRA CONCRETE FOR ALLEY APPROACH RAMP (New Section)

When constructing and finishing cement concrete alley pavement, the Engineer may in some cases require the Contractor to place additional concrete over the surface of the alley pavement to serve as an integral ramp or vehicular access to abutting private property. Such extra concrete shall be placed and finished to the additional thickness directed by the Engineer. Additional thickness for such ramps shall not exceed 6 inches above the original planned concrete surface at any point.

Placing and finishing such cement concrete ramps above plan grade of alley pavement will be paid in accordance with Section 1-09.4.

## 5-06.3(22) EDGE AND SUPPORT WALL (New Section)

Where shown on the Drawings, the Contractor shall construct the edge wall as detailed on Standard Plan No. 403 or the support wall as detailed on Standard Plan No. 800, except that the alley width indicated on the Drawings shall be taken to the face of the curb.

After removal of forms, all lips and edgings where form boards have met shall be removed with a sharp tool or stone. Bolts or concrete ties shall be removed and the holes filled with 1:2 mortar and floated to an even uniform surface. If in the opinion of the Engineer a satisfactory surface has been obtained, no further finishing shall be done. If, however, the surface is not satisfactory, these surfaces shall be thoroughly washed with water and a 1:1 mortar applied with brush and well worked in the small air holes and other crevices. After initial set, the surface shall be rubbed with a damp sack.

The curb shall extend a net 6 inches above the alley pavement.

## 5-06.3(23) CURB WALL (New Section)

Curb wall shall be constructed as indicated on Standard Plan No. 801. Deformed steel bars shall be in accordance to ASTM Designation A615 Grade 60.

## 5-06.3(24) CONCRETE UNDERPINNING (New Section)

Where designated by the Engineer, existing concrete foundations left above grade shall be supported with concrete underpinning.

## 5-06.3(25) STEEL REINFORCING BARS (New Section)

Reinforcing steel bars shall be used to reinforce pavement around castings when the casting is 18 inches or less from any joint or pavement edge. Reinforcing steel shall be 1/2 inch round deformed billet steel bars in accordance with ASTM Designation A615 Grade 60, and shall be a minimum length of 1-1/2 times the diameter of the casting. A minimum of 4 bars shall be installed around each casting, oriented parallel and perpendicular to the joint(s).

## 5-06.3(26) BRIDGE APPROACH SLABS (New Section)

Bridge approach slabs shall be constructed per Section 5-05.3(19) and the Drawings.

The top face longitudinal and transverse reinforcing steel shall be epoxy coated including the reinforcing bars extending from the slab into the roadway side of the barrier curb. Epoxy coating of bottom face reinforcing steel will not be required. The Contractor shall place longitudinal construction joints to suit his method of operation.

## 5-06.4 MEASUREMENT (New Section)

Measurement for pavement or pavement base will be by the square yard of concrete in place, including the area underneath curbs. No deduction will be made for castings in pavement.

Measurement for thickened edge will be by the linear foot as measured along the face of the thickened edge.

Measurement for concrete underpinning will be per cubic yard placed as computed by the Engineer.



Reinforcing steel shown on the Standard Plans and required for ties of the pavement to driveway, curb, and curb and gutter and around castings will not be measured.

Measurement for edge wall, support wall and curb wall will be per cubic yard of concrete based on neat lines indicated on the Standard Plans.

Steel required for pavement reinforcement as specified in Section 5-06.3(8)B will be measured by the pound of steel reinforcement in place.

Measurement and payment for curb constructed with alley pavement will be in accordance with Section 8-04.

Measurement for roadway ballast will be by the ton in accordance with Section 1-09.1.

#### 5-06.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 5-06 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Pavement, Cement Concrete (Class) (Thickness)," per square yard.
- (2) "Pavement, Cement Concrete, (Class), HES, (Thickness)," per square yard.
- (3) "Pavement Base, Cement Concrete (Class), (Thickness)," per square yard.
- (4) "Pavement, Thickened Edge (18 inch x 3 inch)," per linear foot.
- (5) "Underpinning, Cement Concrete CL 5 (3/4)," per cubic yard.
- (6) "Wall, Cement Concrete, Edge, Type 403B," per cubic yard.
- (7) "Wall, Cement Concrete, Support, Type 800," per cubic yard.
- (8) "Wall, Cement Concrete, Curb, Type 801," per cubic yard.
- (9) "Steel Reinforcing Bars, Grade 60," per pound.

The unit contract price for "Pavement, Cement Concrete (Class) (Thickness)" and "Pavement Base, Cement Concrete (Class) (Thickness)," shall include all costs for the specified class and thickness of pavement, including construction joints, contraction joints, through joints, saw cutting, keyways and sealing joints.

The unit contract price for "Pavement, Thickened Edge (18 inch x 3 inch)," shall include all costs for the work required to shape and compact the subgrade for the thickened edge including the concrete.

The unit contract price for "Underpinning, Cement Concrete, CL 5 (3/4)" shall include all costs for the work required including furnishing and placing the underpinning and reinforcing steel and excavating as required.

The unit contract price for "Wall, Cement Concrete Edge, Type 403B" shall include all costs for the work required to construct the wall as shown on the Drawings and as specified. Excavation for the edge wall shall be considered incidental to the wall and no separate payment will be made.

The unit contract price for "Wall, Cement Concrete, Support, Type 800" shall include all costs for the work required to construct the wall as shown on the Drawings and as specified. Excavation and reinforcing steel (including steel extending into pavement slab) for the support wall shall be considered incidental to the wall and no separate payment will be made.

The unit contract price for "Wall, Cement Concrete, Curb, Type 801" (including reinforcing steel extending into pavement slab) shall include all costs for the work required to construct the wall as shown on the Drawings and as specified. Excavation and reinforcing steel for curb wall shall be considered incidental to the wall and no separate payment will be made.

The unit contract price for "Steel Reinforcing Bars," shall include all costs for the work required to furnish and install the reinforcing steel as specified in Section 5-06.3(8)B.

Steel required for pavement ties to driveway, curb, and curb and gutter, and for reinforcement around castings as specified in Section 5-06.3(21) will be considered incidental to the pavement and no separate payment will be made.

Payment for roadway ballast will be as "Mineral Aggregate (Type)" in accordance with Section 4-01.5.

The unit contract price for each specific concrete Bid Item shall include all costs for curing and admixtures.

## SECTION 5-07 - PAVEMENT PATCHING (New Section)

## 5-07.1 DESCRIPTION (New Section)

This work shall consist of the patching of various types of pavement cuts, the performance of which shall be in accordance with the requirements outlined hereinafter and as shown on the Standard Plans.

## 5-07.2 MATERIALS (New Section)

All materials shall conform to the requirements specified for material in other sections of these Standard Specifications, such as sections 9-02 and 5-06.

Asphalt concrete pavement patch shall be Class B meeting the requirements of Section 5-04. Temporary pavement patch shall be MC 250 meeting the requirements of Section 9-02.

Cement concrete pavement patch shall be Class 6.5 (1-1/2) HES meeting the requirements of Section 5-06.

Crushed rock surfacing shall meet the requirements of Mineral Aggregate Types 1 and 2 per Section 9-03.

## 5-07.3 CONSTRUCTION REQUIREMENTS (New Section)

## 5-07.3(1) GENERAL (New Section)

Pavement patching shall be scheduled to accommodate the demands of traffic, and shall be performed as rapidly as possible to provide maximum safety and convenience to public travel.

The placing and compaction of the trench backfill, and the preparation and compaction of the subgrade shall be in accordance with the requirements of the various applicable sections of these specifications.

Before the patch is constructed all pavement cuts shall be trued so that the marginal lines of the patch will form a rectangle with straight edges and vertical faces. The use of a concrete saw will not be required unless so indicated in the Special Provisions.

The class of concrete used in patches will depend upon the urgency of opening the street to traffic. The class of concrete shall be as specified in the Special Provisions and Bid Form. Curing compound as specified in Section 5-06.3(13) shall be placed on the concrete immediately after finishing.

Proper signs, barricades, lights and other warning devices, as may be required by the Engineer, shall be maintained all 24 hours of the day until the patch is completed and ready for traffic.

On all public works contracts, the Contractor shall perform all work required to backfill the excavations made under existing pavements and to restore pavement cuts with patching in accordance with these Specifications unless otherwise provided in the Special Provisions.

Compaction of the subgrade shall be completed prior to the required patching. Compaction shall be to 95% maximum density as determined by the methods specified in Section 2-03.3(14)D.

## 5-07.3(1)A TEMPORARY PAVEMENT PATCHING (New Section)

The Contractor shall furnish, place and maintain a 2 inch thick crushed rock surfacing and a 2 inch thick MC 250 patch over trench areas when and where directed by the Engineer. Such temporary asphalt patching will be required where roadway or walk is needed for vehicular or pedestrian traffic and permanent pavement cannot be placed immediately. The trench backfill shall be compacted as specified in Section 7-17.3(3)A and the MC 250 tamped and leveled to coincide with adjacent surfaces. In the event that the temporary surface subsides after the initial placement, additional MC 250 and crushed surfacing shall be applied to maintain the surface. Stockpile of the plant mix and crushed surfacing shall be provided on the site by the Contractor. Prior to final restoration of the pavement, the Contractor shall remove the temporary asphalt, clean the exposed face of the existing pavement and restore the pavement.

## 5-07.3(2) CEMENT CONCRETE PAVEMENT (New Section)

After the subgrade for the pavement has been constructed and compacted to line and grade, the cement concrete pavement patch shall be placed, compacted and struck off to the grade of the adjacent pavement in accordance with the pertinent provisions of Section 5-06. Through joints and dummy joints shall be placed and edged where directed. The surface shall be finished and brushed with a fiber brush. Approved curing compound shall be placed on the finished concrete immediately after finishing.

## 5-07.3(3) RIGID PAVEMENT RESURFACED WITH ASPHALT CONCRETE (New Section)

Streets which have rigid type pavements resurfaced with asphalt concrete shall be patched as shown on the Standard Plans, or as otherwise specified. The surface of the cement concrete portion of the patch shall be left low enough to accommodate the asphalt portion of the patch. Brush finishing will not be required. Joints shall be placed if directed by the Engineer. Curing shall be accomplished with STF-1 asphalt emulsion diluted with water as directed by the Engineer.

Asphalt concrete or bituminous plant mix shall not be placed until 3 days after the cement concrete has been placed unless otherwise permitted by the Engineer. The edges of the existing asphalt pavements and castings shall be painted with STF-1 cationic special tack emulsion immediately before placing the asphalt patching material. The asphalt concrete pavement shall then be placed, leveled, and compacted to conform to the adjacent paved surface. Immediately thereafter, all joints between the new and original asphalt pavement shall be painted with hot asphalt or asphalt emulsion and be covered with dry paving sand before the asphalt solidifies. Tacking and sealing of asphalt concrete patches shall be in accordance with the requirements of Section 5-04.

## 5-07.3(4) ASPHALT CONCRETE ON GRANULAR BASE (New Section)

After the subgrade has been prepared as shown on the Standard Plan, or as directed by the Engineer, asphalt concrete pavement Class B or Class F shall be placed to a thickness of the existing asphalt pavement depth, or to a minimum of 2 inches, whichever depth is the greater, and compacted in the manner specified in Section 5-07.3(3).

Restoration of asphalt concrete roadway pavement on granular base (non-rigid pavement) shall consist of Mineral Aggregate Type 1 and 2, to a compacted depth of 6 inches consisting of a 2-inch top course of Mineral Aggregate Type 1 placed on a 4-inch base course of Mineral Aggregate Type 2. "Pavement, Asphalt Concrete Cl B" shall be compacted to a thickness equal to the thickness of the adjacent pavement or 2 inches, whichever is greater.

Restoration of MC 800 paved roadway surfaces, or seal coats, on a granular base shall consist of "Mineral Aggregate, Type 2," to a compacted thickness of 4 inches and "Pavement, Asphalt Concrete Cl B" to a compacted thickness of 3 inches.

Restoration of asphalt driveways shall be the same as specified above for MC 800 pavements.

All shoulders on paved roads, disturbed during the course of construction, shall be restored by furnishing and placing Mineral Aggregate, Type 1 to a compacted thickness of 2 inches and width up to 4 feet or as required by the Engineer. Only crushed ledge rock shall be used in the shoulders.

## 5-07.3(5) UNTREATED ROADWAY SURFACES (New Section)

Existing crushed rock, gravel, and oil mat streets shall be restored with Mineral Aggregate Type 1, to a compacted depth of 4 inches within the neat line limits of the trench as detailed on Standard Plan 284. Final surfacing shall be constructed as specified in Section 5-04.3(5)B(1).

## 5-07.4 MEASUREMENT (New Section)

Measurement of concrete pavement patching shall be by the cubic yard for cement concrete patching, by the ton for asphalt concrete and for temporary MC 250 pavement patching. Quantities for surface restorations for sewers, drains and watermain shall be based upon computations made by the Engineer using the required pavement patch thickness and the pavement and sidewalk removal criteria specified in Section 2-02.3(3).

Quantities for pavement patching for electrical conduit will be based on actual measured dimensions with the provision that the width of restoration for payment purposes shall be no greater than 24 inches.

Measurement of temporary pavement patch will be made for the initial placement only. Additional MC 250 and crushed rock surfacing required to maintain the surface of the temporary patch level with adjacent roadway surfaces will not be measured.

Measurement for crushed surfacing will be by the ton in accordance with Section 1-09.1.

#### 5-07.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 5-07, will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Pavement Patch, Cement Concrete, Class 6.5 (1 1/2), H.E.S." per cubic yard.
- (2) "Pavement Patch, Asphalt Concrete, Class B" per ton.
- (3) "Pavement Patch, Temporary, MC 250" per ton.

The unit contract price for pavement patching of the type required shall be limited to the maximum pay width as shown on Standard Plan 404 or 404b or the City's Open and Restoration Policy, and shall include the costs for all work described in Section 5-07, and not otherwise provided for in this pay section, necessary to temporarily restore and maintain or permanently restore, as applicable, pavements or other traffic bearing surfaces which have been opened by trench excavation or similar work. All incidental work required to complete the patching of street surfaces as specified, including installing joints where required, shall be considered incidental to the patching, and the costs thereof shall be included in the items for which payment is provided. Payment for "Pavement Patch, Temporary, MC 250" will include reimbursement for removal of temporary patch before final patching.

The costs for additional MC 250 and crushed surfacing material required to maintain temporary pavement patches after the initial installation shall be borne by the Contractor.

Payment for backfill and compaction of the subgrade shall be included in the unit contract price for the particular work item which necessitated the pavement cut.

Payment for crushed rock surfacing shall be paid separately in accordance with Section 4-01.

#### SECTION 6-01 GENERAL REQUIREMENTS

##### 6-01.2 FOUNDATION DATA

Delete this section and replace with the following:

Foundation data, when shown in the Drawings or Project Manual, have been obtained from test borings, test pits or other sources and represent the best information in the possession of the Engineer as to the character of the underlying material at the locations actually tested.

##### 6-01.5 ERECTION METHODS

Delete this section and replace with the following:

The Contractor shall submit for approval a plan of the method he proposes to follow in the erection of all steel structures, all prestressed concrete girder structures, and if required in the Contract Documents, any other concrete structures. The plan shall be supplemented with any necessary drawing to clearly describe the method proposed. The plan shall show details of all falsework bents, bracing, guys, dead-men, lifting devices and attachments to the bridge members; sequence of erection, location of cranes and barges, crane capacities, location of lifting points on the bridge members and weights of the members. The plan and detail drawings shall be complete in detail for all anticipated phases and conditions during erection.

The plan and detail drawings shall be submitted for approval as prescribed in Section 1-05.3.

##### 6-01.15 NORMAL TEMPERATURES

Delete the title and section and replace with the following:

##### 6-01.15 NORMAL TEMPERATURE AND DIMENSIONS

Dimensions on bridge drawings are for a normal temperature of 64 degrees F. Dimensions on bridge drawings are horizontal or vertical unless otherwise specified.

## SECTION 6-02 CONCRETE STRUCTURES

## 6-02.2 MATERIALS

Supplement this section with the following items:

Bridge Drains . . . . .	9-06.19
Downspouts . . . . .	9-06.20

## 6-02.3(2) PROPORTIONING MATERIALS

Delete paragraph 4 and replace with the following:

\*If the aggregate used in the concrete develops not less than 95 percent of the strength of washed sand and gravel from Steilacoom, Washington when tested in accordance with Section 9-03.1, the following proportions of cement and aggregate may be used in Class AX concrete:

Pounds of dry cement per cubic yard	610
Pounds of dry fine aggregate per cubic yard	1465
Pounds of dry No. 5 coarse aggregate per cubic yard	1790
Maximum water per cubic yard (gallons per 100 wt. of cement - 5.33)	32.5

## 6-02.3(2)B WATER-REDUCING ADMIXTURE

Supplement paragraph 1 with the following:

Water reducing and retardant admixtures shall be used in the concrete mix when required by the Special Provisions or the Engineer.

## 6-02.3(2)C LOW SHRINK CONCRETE

Delete this section and replace with the following:

Low shrink concrete shall meet all the requirements for concrete Class AX as stated in Section 6-02.3 except that the quantity of water shall be reduced such that the water/cement ratio shall not exceed 0.38 by weight.

A water reducing admixture shall be used in this mix and shall be as outlined in Section 6-02.3(2)B.

## 6-02.3(2)D CONCRETE MIXES INCORPORATING FLY ASH (New Section)

Concrete mixes incorporating fly ash may be utilized for all classes of concrete, unless otherwise noted in the Special Provisions. Mix proportions will be subject to approval by the Engineer and shall be in compliance with Section 9-23.9.

## 6-02.3(2)E NON-SHRINK CEMENT SAND GROUT (New Section)

Non-shrink cement sand grout shall be proportioned as follows:

1 part high early strength (H.E.S.) cement.

2 parts clean fine-grained sand by weight and well-mixed with sufficient water to obtain a stiff consistency.

Unpolished aluminum powder shall be added to the dry cement in the proportion of one heaping teaspoonful per sack of cement no more than 30 minutes before the grout mixture reaches its final in-place position.

The required strength of the non-shrink concrete or grout shall be  $f'_c = 4,000$  psi and be verified by the cube strength test. The strength shall be confirmed by schmidt hammering of the pads.

Prior to placing the grout, the contact surface shall be thoroughly cleaned, roughened and wetted with water. The grout shall be covered with burlap sacks after the initial concrete set and wetted at regular intervals until the required strength is obtained.

## 6-02.3(4)A MACHINE MIXING

Delete paragraph 3 and replace with the following:

In general, all concrete shall be mixed for a period of not less than 1 minute after all materials, including water, are in the mixer, except Class D and DX, which shall be mixed  $1\frac{1}{2}$  minutes. Less mixing time may be allowed by the Engineer for special types of mixing equipment if tests indicate that equal or better results are obtainable.

Admixtures for increasing the workability or for accelerating the set shall be added to the mix only when specified or approved by the Engineer.

## 6-02.3(4)C READY MIXED CONCRETE

Supplement this section with the following:

The central ready mix plant shall meet the requirements of ASTM C 94. In general, the batching plant shall include bins, weighing hoppers and scales for the fine aggregates and each size of coarse aggregate. If cement is used in bulk, a bin, hopper and separate scale for cement shall also be included. The weighing hoppers shall be properly sealed and vented to preclude dusting during operation. The batching plant shall be equipped with a suitable non-resettable batch counter which will correctly indicate the number of batches proportioned during a day. Bins and hoppers shall have separate compartments of adequate size for the fine and each size of coarse aggregate. Scales shall meet the requirements of Section 1-09.2. Plants shall be equipped to proportion aggregates and bulk cement by means of automatic weighing devices of an approved type.

Delete paragraph 9 and replace with the following:

The mix shall be subject to inspection, surveillance, and testing by the Engineer at either the plant site or the job site, at the Engineer's discretion.

## 6-02.3(4)D RETEMPERING

Delete this section and replace with the following:

Concrete shall be mixed only in such quantities as are required for immediate use and shall be used while fresh before initial set has taken place. Any concrete having initial set before placing and finishing shall be wasted and not used for the work. Retempering of concrete (remixing with water or other materials) will not be allowed.

## 6-02.3(5) CONSISTENCY

Delete this section and replace with the following:

Slump shall be measured in accordance with ASTM C143 Method of Test for Slump of Portland Cement Concrete and shall not exceed 2 inches for vibrated concrete, or shall not exceed  $3\frac{1}{2}$  inches for non-vibrated concrete.

## 6-02.3(6) PLACING CONCRETE

The 17th paragraph is supplemented by the following:

The concrete traffic and pedestrian barrier may be constructed by the slip-forming method at the Contractor's option.

If an unsatisfactory barrier is constructed, the Contractor shall stop work, remove the unsatisfactory barrier, and take corrective action before proceeding.

The maximum allowable deviation from a 10-foot straight edge held longitudinally on the front face, top surface, and back face shall be  $\frac{1}{4}$ -inch.



## 6-02.3(6)A WEATHER AND TEMPERATURE LIMITATIONS - PROTECTION OF CONCRETE

Delete this section and replace with the following:

The temperature of the concrete mixture during placement shall be between 60 degrees F. and 90 degrees F.

Concrete shall not be placed on frozen ground, against frosted reinforcing steel, or frosted forms.

Concrete shall not be mixed nor placed while the atmospheric temperature is below 35 degrees F. unless adequate means are employed to heat the water and/or aggregates and satisfactory provisions have been made for enclosing the concrete and heating the enclosures. No concrete shall be placed when the weather forecasts indicate the air temperature will be below 35 degrees F. during the succeeding 7 days unless provisions are made for enclosing the concrete and heating the enclosure.

When concrete is placed at atmospheric temperatures below 35 degrees F. the mixing water and/or aggregates shall be heated to a temperature of at least 70 degrees F. The temperature of the aggregate shall not be more than 150 degrees F. If the water is heated to more than 150 degrees F. the water shall be mixed with the aggregates before the cement is added. The heating equipment and methods shall be capable of heating the materials uniformly and shall not alter or prevent the entrainment of the required amount of air in the concrete.

Stockpiled aggregates may be heated by the use of dry heat or steam. Aggregates shall not be heated directly by gas or oil flame or on sheet metal over fire. When aggregates are heated in bins, steam-coil heating, water-coil heating, or other methods which will not be detrimental to the aggregates may be used. The use of live steam on or through binned aggregates will not be permitted. If the aggregate has been dry heated, the mixing time shall be increased sufficiently to permit absorption of moisture by the over-dry aggregates.

Concrete shall be effectively protected from atmospheric temperatures below 35 degrees F. for a period of 7 days after placing. The Contractor shall enclose the structure immediately after placing concrete and provide dry heat and moisture in such a way that the air within the enclosures is kept above 50 degrees F., but not above 90 degrees F., for a period of 7 days after concrete placement. The addition of moisture, except on roadway slabs, shall be discontinued 24 hours prior to discontinuing the application of heat. Exposed top surfaces, corners and edges, thin sections, and concrete poured in steel forms are particularly vulnerable to freezing and need special attention.

When required by the Engineer, the Contractor shall provide and maintain a suitable recording thermometer in the general vicinity of the structure site where concrete is being placed. It shall be used, when required by the Engineer, to provide control during freezing or near freezing weather and the information obtained thereby shall be made readily available to the Engineer.

The Contractor assumes all risks connected with the placing of concrete during cold weather. The Contractor shall provide a written procedure for cold weather concreting to the Engineer for review and approval. Permission given by the Engineer to place concrete during cold weather will in no way ensure acceptance of the work by the Owner. Should the concrete placed under such conditions prove unsatisfactory in any way, the Engineer shall still have the right to reject the work although the plan and the work was carried out with his permission.

When the ambient temperature is above 90 degrees F., the forms, reinforcing steel, steel beam flanges, and other surfaces which will come in contact with the mix shall be cooled to below 90 degrees F. by means of a water spray or other approved methods. Water reducing admixtures shall be used so the maximum amount of water or slump is not exceeded. The mixing of the concrete and the time between mixing and placing shall be kept to a minimum. Mixer trucks shall not be exposed to the sun while waiting to be unloaded. Chutes, conveyors, and pump lines shall be shaded.

In no case shall the concrete temperature be more than 90 degrees F. The Contractor shall employ such measures as are necessary to maintain the concrete temperature below 90 degrees F. The measures may include shading, cooling the aggregate piles, refrigerating the mixing water, or substitution of crushed ice for all or a portion of the mixing water. Sprinkling the aggregate piles with water will not be allowed. When ice is substituted, it shall be completely melted at the time of placement. When the Engineer determines there is a probability that concrete temperatures will exceed 90 degrees F. under normal concreting practices, he may require that measures to reduce the concrete temperature be made available prior to the start of concrete placement. Temperature reduction measures shall be subject to approval by the Engineer.

In addition, concrete placed in bridge roadway slabs must meet the following requirements:

To keep the forms and reinforcing steel cool prior to placing the concrete, the top layer of reinforcing steel shall be completely covered with clean, wet burlap and the forms and reinforcing

steel shall be sprinkled with cool water immediately prior to placing the concrete as ordered by the Engineer. The concrete slab shall be finished without delays. Equipment for applying a water fog spray after finishing is completed shall be available in case it is needed to prevent plastic cracks.

When the combination of air temperature, relative humidity, temperature of the concrete, and the wind velocity at the site produces an evaporation rate of 0.20 pound per square foot of surface per hour, as determined from Table 6-02.3(6), the Contractor shall provide a windbreaker enclosure to protect the concrete from winds blowing over the surface of the concrete until the curing compound is applied. If the Contractor proposes to cast deck concrete having temperatures above 80 degrees F., he shall supply approved equipment for determining the relative humidity and wind velocity at the site.

## 6-02.3(6)B PLACING CONCRETE IN WATER

Delete the last paragraph and replace with the following:

Concrete placed under water shall be Class D or DX mix and shall be proportioned for a maximum slump of 7 inches. The length and width of section of footing being poured shall not exceed 18 feet for each tremie used.

## 6-02.3(6)D POINT OF ACCEPTANCE (New Section)

Determination of concrete properties for acceptance will be made based on samples taken to most nearly represent the condition of the concrete as placed in the forms. Any placement system which, in operations, alters the specified properties of the concrete will require sampling at the discharge from the placement system.

It shall be the Contractor's responsibility to provide adequate and representative samples of the fresh concrete to a location designated by the Engineer for the testing of concrete properties and making of cylinder specimens. Samples shall be provided as directed in Sections 1-06.1 and 1-06.2.

When mutually agreeable to the Owner and the Contractor, acceptance samples may be taken at a location other than the point of discharge. The alteration of concrete properties in passage through the placement system shall be recognized in analyzing results of such samples and in determining acceptance of the fresh concrete.

## 6-02.3(10) FINISHING ROADWAY SLABS

The title of this section is revised to read:

## 6-02.3(10) ROADWAY SLABS

The 11th paragraph is revised to read:

Concrete shall be placed the full width of the roadway slab or the full width between construction joints shown on the Drawings. In general, construction joints must be over beams or webs which will adequately support the slab on each side of the joint. Joints will not be permitted over piers, except as shown on the Drawings. The construction joint shall be formed vertical and in true alignment. Falsework and wedges supporting each part of the roadway slab shall not be released until the concrete of both parts has properly aged as specified.

The 12th paragraph is deleted.

The 14th paragraph is supplemented with the following:

All concrete splashed or otherwise deposited on exposed reinforcing steel of adjacent parts shall be removed before those adjacent parts are poured.

Delete paragraph 21 (bottom of page 206) and replace with the following:

The bridge deck shall be given a final surface finish by texturing with a comb perpendicular to the centerline of the pavement. The comb shall consist of a single row of metal tines and be capable of producing striations approximately 3/16 inch in depth, 1/8 inch in width at approximately 1/2 inch spacings in the fresh concrete. The actual nominal depths of striations shall be determined in the field by the Engineer. The combs shall be operated manually or mechanically, either singly or in gangs with several placed end to end. The texturing operations shall be done at such time and in such manner that the desired texture will be achieved while avoiding or minimizing displacement of the larger



aggregate particles. The texture shall not extend into areas within 2 feet of the curb lines. The non-textured concrete within 2 feet of the curb lines shall be hand finished with a steel trowel. If the striation equipment has not been previously approved, a test section shall be constructed prior to approval of the equipment.

#### 6-02.3(10)A FINISHING BRIDGE APPROACH SLABS (New Section)

The reinforced concrete bridge approach slabs shall conform to the requirements of Section 5-06 except that the concrete shall be Class A mix. The finished and cured bridge approach slabs shall be free from any deviation exceeding 1/8 inch under a 10 foot straightedge placed parallel and perpendicular to the centerline of the roadway.

#### 6-02.3(11)A CURING AND FINISHING CONCRETE TRAFFIC AND PEDESTRIAN BARRIERS

The 6th paragraph is revised to read:

The Contractor shall supply sufficient water and workmen to properly cure the concrete surfaces in the manner and for the length of time specified. No curing compound of any kind shall be used on the new concrete masonry except upon roadway slabs, sidewalk slabs, slip-formed concrete traffic and pedestrian barrier, and the top slabs of culverts, as specified in Section 6-02.3(11).

The following is added after the sixth paragraph:

For concrete traffic and pedestrian barrier constructed by the slip-forming method, the concrete finishing shall consist of two separate operations. The first operation shall consist of finishing the barrier with a steel trowel to close all surface pockmarks and holes. The second operation shall consist of a light brush finish in the vertical direction on the front and back face and in the transverse direction on the top surface of all plain surface finish barrier.

After the finishing operations have been completed the slip-formed concrete traffic and pedestrian barrier shall be cured by one of the following methods:

- (a) After the free water has left the concrete surface, spray with clear chlorinated rubber type curing compound, Type 1, applied in two applications. The total coverage shall be at least 1 gallon per 100 square feet. No later than the morning following application of the curing compound, the slip-formed barrier shall be covered with white reflective type sheeting for a period of at least 10 days. At the end of the curing period the curing compound shall be completely removed by either a light sandblast or a high pressure water jet to provide a uniform appearance.
- (b) As soon as the barrier has gained sufficient strength to prevent damage, cover with heavy quilted blankets which shall be kept continuously wet for a period of at least 10 days. At the end of the curing period no additional finishing will be required.

#### 6-02.3(12) CONSTRUCTION JOINTS

The first paragraph is revised to read:

Construction joints shall be made where shown on the Drawings. If approved by the Engineer, construction joints shown on the Drawings may be deleted or relocated or additional construction joints may be formed if requests for such changes are submitted in writing by the Contractor. Any request for such changes must be accompanied with a drawing showing the proposed relocation, addition, or deletion. Additional costs due to changes in construction joints requested by the Contractor will be at his expense.

All construction joints shall be neatly formed as shown on the Drawings by the use of grade strips or other approved methods. Irregular or undulating pour lines will not be allowed. All construction joints shall be either horizontal or vertical, or if the main reinforcement is inclined, the joints shall be normal to the direction of the main reinforcement. Wire mesh of any kind will not be permitted for forming material. An edger shall not be used on the joint, but lips and edgings shall be removed before making the adjacent pour.

The 3rd paragraph is revised to read:

Shear keys shall be provided at all construction joints except those where the Drawings call for a roughened surface.

#### 6-02.3(13) EXPANSION JOINTS (BRIDGE DECKS)

Supplement this section with the following:

The expansion joints shall be as shown and noted in the Drawings and shall be installed in accordance with the manufacturer's written recommendations.

The Contractor shall submit working drawings of the expansion joints proposed for use to the Engineer for approval. Submittal of working drawings shall be in accordance with provisions of Section 1-05.3 of the Standard Specifications. The working drawings shall show details of the system(s), including materials and dimensions, method of installation, and method of sealing the system to prevent leakage of water through the joint. The Contractor shall submit, with his working drawing submittal, the manufacturer's written installation procedures to the Engineer for approval.

After the joint system(s) is installed, the joint area shall be flooded with water and inspected, from below the joint, for leakage. If leakage is observed, the joint system shall be repaired, at the expense of the Contractor, as recommended by the manufacturer and approved by the Engineer.

To aid in assuring proper use and installation of the expansion joint system under job conditions, the Contractor shall have available, during installation of the system and at no cost to the Owner, the services of a qualified, full-time field representative of the manufacturer of the expansion joint system to be installed in this project. Recommendations made by the manufacturer's representative, on and/or off the job site, and approved by the Engineer, shall be adhered to by the Contractor at his own expense.

The expansion joints shall seal the roadway deck surface and curbs to prevent water from passing through the joint to portions of the structure below. Installation of the expansion joints and painting of the exposed metal parts shall be in accordance with the manufacturer's recommendation. The sealant recommended by the manufacturer supplying the expansion joint shall be approved by the Engineer before installation. The transition of the expansion joint from the roadway, up the curb face and horizontally to the back of the curb shall be in a continuous factory fabricated curb/gutter unit.

The seats for the expansion joints shall be absolutely parallel to longitudinal and transverse roadway grade and shall match the transverse crown of the final pavement surface. All spalls, low areas or high areas in the expansion joint seat shall be recontoured so that the variation is no more than 1/16 inch from a 10 foot straightedge on a constant cross slope and from a 3 foot straightedge on a parabolic crown. Each successive check with the straightedge device shall lap the previous check by at least 1/2 of the length of the straightedge. All concrete outside corners of the expansion joint slot shall have a radius of rounding no greater than 1/4 inch.

When the expansion joint seat consists of steel plates or steel angles, all high areas shall be ground and all low areas having a depth of less than 1/4 inch from the true seat contour shall be filled with epoxy. Areas with a depth greater than 1/4 inch shall be filled with an epoxy sand grout. The tolerance from a 10 or 3 foot straightedge shall be the same as stated above for concrete seats.

The expansion joint material shall have full firm bearing for the entire length and width of the joint.

The expansion joint material shall be placed so that its top surface is recessed 1/8 inch  $\pm$  1/16 inch below the driving surface of the pavement on both sides of the expansion joint.

Shims, washers or other devices shall not be used below the expansion joint material to bring the joint into proper elevation and/or tolerance.

#### 6-02.3(13)A COMPRESSION SEAL (New Section)

##### 6-02.3(13)A1 GENERAL (New Section)

The Contractor shall furnish and install compression seals of the size and type specified at the locations shown on the Drawings.

The compression seals shall conform to the minimum requirements for the type of seal specified on the Drawings as manufactured by the D. S. Brown Company, Watson Bowman and Acme Corporation, or approved equal and according to the following provisions:

The seals shall conform to the requirements of ASTM Designation D735 and shall be formed by an extrusion process resulting in a dense neoprene with uniform dimensions and smooth exterior surface.

The cross section of the seal shall be shaped to allow adequate compression of the seal under design conditions. The length of seals shall be as indicated on the Drawings. Stretching of the seals will not be permitted. Details of the seal, including corner joints and type of material to bond joints shall be submitted to the Engineer and approved before submitting samples for lot acceptance. For the purpose of these specifications, a lot shall be considered all material of one size produced during one production run for use on this project. A sample shall consist of a 3-foot length of actual seal. The supplier of the joint seals will be required to furnish the Engineer with a certified copy of the test results indicating that the material complies with the specification requirements.

The seal shall be installed with an approved lubricant adhesive in accordance with the manufacturer's recommendations. The lubricant adhesive shall be delivered in containers plainly marked with the manufacturer's name or trademark, lot number and date of manufacture. A one pint sample of lubricant adhesive shall be furnished to the Engineer prior to installation.

#### 6-02.3(13)A2 PREPARATION OF SURFACES FOR INSTALLATION (New Section)

The groove or recess for compression seals shall have parallel sides and be constructed to the proper depth. The width of the recess shall not vary more than 1/16 inch in a distance of 10 feet. The bottom shall be a true, smooth plane parallel to the surface of the roadway, curb, or sidewalk.

All surfaces to receive elastomeric compression seal shall be free from dirt, water, oil, rust, frost, spalls, cracks, and any other loose foreign debris which may be detrimental to effective joint sealing.

It is imperative that a clean opening with 3/8 inch rounded top edges shall be produced for the specified opening and the full depth of joint required. After the joints are constructed and all foreign materials removed from the joint grooves, all joint grooves shall be inspected for spalling. Any spalling which increases the specified size of the joint groove beyond the following limits shall be repaired by patching with epoxy mortar.

- (a) Spalls over 1/4 inch wide and over 1/2 inch below the surface of the pavement.
- (b) Spalls over 1/4 inch wide and 2 inch or more in length, regardless of the depth of spall below the surface of the pavement.

#### 6-02.3(13)A3 INSTALLATION (New Section)

Where indicated on Drawings, the Contractor shall install the proper seals in a neat, workmanlike manner, and to the satisfaction of the Engineer.

For ease of installation, the air temperature should be below 85°F.

At end joints or miter joints as shown on the Drawings, a 1/4 inch thick neoprene sponge shall be bonded to the seal ends with an approved cyanoacrylate adhesive. In order to insure proper fitting, the neoprene sponge shall be cut to the size and shape of the uncompressed seal (nominal dimensions). Further, the seal plus the sponge shall be slightly longer than the gap to be filled so that the sponge is in a state of compression against the ends of the seal. The cyanoacrylate adhesive shall be applied to outer webs and top web of the seal only, to allow entrapped air to escape and the sponge to properly function.

The seal surface to be bonded shall be cleaned with toluene or approved solvent prior to applying adhesive. A continuous coat of adhesive shall be applied to both joint interfaces immediately prior to seal installation. Adhesive shall not be applied below 40° F.

At seal upturn or downturn locations the following procedure shall be followed. See detail on the Drawings.

- (a) Locate 1/2 inch diameter hole and drill through seal as shown, using a standard twist drill.
- (b) Using a sharp long blade knife or hacksaw, cut lower section of seal to 1/2 inch diameter hole as shown.
- (c) Bend seal in desired position and install as shown.
- (d) Complete seal installation following normal sealing instructions.

The seal surface to be bonded shall be cleaned with toluene or approved solvent prior to applying adhesive. A continuous coat of adhesive shall be applied to both joint interfaces immediately prior to

seal installation. Adhesive shall not be applied below 40° F. The compression seal shall be placed such that the top surface, or surface facing the front of the curb shall be recessed 1/8 inch to 1/4 inch into the adjacent concrete surface.

#### 6-02.3(16) PLANS FOR FALSEWORK AND FORMS

Delete this section and replace with the following:

##### 6-02.3(16)A NONPRE-APPROVED FALSEWORK AND FORMING PLANS

The Contractor shall submit to the Engineer, for approval, 6 copies of drawings showing details of the falsework and nonpre-approved forms intended to be used. The drawings will be returned from the Engineer to the Contractor. Drawings will not be required for footing or retaining walls 4 feet or less in height. The footing pedestal is not included in the footing height. If a railroad is involved, four additional sets are required for each railroad company involved. The drawings shall show the proposed details of construction such as sizes of members, spacing of bents, posts, studs, wales, stringers, collars, bolts, wedges, bracing, rate of pour, and the manufacturer's recommended safe working capacity of all form ties and column wraps.

Falsework and forms shall not be constructed until approval has been given by the Project Engineer. Approval by the Project Engineer will not relieve the Contractor of responsibility for the sufficiency of the falsework and forms. Falsework, form, and other related working drawings which are necessary for the prosecution of the work shall be designed by or under the direction of a Professional Engineer, licensed under the provisions of Title 18 RCW with the State of Washington, and shall bear his signature and seal. All assumptions, dimensions, material properties, and other data used in making the structural analysis shall be noted on the drawing. Upon request, the Contractor shall furnish copies of the design calculations to the Engineer for examination as a condition for approval. Prints returned for correction shall be resubmitted and shall be approved by the Engineer before the construction of the falsework and forms in undertaken.

All drawings shall be made on sheets conforming in size to the provisions of Section 1-05.3 and all details shall be made clear, complete and to scale in accordance with standard drafting procedures.

For calculating the strength of falsework, a weight of 160 pounds per cubic foot shall be assumed for green concrete.

##### 6-02.3(16)B FORMING PLANS

Form plans for abutments, wingwalls, diaphragms, retaining walls, columns, girders and beams, railings, and bulkheads shall also be submitted to the Engineer for approval. Contractors submitting plans for approval shall submit one reproducible drawing for each plan sheet. The plan will be returned to the Contractor for any necessary modifications, revisions, or special instructions. Upon final approval, the plan will be stamped "Approved", dated, and returned to the Contractor.

Construction shall not proceed until approval has been given by the Engineer. Use of the approved plans for contracts on or adjacent to railroad right of way will require railroad approval. Four additional copies shall be submitted to the Project Engineer for railroad review and approval.

Falsework plans for supporting the roadway slab for the interior spans between precast prestressed concrete girders shall be submitted for approval. Other falsework plans shall be submitted in accordance with Section 6-02.3(16)A.

#### 6-02.3(17) FALSEWORK AND FORMS

This section is supplemented as follows:

Formwork is defined as the structural systems that contains the lateral pressure exerted by concrete placed in the forms. Falsework is defined as the structural system that supports the vertical load of the formwork, reinforcing steel, concrete, and construction live loads.

##### 6-02.3(17)A CAPS, PILING, POSTS AND MUDSILLS

The sixth paragraph is supplemented with the following:

The Contractor shall provide a suitable sample of each proposed imported material for use under mudsills and shall allow up to five working days for the Engineer's approval. The imported material shall not be used until approval for use.

## 6-02.3(17)C BRACING

The following paragraph is added between the first and second paragraphs:

Bracing shall be provided between prestressed concrete girders to prevent movement or rotation when the diaphragm and roadway slab are poured.

Delete the table in paragraph 7 and replace with the following:

Series 6 Girder - 2 feet-6 inches  
Series 8 Girder - 3 feet-6 inches  
Series 10 Girder - 5 feet-3 inches  
Series 14 Girder - 5 feet-6 inches

Supplement this section with the following:

Bracing shall be provided between prestressed concrete girders to prevent movement or rotation when the diaphragm and roadway slab are poured.

## 6-02.3(17)E FORM TIES

Delete paragraphs 2 and 3 and replace with the following:

Wire form ties and taper ties will not be allowed.

## 6-02.3(21) DRAINAGE OF BOX GIRDER CELLS

This section is revised to read:

To provide drainage for box girder cells, the Contractor shall furnish and install short lengths of nonmetallic pipe in the bottom slab at the low point of each cell in accordance with the detail shown in the plans. The pipe shall have a minimum inside diameter of 4 inches. Pipe shall be installed in each end of the box girder cell when the difference in the plan elevation is 2 inches or less.

## 6-02.3(24) REINFORCEMENT

Delete this section and replace with the following. Subsections of 6-02.3(24) remain unchanged except as noted below:

The Contractor shall furnish a bar list and bending diagram to the Engineer for approval prior to fabrication.

## 6-02.3(24)C PLACING AND FASTENING

The following is added after the first paragraph:

The reinforcing bars for the slip-formed concrete traffic and pedestrian barrier shall be tied and braced to prevent displacement of the reinforcing cage during placement of the concrete.

## 6-02.3(24)E WELDING REINFORCING STEEL

In the formula under paragraph 2, correct the word "Vandanium" to read "Vanadium".

The first sentence of the first paragraph is revised to read:

Welding of steel reinforcing bars shall conform to the requirements in the AWS D1.4 Reinforcing Steel Welding Code and the Contract Documents.

The last sentence of the third paragraph is revised to read:

A suggested form for furnishing the required information is given in Appendix A of AWS D1.4.

Delete paragraph 13.

## 6-02.3(25) PRESTRESSED CONCRETE GIRDERS

The following paragraph is added between the third and fourth paragraphs:

The width of the end block under Series 14 Girder may be changed to 1 foot 4 inches provided that the reinforcing steel in the end block region is adjusted to maintain the clearance as shown in the contract plans.

The third sentence of the fourth paragraph is revised to read:

Grout compressive strength will be determined by testing cubes in accordance with AASHTO Test T 106.

Supplement this section with the following:

All plants fabricating prestressed concrete products for City of Seattle projects shall be currently certified under the "Prestressed Concrete Institute Certification Program". Proof of plant certification by PCI shall be submitted along with the shop drawings by the Contractor to the Engineer.

## 6-02.3(25)A TEE GIRDER FLANGE CONNECTION

The third sentence of the second paragraph is revised to read:

Low shrink concrete compressive strength will be determined by testing cubes in accordance with AASHTO Test T 106.

## 6-02.3(25)C CASTING AND SHOP PLANS

Delete paragraph 5.

Delete paragraph 6 and replace with the following:

The Contractor may provide circular block outs for falsework hangar rods in the top flanges of all prestressed concrete girders. The block outs shall be: a maximum of 1 inch in diameter; spaced at 6 feet - 0 inches maximum longitudinally; and a minimum of 3 inches from the outside edge of the top flange for the Series 4 thru 6 girders and 10 inches for the Series 14 Girders.

## 6-02.3(25)G HANDLING AND STORAGE

Delete paragraph 2 and replace with the following:

Long girders, and specifically those over 105 feet in length for Series 10 and over 112 feet for Series 14 girders, shall be braced laterally to prevent buckling during transportation and erection.

The bracing shall be securely attached to the top flange of the girders and shall be of sufficient stiffness to substantially prevent lateral deflection of the top flange during all handling conditions. When this bracing must be removed before the diaphragms are cast, the girders shall be carefully secured in position by other means before the bracing is removed. The Contractor is cautioned that for some delivery routes, more conservative guidelines for lateral bracing may be required.

The first sentence of the third paragraph is revised to read:

If the Contractor wishes to deviate from the vertical pickup, the pickup point, or from the bracing to prevent lateral deflection, he shall have his proposed methods analyzed by his engineer and shall submit his method, with supporting calculations, in accordance with Section 6-02.3(16)A.

## 6-02.3(25)H WORKMANSHIP

Item (a) through (o) are replaced with the following:

- (a) Length (overall):  $\pm 1/4$  inch per 25 feet of the beam length,  $\pm 1$  inch maximum.
- (b) Width (flanges):  $\pm 3/8$  inch,  $-1/4$  inch.
- (c) Width (narrow web section):  $\pm 3/8$  inch,  $-1/4$  inch.

- (d) Girder depth (overall):  $\pm 1/2$  inch,  $-1/4$  inch.
- (e) Flange depth:  $\pm 1/8$  inch.
- (f) Strand position:  $\pm 1/4$  inch from center of gravity of strand group and individual strands.
- (g) Longitudinal position of deflection points for deflected strands:  $\pm 12$  inches.
- (h) Bearing recess (center recess to end beam):  $\pm 1/4$  inch.
- (i) Beam ends (deviation from square or designated skew): horizontal:  $\pm 1/2$  inch measured from centerline of web to edge of flange. Vertical:  $\pm 1/8$  inch per foot of beam depth.
- (j) Bearing area deviation from plane (in length of width of bearing):  $1/16$  inch.
- (k) Stirrup reinforcing spacing:  $\pm 1$  inch.
- (l) Stirrup projection from top of beam:  $\pm 3/4$  inch.
- (m) Mild steel concrete cover:  $-1/8$  inch,  $\pm 3/8$  inch.
- (n) Offset at form joints (deviation from a straight line that extends 5 feet each side of joint):  $\pm 1/4$  inch.
- (o) Differential camber between girders in a span (measured in place at the jobsite):  $1/8$  inch per 10 feet of beam length for I-girders. For T-girder when the difference in camber between adjacent girders or stages exceeds  $1/4$  inch at midspan for girders with asphalt overlay and  $1/8$  inch for girders without asphalt overlay the girder cambers shall be equalized by an approved method.
- (p) Position of inserts for structural connections:  $\pm 1/2$  inch.
- (q) Position of lifting loops:  $\pm 3$  inches longitudinal,  $\pm 1$  inch transverse.

#### 6-02.3(25)J SHIPPING

Prestressed concrete girders shall not be shipped until tests on concrete cylinders, manufactured of the same concrete and cured under the same conditions as the girders, indicate that the concrete of the particular girder has attained a compressive strength equal to the specified design compressive strength of the concrete in the girder and attained a minimum age of seven days for Bulb-T prestressed girders and 10 days for all other prestressed concrete girders.

During shipping, the girders shall be supported within: 3 feet of the ends of the girders for Series 4, 6, and 8 and for Bulb-T prestressed girders; within 4 feet for Series 10 prestressed girders; and within 5 feet for Series 14 prestressed girders.

The Contractor may deviate from the support locations listed above provided he submits his proposal, with supporting calculations, in accordance with Section 6-02.3(16)A.

Contractor's calculations must verify that the concrete stresses in the prestressed girders during shipping do not exceed that listed below:

#### CRITERIA FOR CHECKING GIRDER STRESSES AT TIME OF LIFTING OR TRANSPORTING

Stresses at both support and harping points must be satisfied based on the following:

- (a) Specify concrete strength at time of lifting or transporting,  $f'_{cm}$   
 $f'_{cm}$  = compressive strength at time of lifting or transporting verified by test but shall not exceed design compressive strength ( $f'_c$ ) at 28 days in psi + 1000 psi.
- (b) Allowable compression stress,  $f_c = 0.60 f'_{cm}$
- (c) Allowable tension stress,  $f_t$ 
  - a. With no bonding reinforcement = 3 times the square root of  $f'_{cm}$
  - b. With bonded reinforcement to resist total tension force in the concrete computed on the basis of an uncracked section = 7.5 times the square root of  $f'_{cm}$ . The allowable tensile stress in reinforcement is 30 ksi. (ASTM A 615 Gr. 60)

- (d) Prestress losses
  - 1 day - 1 month = 20,000 psi
  - 1 month - 1 year = 35,000 psi
  - 1 year or more = 45,000 psi (Max.)
- (e) Impact on dead load
  - Lifting = 0%
  - Transporting = 20%

#### 6-02.3(25)M CAMBER

The first sentence of the second paragraph is replaced by the following:

The Contractor shall control the camber of prestressed concrete girders that are to receive a cast-in-place slab by scheduling fabrication or other means. The actual girder camber at the midspan may vary from the "C-1" value by a maximum of  $\pm 1/2$  inch for girder lengths up to 80 feet and  $\pm 1$  inch for girder lengths over 80 feet at the time of slab pour.

#### 6-02.3(26)A SHOP DRAWINGS

The first sentence of the second paragraph is revised to read:

Before casting the structural elements, the Contractor shall submit for approval, in accordance with Section 6-02.3(16)A, complete details of the method, materials, and equipment he proposes to use in the prestressing operations.

#### 6-02.3(26)B ANCHORAGES

Delete paragraph 6 and replace with the following:

The Contractor shall submit a certified report, prepared by himself or his agent, for each size and type of anchorage device proposed for use showing that the anchorage assembly will develop 95% of the ultimate strength of the prestressing reinforcement.

#### 6-02.3(27) SUPERSTRUCTURE (New Section)

The superstructure for bridges shall include all materials (except those noted below) above the top of the cross beams or pedestals as the case may be, and between the abutment expansion joints, including concrete Class AX, reinforcing steel, prestressed concrete girders, deck slab, diaphragms, sidewalks, curb/parapets, earthquake restrainers, railing anchorage, concrete for precast and prestressed components, prestressing steel, expansion joints, inserts, compression seals, elastomeric pads, bridge drains with reducers, and electrical conduits/expansion fittings encased in concrete.

**EXCEPTIONS:** Items excluded under "Superstructure" are the following:

- (a) Metal traffic and pedestrian railings and posts.
- (b) Steel bridge bearings, steel and reinforced concrete transverse stops.
- (c) Downspouts.
- (d) Painting.
- (e) Light poles (standards) luminaires and other electrical-related items specified elsewhere herein except as otherwise noted above.

The Superstructure contains the approximate quantities of materials as listed in the Special Provisions. The quantities listed are for major items only and are not intended to be a complete list of all items required for construction of the superstructure. The quantities are approximate and are for the convenience of the Contractor in determining the volume of work involved and are not guaranteed to be accurate. The prospective bidders shall verify these quantities before submitting a bid. No adjustments other than for approved changes will be made in the lump sum contract price for "Superstructure," even though the actual quantities required may deviate from those listed.



**6-02.3(28) BRIDGE DRAINS (New Section)**

The Contractor shall furnish and install drains in the roadway slab, of the type specified in the Drawings and at the locations shown therein.

Bridge drains shall meet the requirements of Section 9-06.19.

**6-02.3(29) DOWNSPOUTS (New Section)**

The Contractor shall furnish and install 4 or 6 inch standard weight steel pipe downspouts at the locations shown and as detailed in the Drawings.

The downspouts shall be full length pipe sections in all straight runs. If approved by the Engineer, the Contractor may use other types of couplings and fittings in lieu of the grooved couplings and fittings shown in the Drawings, provided they are equal and are approved by the Engineer.

The portion of downspouts and/or drain pipe constructed within concrete shall be fully encased in a sponge rubber compound 1/2 inch thick and meeting the requirements of ASTM Designation D 1752 Type No. 1, except the color requirement is waived.

**6-02.3(30) DRILLING HOLES IN CONCRETE (New Section)**

The Contractor shall drill holes in the existing concrete facilities as shown and noted on the Drawings. The diameter of holes shall be as follows:

Diameter Holes for #18 Bars	2-3/4"
Diameter Holes for #14 Bars	2-1/4"
Diameter Holes for #11 Bars	1-7/8"
Diameter Holes for #10 Bars	1-3/4"
Diameter Holes for # 9 Bars	1-1/2"
Diameter Holes for # 8 Bars	1-3/8"
Diameter Holes for # 7 Bars	1-1/4"
Diameter Holes for # 6 Bars	1-1/8"
Diameter Holes for # 5 Bars	1"
Diameter Holes for # 4 Bars	7/8"
Diameter Holes for # 3 Bars	3/4"

For threaded rod, 1/4" larger than the outside diameter of the rod.

The holes to be drilled in the existing concrete shall be drilled with equipment that will not fracture or damage the existing concrete which is to remain or fracture the aggregate that surrounds the hole. Jackhammers shall not be used to drill holes. The method used to drill the holes shall provide a fracture free surface in which to epoxy bond the bars and/or threaded rods.

The Contractor shall demonstrate his proposed method or methods of drilling the holes to the Engineer for approval. If the Engineer rejects the Contractor's proposed methods, the Contractor shall use other means of drilling the holes which will give the required results.

Any damage caused by the Contractor's methods or equipment used in drilling holes shall be repaired by the Contractor at his own expense. Tools classified as demolition tools shall not be used.

**6-02.3(31) EPOXY IN DRILLED HOLES (New Section)**

Reinforcing bars or threaded rods shall be secured in drilled holes in the existing concrete where indicated on the Drawings with an high strength, creep resistant epoxy resin such as Adhesive Engineers Concrete 1463-G for vertical bars or rods or Concrete 1441 for horizontal bars or rods. For epoxy

resins other than those specified above, the Contractor shall submit a test report from a testing laboratory approved by the Engineer verifying that application temperature range cure time, heat deflection temperature (ASTM D648), and slant shear strength (AASHTO T237) are equal to or better than the epoxy resins specified.

The Contractor shall place the reinforcing steel and/or threaded rods scheduled to be embedded in the existing concrete, in the following manner:

- Sandblast the section of reinforcing steel and/or threaded rods, scheduled to be embedded in the existing concrete to white metal (see note below).
- Prime with epoxy the part of the reinforcing bar and/or threaded rod which has been sandblasted to white metal (see note below).
- Dry the drilled hole thoroughly immediately before placing the epoxy by clean, hot air, or by flame. If flame is used, only that produced with propane gas will be allowed.
- Place the epoxy in the drilled hole in such a manner as to prevent the formation of air pockets.
- Clean the primed epoxy surface of the reinforcing bar and/or threaded rod with a clean rag dipped in a solution of methyl/ethyl ketone or acetone.
- Insert the reinforcing bar and/or threaded rod into the drilled holes. In the horizontal drilled holes, caulk the annular space between the entrance of the hole and the bar and/or threaded rod with lead wool or approved equal.

NOTE: For factory coated epoxy bars, Steps 1 and 2 shall be omitted.

**6-02.3(32) REPAIR OF SPALLED AND DELAMINATED CONCRETE (New Section)****6-02.3(32)A DESCRIPTION (New Section)**

The work shall consist of cleaning and repairing loose spalled, and delaminated concrete at locations indicated on the Drawings and in accordance with the following requirements.

**6-02.3(32)B CLEANING AND PREPARATION (New Section)**

The Contractor shall remove all loose, defective and delaminated concrete by chipping with pneumatic chipping hammers, hand tools, or high pressure water jets. All cracks and cavities shall be chipped to such formation that their sides are approximately perpendicular to the exposed surface forming a mechanical shoulder for at least 1/2 inch in depth. In addition to chipping, all concrete to be repaired shall be cleaned by flushing with water and compressed air jets. The nozzle shall have sufficient air pressure to assure removal of all dirt, grease, oil, moss and loose particles.

Cleaned surfaces shall be free of all dirt, grease, oil, moss scale, and rust before repairs are made.

Care shall be taken in removing concrete to prevent overbreakage. Concrete shall be carefully broken away from reinforcing bars where applicable, to prevent damage to steel reinforcement.

**6-02.3(32)C REPAIRS (New Section)**

The Contractor shall have the option of making the concrete repairs with the best methods available subject to the approval of the Engineer. Two proposed methods are outlined below:

- Hand placed sand and cement grout with approved epoxy bonding agent.
- Quick-set concrete as approved by the Engineer.

Hand placed sand and cement grout shall be used only on the smaller spalled areas with a depth of 1/2 inch or less. All repairs shall be finished to the original size and contour of the member being repaired.

Spall depths over 1 inch shall be reinforced with 4 X 4 W0.5 welded wire fabric secured to the existing concrete with 1/4 inch tie wire anchors and 16 gauge wire ties. Welded wire fabric shall clear the new surface by no less than 1/2 inch, preferably 3/4 inch. Location, spacing and type of anchor subject to approval of the Engineer.



## 6-02.3(33) EPOXY INJECTION OF CONCRETE CRACK (New Section)

## 6-02.3(33)A GENERAL (New Section)

Cracks in existing concrete shall be repaired by epoxy injection where indicated on the Drawings or where directed by the Engineer in accordance with the following specifications. The Contractor shall submit his procedure for epoxy injection to the Engineer for approval two weeks prior to performing this portion of the work.

The material used as a surface seal must have adequate strength and adhesion to hold injection ports firmly in place and to resist injection pressures adequately to prevent leakage during injection.

The epoxy resin system for crack injection shall be a Type I, Grade 1 system conforming to ASTM C881 except for the following requirements:

- (a) Gel Time<sup>1</sup> . . . . . 20 Minutes Minimum
- (b) Viscosity . . . . . 700 Centipoises Maximum
- (c) Shrinkage . . . . . Not Required
- (d) Heat Deflection Temperature . . 130°F. Minimum

<sup>1</sup>Gel time shall not apply if continuous flow nozzle mixing injection equipment is used.

The injection equipment shall have the capability of discharging the mixed adhesive at pressures up to 200 psi and maintaining that pressure.

## 6-02.3(33)B GUIDELINES (New Section)

Concrete cracks over 1/32-inch thick and as designated and marked by the Engineer for injection shall be repaired as follows:

- (a) Before repair work begins, cracks shall be free from loose or foreign matter such as dirt, efflorescence laitance, oil, grease, salt or any other contaminants. Acids and corrosives shall not be used as cleaning agents.
- (b) Entry ports shall consist of tubes, tees, or other valve devices suitable for accepting epoxy injection resins under pressure and shall be provided along the crack at intervals of not less than the thickness of the concrete at that location. For thick sections (2 feet plus), entry ports may be spaced at distances as recommended by the manufacturer or directed by the Engineer. The holes for the entry ports shall be drilled with a hollow bit with an attached vacuum chuck to prevent dust from becoming embedded in the crack.
- (c) Prior to injection of the crack, the surface sealing system shall be applied to the face of the crack and areas around entry ports to attain a seal capable of withstanding the applied injection pressures. For through cracks, the surface seal shall be applied to all accessible faces.
- (d) The surface seal shall be allowed to gain adequate strength before proceeding with the injection. However, prior to epoxy injection, crack should be air injected to determine if the crack is capable of epoxy injection (air detected coming out of adjacent ports means that crack is injectible). If not injectible, entry port should be temporarily abandoned and procedure repeated at adjacent ports. At a later time, previously non-injectible cracks should be given a second air injection test.
- (e) The injection of the adhesive into each crack shall begin at the entry port at the lowest elevation. Injection of deck cracks shall be done from the top side; through cracks may require sealing crack on bottom with epoxy paste. Injection shall continue at the first port until the injection adhesive begins to flow out of the port at the next higher elevation. The first port shall be plugged and injection started at the second port until adhesive flows from the next port. The entire crack shall be injected with the same sequence. If port to port travel of epoxy adhesive is not indicated, the work shall immediately be stopped and the Engineer notified. On wide cracks where resin travel between ports will be rapid, two or more ports may be pumped simultaneously. On exceptionally large cracks, a formulation (dependent upon crack width, ambient temperature, modulus requirements and other variables) of epoxy resin and fine sands shall be used as approved by the Engineer.

(f) After the injection adhesive has cured, the surface seal shall be removed. The face of the crack shall be finished flush with the adjacent concrete. There shall be no indentations or protrusions caused by placement of entry ports.

(g) Supervision of this process by the manufacturer's representative shall be required until the Contractor is familiar with the products and the operations.

(h) The sealing and injection procedures outlined herein is an approved method for accomplishing the work. However, the Contractor may, upon written approval of the Engineer, use other equipment and/or procedures.

The Contractor shall obtain three 2-inch diameter core samples in the first 100 linear feet of crack repaired and one core sample for each 100 linear feet thereafter at his expense. The cores shall be for full crack depth and taken from locations selected by the Engineer. If less than 90% of the visible crack is not filled with cured epoxy adhesive, the crack from which the cores were taken shall be deemed not to have been repaired in accordance with this specification and no payment shall be made until satisfactory repairs are completed by the Contractor. The Contractor shall reinject crack and the repair will again be subject to the approval of the Engineer.

Upon approval of the repair by the Engineer, the Contractor shall fill the core holes using an epoxy bonding agent and portland cement mortar ( $f'c = 4,000$  psi) and finish the surface to blend with the adjacent concrete.

## 6-02.3(33)C SUBMITTALS (New Section)

The Contractor shall submit the following documentation for approval along with the Bid:

- (a) Applicator's Qualifications: a list of projects, dates, locations, contacts, and contact's telephone number for successful epoxy resin repairs on concrete structures.
- (b) Epoxy Injection Adhesive: After award of contract, the epoxy manufacturer shall provide material certifications and test report.

## 6-02.3(34) BONDING NEW CONCRETE TO EXISTING CONCRETE (New Section)

Surfaces to which new concrete is to be bonded shall be rough and clean. Loose particles, dust and dirt shall be removed by vigorous brushing with wire brushes followed by a thorough washing with high pressure water jet prior to application of new materials. Oil or film of any sort that may reduce the bond of the new material to the old concrete will not be permitted.

Bonding surfaces between old and new concrete shall be treated in the following manner after the free water has dried from the area.

The surface shall be coated with epoxy resin forming a 10-15 mil thickness. The epoxy surface shall appear shiny and shall be tacky just before new concrete is placed. If the concrete has absorbed the adhesive, as evidenced by a dull appearance, apply another coat. The new concrete shall then be placed while the epoxy remains tacky.

Epoxy resin shall conform to the requirements of ASTM C881 for Type II, Grade 2, Class A, B or C depending on the temperature of the existing concrete. The shrinkage test in ASTM C881 is not required. Refer to Section 9-26 of the Standard Specifications.

## 6-02.4 MEASUREMENT

Delete this section and replace with the following:

Measurement for "Concrete (Class) (Use)," will be by the cubic yard in place. Measurements will be to the neat lines of the structure as shown in the Drawings unless authorized otherwise in writing by the Engineer, except in the case of concrete in cofferdam seals. No payment will be made for concrete below the established elevation of the bottom of the footing or seal, and no deduction will be made for pile heads, reinforcing steel, structural steel, bolts, weep holes, rustications, chamfers, edgers, bridge drains, joint filler, junction boxes, miscellaneous hardware and conduit and drain pipes under 6 inches diameter.

Class D or DX concrete, when used in the seals of underwater cofferdams, will be paid for on the basis of the actual volume deposited as determined by the average cross-sectional area of the inside of the

cofferdam except that no payment will be made for the volume so determined which is outside of an area which is bounded by vertical planes 1 foot outside of the neat lines of the seal. The limiting vertical planes shall be parallel to the location of the neat lines based upon the traverse and longitudinal centerlines of the seal as shown on the Drawings.

Measurement for "Steel Reinforcing Bar" will be by the pound in place as calculated from the Drawings, unless ordered otherwise in writing by the Engineer. No allowance will be made for spreaders, form blocks, wire clips or other fastenings, which must be furnished by the Contractor. When splices are made other than those shown in the Drawings, no allowance will be made for the extra steel required. When shear steel is required at construction joints which are not shown in the Drawings, and which are permitted for the Contractor's convenience, no allowance will be made for the additional steel required.

Measurement for "Superstructure" will be by lump sum. Separate measurement will not be made for those quantities described in Section 6-02.3(27) as being included with the "Superstructure."

When a bid item for "Superstructure" is included on the Bid Form, no measurement will be made for concrete or reinforcing steel placed in the area defined as superstructure.

Measurement for "Steel Reinforcing Bar, Epoxy Coated" will be by the pound before epoxy coating is applied, as set forth above for uncoated steel reinforcing bars.

Measurement for "Wire Mesh (Gage)(Mesh Size)" will be by the square yard for the area covered as calculated from the Drawings. No extra allowance will be made for required overlap of mesh.

Measurement for "Expansion Joint (Type)" or "Compression Seal (Type)" will not be made at or between the abutment expansion joints when there is a bid item for "Superstructure". Otherwise, Measurement for "Expansion Joint (Type)" or "Compression Seal (Type)" will be per linear foot along the slope including length along miter joints.

Measurement for "Downspout, Galvanized Steel Pipe (Diameter)" will be by the linear foot along the center line of the pipe through fittings, except when there is not an item for downspout in the Bid Form, in which case no separate payment will be made.

Measurement for "Drill Holes for Dowels" will be by the linear foot of holes drilled.

Measurement for "Repair of Spalled and Delaminated Concrete" will be by lump sum.

Measurement for "Injection of Concrete Crack" will be by lump sum.

Measurement for gravel backfill for drains will be by the cubic yard as Mineral Aggregate (Type) per Section 1-09.1.

#### 6-02.5 PAYMENT

Delete this section and replace with the following:

Compensation for the cost necessary to complete the work described in Section 6-02 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Concrete (Class) (Use)," per cubic yard.
- (2) "Steel Reinforcing Bar," per pound.
- (3) "Steel Reinforcing Bar, Epoxy Coated," per pound.
- (4) "Wire Mesh (Gage)(Mesh Size)," per square yard.
- (5) "Expansion Joint (Type)," per linear foot.
- (6) "Compression Seal (Type)," per linear foot.
- (7) "Downspout, Galvanized Steel Pipe, (Diameter)," per linear foot.
- (8) "Superstructure," per lump sum.
- (9) "Drill Holes," per linear foot.

(10) "Repair of Spalled and Delaminated Concrete," per lump sum.

(11) "Epoxy Injection of Cracks," per lump sum.

(12) "Bridge Drains," per each.

The unit contract price for "Concrete (Class) (Use)" shall include all costs for the work required to furnish and install structural concrete in place including falsework, forms, expansion joint material, and construction of weep holes including gravel backfill for drains surrounding the weep holes. The contract price shall exclude concrete in the superstructure when this is covered by a separate bid item.

The unit contract price for "Steel Reinforcing Bar" or "Steel Reinforcing Bar, Epoxy Coated" shall include all costs for the work required to furnish, fabricate, coat, and place the steel reinforcement as specified, and to provide a bar list/bending diagram. In structures of reinforced concrete where there are no structural steel bid items, such minor metal parts as expansion joints, bearing assemblies, and bolts will be paid for at the unit contract price for reinforcing steel unless otherwise specified. When a bid item for "Superstructure" is included in the Bid Form, all reinforcing steel in the superstructure shall be incidental to the bid item "Superstructure".

The unit contract price for "Wire Mesh (Gage) (Mesh Size)", shall include all costs required to furnish and place the mesh as specified.

The lump sum contract price for "Superstructure" shall include all costs for the work required to furnish and install all items described herein to be complete as specified. No separate payment will be made for these items described in Section 6-02.3(27) as being included with the "Superstructure".

All costs in connection with lifting, transporting, and erecting girders including inserts, shims for leveling, grout, field cutting and bending, rebar for drains, welding, blockouts in girders and slabs, and special construction features shall be included in the lump sum contract price for "Superstructure".

The unit contract price for "Expansion Joint (Type)", shall include all costs to furnish and install the complete expansion joint system as specified, including hardware and miter joints. Refer to Section 6-02.4, paragraph 7 herein.

The unit contract price for "Compression Seal (Type)" shall include all costs for the work required to furnish and install the compression seal in place. All costs in connection with the compression seals in the deck, sidewalk slabs, concrete overlay, curbs and abutment backwalls, including miter joints, lubricant adhesive, samples and all necessary items to make a complete installation shall be included in the unit contract price for "Compression Seal (Type)".

The unit contract price for "Downspout, Galvanized Steel Pipe", shall be full compensation for all costs in connection with furnishing and installing the downspouts, including shop drawings, field measuring, galvanizing, and other items necessary to make a complete construction as specified.

The unit contract price for "Drill Holes" shall include all costs for the work required to perform the drilling as specified.

The unit contract price for "Repair of Spalled and Delaminated Concrete" shall include all costs for the work specified in Section 6-02.3(32).

The unit contract price for "Epoxy Injection of Cracks" shall include all costs for the work specified in Section 6-02.3(33).

All necessary items not specifically listed as a contract bid item in the Bid Form, and payment is not otherwise provided, shall be considered to be included in the various items comprising this improvement. No separate payment will be made.

Structure excavation, shoring, cribbing, and cofferdams will be paid in accordance with Section 2-09.

Gravel backfill for walls and gravel backfill for drains will be paid as Mineral Aggregate (Type) in accordance with Section 4-01.5.

Structural removals will be paid in accordance with Section 2-02.

The unit contract price for "Bridge Drain" shall be full compensation for all materials, labor, and equipment necessary to install drain and grate to structure. Grate shall be Vane Grate.

## SECTION 6-03 - STEEL STRUCTURES

## 6-03.3(8) SHOP PLANS

Delete paragraph 2 and replace with the following:

The Contractor shall submit shop detail plans in accordance with Section 1-05.3, except that for grade separation structures which carry a railroad over a highway, 4 additional sets are required for each railroad company involved. Sheets returned for correction shall be corrected, and the required number of corrected sheets shall be submitted for approval. No material shall be fabricated until the plans have been approved by the Engineer.

## 6-03.3(9) SUBSTITUTIONS

The second sentence is revised to read:

Should the substitution of heavier members be allowed upon the Contractor's request, the substitution shall be at no additional cost to the Owner.

## 6-03.3(14) FALSEWORK

This section is revised to read:

All falsework and forms shall conform to the requirements specified in Section 6-02.

## 6-03.3(20)B APPLICATION

All paint shall be applied by brushing unless other methods are specifically stated in the Special Provisions or authorized in writing by the Engineer. Painting shall be done in a workmanlike manner by competent painters yielding a minimum thickness in accordance with Section 6-07.3(6) of the Standard Specifications.

## 6-03.3(28) ASSEMBLING AND BOLTING

Delete paragraph 8 and replace with the following:

Where bolted connections are shown in the Drawings or specifically authorized, all bolts, nuts, and washers shall conform to the specifications for material and assembly of structural joints using high strength steel bolts as provided in Division I, Design, Article 10.32.3, and Division II, Construction, Articles 10.3 and 10.17 of the current AASHTO Standard Specifications for Highway Bridges.

## 6-03.4 MEASUREMENT

Delete paragraph 1 and replace with the following:

Structural carbon steel, structural low alloy steel, and structural high strength steel will be measured by the pound.

## 6-03.5 PAYMENT

Delete first 3 bid items and replace with the following:

- (1) "Structural Carbon Steel" per pound.
- (2) "Structural Low Alloy Steel" per pound.
- (3) "Structural High Strength Steel" per pound.

Delete paragraphs 2, 3, 4, and replace with the following:

The contract bid price per pound for the items listed above shall be full compensation for all costs in connection with furnishing all materials, labor, tools and equipment necessary for manufacture,

fabrication, transportation, erection and painting, including protective coating or treatment as may be called for on the Drawings or in the Project Manual.

Delete paragraph 5 and replace with the following:

Prospective bidders shall verify the estimated weight of structural steel before submitting the bid.

Delete paragraphs 6, 7, and 8.

## SECTION 6-04 - TIMBER STRUCTURES

## 6-04.3(6) BOLTS, WASHERS AND OTHER HARDWARE

Delete paragraph 4 and replace with the following:

Where flat head bolts are specified, washers shall be used under the nuts only. Details for flat head bolts shall be as shown on the Drawings.

## SECTION 6-05 - PILING

## 6-05.3(1)A ORDERING PILING

Delete paragraph 1 and replace with the following:

All piling shall be ordered by the Contractor and he shall determine the length required from the results obtained by the driving of the test piles called for in the Drawings and subsurface exploration data. The Contractor shall increase the lengths, at his own expense, the necessary amount to provide for fresh heading and to reach from the cutoff elevation up to the position of his driving equipment.

Any pile which is damaged or destroyed before or at the time it is being driven shall be replaced by the Contractor at his own expense.

## 6-05.3(1)B DRIVING PILES

Delete paragraphs 2 and 3, and replace with the following:

Piles shall be driven to depths sufficient to develop the load bearing capacity shown in the Drawings, but not less than 10 feet. When minimum tip elevation is specified, piles shall be driven to reach the specified minimum tip elevation unless otherwise directed by the Engineer. If the load bearing capacity of the piles has not been reached at the specified tip elevation, driving shall continue until the load bearing capacity is reached.

Delete the second sentence of paragraph 8.

## 6-05.3(1)C EQUIPMENT FOR DRIVING

Delete paragraph 6 and replace with the following:

Precast concrete piles 13 inch, 16 inch, and 18 inch in diameter shall be driven with a single-acting steam, air, or diesel hammer. The hammer used shall develop not less than 13,000 foot-pounds of energy per blow for 13 inch pile and not less than 24,000 foot-pounds of energy per blow for 16 inch and 18 inch piles. The ram weight shall be not less than half the weight of the pile and the ratio of foot-pounds of energy to ram weight shall not exceed 6.

## 6-05.3(1)D TEST PILES

Delete paragraph 1 and replace with the following:

When specified in the Drawings or ordered by the Engineer, the Contractor shall drive test piles to determine the lengths of piling required to obtain the necessary load carrying capacity or penetration. These piles shall be driven at the locations designated by the Engineer and shall be of sufficient length to provide for any variation in soil conditions. Test piles shall be of the same material as the permanent piles and shall be driven with a pile tip when pile tips are specified for the permanent piles and shall be prebored when preboring is specified for the permanent piles. Test piles for treated timber piles may be either treated or untreated timber piles conforming to the requirements of these Specifications. Timber test piles shall have approximately the same tip diameter as the permanent piles. Steel shells or casings used as test piles for cast-in-place concrete piles, and precast concrete and steel test piles shall have the same cross section and other characteristics as the permanent piles.

## 6-05.3(2)F DETERMINATION OF BEARING VALUES

Delete paragraph 1 and replace with the following:

The safe bearing values for timber piles shall be determined by the following formulas.

$$P = \frac{2WH}{SPT.U} \text{ for gravity hammers}$$

$$P = \frac{2WH}{SPT.I} \text{ for all single-acting hammers and closed end (double acting) diesel hammers*}$$

$$P = \frac{2 H(W+Ap)}{S+0.1} \text{ for double-acting steam or air hammers}$$

Where P = safe bearing power in pounds.

W = weight in pounds, of striking parts of hammer.

H = drop of hammer or stroke of ram, in feet.

A = area of piston in square inches.

p = steam pressure in pounds per square inch at the hammer.

S = the average penetration in inches per blow for the last 5 to 10 blows for gravity hammers and the last 10 to 20 blows for steam or air hammers.

\* For closed end diesel hammers (double acting) the energy (WH) is to be determined from the bounce chamber reading. Bounce chamber gauge is to be calibrated for each project.

#### 6-05.3(3)C CURING

Delete paragraph 1 and replace with the following:

Precast concrete piling shall be cured with water. The concrete shall be kept wet continuously for a period of not less than 10 days when Type II portland cement is used, and not less than 3 days when Type III cement is used. Side forms may be removed at any time after 24 hours from the placing of the concrete, provided the air temperature surrounding the concrete is maintained at a minimum temperature of 50 degrees Fahrenheit for a period of 5 days when Type II portland cement is used or 3 days when Type III cement is used. Piling shall not be subjected to any handling stresses until the concrete has attained a strength of at least 3,300 psi, as determined by test cylinders cured with the piling. Test cylinders shall be cast with each set of piles as they are poured.

#### 6-05.3(3)G EXTENSIONS OR BUILD-UPS

The last sentence of the third paragraph is revised to read:

The concrete in the build-up shall have a minimum compressive strength of 4000 psi at 28 days for precast piles and 5000 psi at 28 days for precast-prestressed piles.

#### 6-05.3(3)I PRESTRESSING STEEL

The following new section is added after Section 6-05.3(3)H:

##### 6-05.3(3)I Prestressing Steel

Prestressing steel shall meet the requirements of Section 9-07.6.

Prestressing steel shall be tensioned in accordance with Section 6-02.3(25)E. 6-02.3(25)E.

#### 6-05.3(4)B DRIVING AND INSPECTION OF STEEL CASINGS

The first sentence of the fifth paragraph is revised to read:

Where piles with steel casings are used, and a portion of the pile is exposed to view above the finish ground line or the low water line in water crossings, the steel casings shall not extend above the elevation of 0.5 feet below the finish ground line or above the low water line as determined by the Engineer.

#### 6-05.3(4)C REINFORCEMENT

Delete this section and replace with the following:

Reinforcing steel for cast-in-place concrete piles shall be: six No. 5 bars for 12-inch diameter 55 ton pile; seven No. 5 bars for 14-inch diameter 70 ton pile; 1.5 percent of the cross-sectional area of the concrete, using No. 5 bars for all other pile sizes.

Reinforcement shall extend to the bottom of the pile or 25 feet below the ground line, whichever is less. Reinforcement shall extend a minimum of 2 feet into the footing or pile cap or to 2 inches from the top of the footing or pile cap.

All bars shall be rigidly fastened together in a single unit which shall be lowered into the casing before the concrete is placed. No loose bars will be permitted. The reinforcement shall be carefully

positioned and securely fastened in such a manner as to ensure 2 inches clearance between the main reinforcing bars and the pile casing.

Spiral hooping reinforcing steel shall be placed at 4-inch centers around the top 10 feet of the main reinforcement. This spiral hooping shall be No. 3 deformed steel bar, 3/8-inch diameter plain steel bar, W11 cold drawn wire or D11 deformed wire. Spiral hooping reinforcing steel shall be placed at 6-inch centers around the remainder of the main reinforcement. This spiral hooping shall be W5 cold drawn wire or D5 deformed wire.

#### 6-05.3(4)D PLACING CONCRETE

The first paragraph is revised by adding the following after the second sentence:

Such vibration shall extend 25 feet below the top of the pile or to the bottom of the pile, whichever is less.

#### 6-05.3(5)C DETERMINATION OF BEARING CAPACITIES (New Section)

Bearing capacities of prestressed hollow concrete piling shall be determined by the formulas under Section 6-05.3(2)F.

#### 6-05.4 MEASUREMENT

Delete paragraphs 2 and 3, and replace with the following:

Measurement for furnishing timber piling (untreated or name treatment) will be the number of linear feet actually driven below cutoff.

Measurement of composite piles made with 2 or more pile sections spliced together as 1 pile will be the number of linear feet actually driven below cutoff for each type of pile used.

Delete paragraphs 5, 6, and 7, and replace with the following:

Composite piling made with an untreated timber lower section and a reinforced concrete upper section spliced together will be considered as one pile. Measurement will be the number of linear feet actually driven below cutoff for each type of pile used.

Measurement for furnishing concrete piling will be as follows:

Precast concrete and precast-prestressed concrete piling: Measurement will be the number of linear feet actually driven below cutoff.

Cast-in-place concrete piling: Measurement will be the number of linear feet actually placed.

Measurement for furnishing steel piling will be the number of linear feet actually driven below cutoff.

#### 6-05.5 PAYMENT

Delete paragraph 2 and replace with the following:

Test piles will be paid for at the unit contract price per each for "Furnishing and Driving (Kind) Test Pile", which price shall be full compensation for furnishing and driving test piles, and furnishing and installing a pile tip when pile tips are specified for the permanent piles, preboring when preboring is specified for the permanent piles, to the bearing capacity or penetration required by the Engineer and for pulling the piles or cutting them off, as required, and for removing them from the site or for delivery to the State for salvage when ordered by the Engineer. This price shall also include all costs in connection with moving all pile driving equipment or other necessary equipment to the site of the work and for removing all such equipment from the site after the piles have been driven. If, after the test piles have been driven, it is found necessary to eliminate the piling from all or any part of the structure, no additional compensation will be allowed for moving the pile driving equipment to and from the site of the work.



## SECTION 6-06 - BRIDGE RAILINGS

## 6-06.5 PAYMENT

Supplement paragraph 1 with the following item:

- (3) "Metal Railing (Type)," per linear foot.

## SECTION 6-07 - PAINTING

## 6-07.3(4) PAINTING GALVANIZED RAIL

Delete this title and section, and replace with the following:

## 6-07.3(4) PAINTING GALVANIZED SURFACES (6-21-85)

All galvanized surfaces to be painted shall be prepared and painted as follows:

- (a) Clean all surfaces thoroughly with toluene base solvent.
- (b) Wipe off the solvent with clean rags until surface is dry.
- (c) Apply a 5% solution of phosphoric acid or a copper sulphate solution to the surface. NOTE: Since copper sulphate stains adjacent surfaces such as fresh concrete, do not use in the field.
- (d) After the pretreatment solution has been on the surfaces for a short time and the chemical action has stopped, the surfaces should be thoroughly rinsed with fresh, clean water and allowed to dry.
- (e) The clean and dry surface shall be painted according to the following schedule:
  - A-4-83 Phenolic Red Lead Primer - Shop Coat.
  - B-4-83 Phenolic First Field Coat.
  - C-9-83 Phenolic Finish Field Coat.

The color of the finish field coat shall be tinted Pioneer Square Green unless indicated otherwise in the Project Manual. The finish color shall match the color sample available at the Materials Laboratory of the Seattle Engineering Department.

## SECTION 6-09 - CRIBBING

Delete all references to "Structure Excavation Class B" and "Structure Excavation Class B Including Haul," and replace with "Structure Excavation."

## 6-09.2 MATERIALS

The following material is deleted:

Fiber Bonded Metal Cribbing.....9-27.2

## 6-09.3(5) METAL CRIBBING

The third paragraph is deleted.

The following paragraph is added after the sixth paragraph:

Excavation for metal cribbing shall be performed in accordance with Section 2-09 for structure excavation Class B.

## 6-09.4 MEASUREMENT

The first paragraph is revised to read:

Measurement for metal cribbing will be on the square foot basis by adding the facial areas of the bins of the various types of metal retaining walls.

## 6-09.5 PAYMENT

The first paragraph is revised by deleting the following bid item:

- (2) "Fiber Bonded Metal Cribbing Type \_\_\_\_ Design \_\_\_\_", per square foot.

The first sentence of the second paragraph is revised to read:

The unit contract prices per cubic yard for "Structure Excavation Class B", "Structure Excavation Class B Including Haul", and per square foot for "Metal Cribbing Type \_\_\_\_ Design \_\_\_\_", shall be full pay for furnishing all labor, materials, tools, and equipment necessary for construction and backfilling of the metal cribbing.

## DIVISION 7

DRAINAGE STRUCTURES, STORM SEWERS, SANITARY SEWERS  
WATER MAINS AND CONDUITS

Delete this title and replace with the following:

## DIVISION 7

STORM DRAINS, CULVERTS, SANITARY AND COMBINED SEWERS,  
WATER MAINS AND RELATED STRUCTURES

## SECTION 7-01 DRAINS

## 7-01.1 DESCRIPTION

Supplement this section with the following:

This work shall also consist of constructing sidewalk drains as specified herein and in accordance with the Standard Plans. The work shall include installing a 4-inch drain pipe under the sidewalk, installing a 12-inch x 12-inch gravel drain behind the sidewalk, installing filter fabric, saw cutting and removing the curb, and constructing a reinforced cement concrete curb block.

## 7-01.2 MATERIALS

Delete the following items and their references:

Asbestos Cement Drain Pipe . . . . . 9-05.1(4)  
Perforated Bituminized Fiber Underdrain Pipe. . . . . 9-05.2(3)

Delete reference to "bituminized fiber" in paragraph 3.

Delete reference to "asbestos cement" in paragraphs 2 and 3.

Supplement this section with the following:

Filter fabric. . . . . 9-05.17

Gravel for the gravel drain and gravel backfill for drain shall be Mineral Aggregate Type 26, meeting the requirements of Section 9-03.16.

## 7-01.3 CONSTRUCTION REQUIREMENTS

Delete paragraph 3 and replace with the following:

The underdrain trench shall be dug to the required alignment and grade only so far in advance of pipe laying as the Engineer will approve. The clear width of unsheeted or sheeted trench measured at the horizontal diameter of the pipe in place shall be 24 inches, or 1 foot greater than the outside diameter of the pipe, whichever is the greater. Any part of the trench excavated below grade or to a greater width than specified shall be backfilled at the expense of the Contractor with filter material hereinafter described.

Extreme care shall be exercised by the Contractor at all times during the performance of the work to maintain the trench. There shall be no mixing of the excavated material with the filter material to be used for backfilling. All excess excavated material not required elsewhere on the project shall be disposed of by the Contractor, unless otherwise provided for in the Special Provisions.

The gravel filter material for drain shall be damp when placed in the trench and shall be deposited uniformly on both sides of the pipe for the full width of the trench and to the springline of the pipe. The material shall be tamped in 4-inch layers to provide thorough compaction under and on each side of the pipe. Succeeding layers of gravel shall be deposited in 8-inch layers and be thoroughly compacted to the depth shown on the Drawings, or as specified.

The drainage fabric shall be placed in the manner and at the locations shown on the Drawings. The surface to receive the fabric and/or the trench into which the fabric is to be placed shall be free of obstructions and debris.

Should the fabric be damaged during construction, the torn or punctured section shall be repaired by placing a piece of fabric that is large enough to cover the damaged area and to meet the overlap requirement. Adjacent borders of the fabric shall be overlapped a minimum of 12 inches or sewn.

The Contractor shall construct sidewalk drains where indicated on the Drawings or where designated by the Engineer.

Where shown on the construction plans for sidewalks or directed by the Engineer, 4-inch approved drain pipe shall be placed under the sidewalk in 1 length and extended across the planting area to the roadway gutter line, or if existing, through curb. See the Standard Plans.

The slope of the 4-inch drain pipe will be established in the field by the Engineer at the time of excavating for the sidewalk construction.

Sidewalk drain pipe will be paid for on a basis of linear feet for inlet depths at the gravel pocket.

The unit contract price shall include all labor, tools, drain in accordance with the details shown on the Standard Plan, including an excavation at the inlet end of the pipe to make a gravel pocket corresponding to that shown on the Standard Plan, Section A-A, that is a minimum of 3 feet in length parallel to the back of the sidewalk.

One end of the drain pipe shall terminate at a gravel drain behind the sidewalk. The opposite end of the drain pipe shall terminate at the gutter line or face of the curb. Where curb exists or new curb is to be installed under the contract, the curb side terminus of the drain pipe shall be encased in an 18-inch x 24-inch reinforced cement concrete curb block of the depth indicated on Standard Plan No. 281.

The gravel drain shall be 12 inches x 12 inches and of the length indicated on the Drawings.

Clearances between water mains and drains shall be maintained per Section 1-07.17(1).

#### 7-01.4 MEASUREMENT

Delete this section and replace with the following:

Measurement for "Pipe, Perforated, (Type), (Size)" will be by linear foot installed.

Measurement for "Gravel Filter Material" will be per cubic yard based on the neat line cross section indicated on the Drawings.

Measurement for "Filter Fabric" will be per square yard installed. Measurement will not be made for extra fabric required to meet overlap requirements.

Measurement for "Sidewalk Drain, 4-inch, Type 281" will be by the linear foot of drain pipe.

Measurement for "Gravel Drain, Type 281," will be by the linear foot of drain.

#### 7-01.5 PAYMENT

Delete this section and replace with the following:

Compensation for the cost necessary to complete the work described in Section 7-01 will be made at the unit contract prices only for the pay items listed or referenced below:

- (1) "Pipe, Perforated, (Type), (Size)," per linear foot.
- (2) "Gravel Filter Material" per cubic yard.
- (3) "Filter Fabric" per square yard.
- (4) "Sidewalk Drain, 4-inch, Type 281" per linear foot.
- (5) "Gravel Drain, Type 281" per linear foot.

The unit contract price for "Pipe, Perforated, (Type), (Size)" shall include all costs for the work required to furnish and install the pipe.

The unit contract price of "Gravel Filter Material" shall include all costs for the work required to furnish and install and compact Mineral Aggregate Type 26.

The unit contract price of "Filter Fabric" shall include all costs for the work required to furnish and install the filter fabric.

The unit contract price for "Sidewalk Drain, 4 inch, Type 281" shall include all costs for the work required to furnish and install the drain pipe and the reinforced concrete curb block at the curb face, excavation and backfill and to saw cut and remove the existing curb.

The unit contract price for "Gravel Drain, Type 281" shall include all costs for the work required to excavate a trench 12 inches wide, fill it with Mineral Aggregate Type 26 to a depth of 12 inches, install filter fabric and backfill trench with suitable excavated material.

## SECTION 7-04 - STORM SEWERS

Delete Section 7-04 in its entirety. Refer to Section 7-17.

## SECTION 7-05 - MANHOLES, GRATE INLETS, DROP INLETS, AND CATCH BASINS

Delete the title and content of Section 7-05 in its entirety and replace with the following:

## SECTION 7-05 - MANHOLES, CATCH BASINS, AND INLETS (New Section)

## 7-05.1 DESCRIPTION (New Section)

This work shall consist of excavation, shoring, foundation preparation, bedding, backfilling, compacting and disposal of surplus material for the construction of manholes, catch basins and inlets.

All work, including excavation, foundation preparation, backfilling and compacting for the construction of manholes, catch basins, and inlets shall meet the general construction requirements of Section 7-17.

## 7-05.2 MATERIALS (New Section)

Materials shall meet the requirements of the following sections of these Specifications:

Reinforced Concrete	9-12.1
Steps	9-12.2
Ladders	9-12.3
Mortar	9-12.4
Non-Shrink Grout	6-02.3(2)E
Concrete Masonry Units	9-12.5
Concrete Brick	9-12.6
Clay Brick	9-12.7
Frames and Covers	9-05.15
Precast Manhole Components	9-12.9
Monolithic Concrete Manholes	9-12.11
Traps	9-12.12
Joints	9-12.9(7)

Manholes, catch basins and inlets shall be constructed of pre-cast units in accordance to Standard Plans. Any deviations from Standard Plans will be subject to a shop drawing submitted by Contractor and approved by the Engineer. Concrete blocks or clay bricks may be used for adjustment of the casting to final street grade.

Joints between manhole elements shall be rubber gasket.

## 7-05.3 CONSTRUCTION REQUIREMENTS (New Section)

## 7-05.3(1) FOUNDATION PREPARATION (New Section)

## 7-05.3(1)A DEWATERING (New Section)

Dewatering of manhole and catch basin excavations shall conform to the requirements for trench dewatering in Section 7-17.3(1)A.

## 7-05.3(1)B SUB-BASE PREPARATION (New Section)

Adequate foundation shall be obtained by removal of unsuitable material and replacement with well graded granular material; or with coarse ballast rock, or by such other means as provided for foundation preparation of the connected sewers, or as required in the Special Provisions. Where water is encountered in the excavation, all cast-in-place bases or monolithic structures shall be placed on a one-piece waterproof membrane, so placed as to prevent any movement of water into the fresh concrete.

## 7-05.3(2) BEDDING FOR PRECAST BASE SECTION (New Section)

Unless otherwise provided in the Special Provisions or directed by the Engineer, manholes and catch basins constructed with precast base sections shall be placed to grade upon a 4-inch minimum thickness of Mineral Aggregate Type 9 per Section 9-03 mixed with 4 sacks of portland cement per cubic yard of mineral aggregate, with sufficient water added to form a stabilized layer. The mixed material shall be

placed across the entire width of the base excavation and leveled so as to provide bearing contact with the entire bottom area of the precast base section.

#### 7-05.3(3) BEDDING FOR CAST-IN-PLACE BASE SECTION (New Section)

Manholes and catch basins constructed with cast-in-place bases shall be poured to grade upon undisturbed earth or may require 4 inches of Mineral Aggregate Type 2 to be compacted in place prior to pouring the base. The Mineral Aggregate shall be placed across the entire width of the excavation and leveled. The base shall be poured to thickness as specified in the Standard Plans.

#### 7-05.3(4) MANHOLES WITH MONOLITHIC BASE (New Section)

Monolithic concrete base manholes shall be constructed as shown on the Standard Plan. The manhole base sections shall be formed and cast in place around the existing large diameter pipe.

#### 7-05.3(5) DIMENSIONS (New Section)

Manholes, catch basins, or inlets shown on the Drawings shall conform in all respects to the applicable requirements on the corresponding Standard Plan for each type specified.

#### 7-05.3(6) PRECAST MANHOLES (New Section)

##### 7-05.3(6)A PRECAST BASE (New Section)

The base section shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment, and ensuring that all entering pipes can be inserted on proper grade.

All lift holes shall be thoroughly wetted and then completely filled with mortar, and smoothed both inside and out to ensure watertightness. All joints between precast sections shall be rubber-gasketed joints.

Precast sections shall be placed and aligned to provide vertical sides and vertical alignment of the ladder runs. The completed manhole shall be rigid, true to dimensions, and watertight.

In precast manhole sections where steel loops have been provided in lieu of lift holes, the loops shall be removed flush with the inside wall surface after the manhole has been completed. No sharp cutoff protrusion will be permitted. If concrete spalling occurs as a result of the loop removal, the spalled area shall be restored in a workmanlike manner to a uniform smooth surface with mortar.

##### 7-05.3(6)B CAST IN PLACE BASE (New Section)

The first precast section shall be placed on the monolithic base structure before the base has taken initial set, and shall be carefully adjusted to true grade and alignment with all inlet pipes properly installed so as to form an integral, watertight unit; or the section shall be mortared into a suitable groove provided in the top of the monolithic base. The first section shall be uniformly supported by the base concrete, and shall not bear directly on any of the pipes.

All lift holes and all pipes between precast elements and cast-in-place bases or structures shall be thoroughly wetted, completely filled with mortar, and smoothed and pointed both inside and out to ensure watertightness.

Precast sections shall be placed and aligned so as to provide vertical sides and vertical alignment of the ladder rungs. The completed manhole shall be rigid, true to dimension, and watertight.

#### 7-05.3(7) VACANT

#### 7-05.3(8) SHOP FABRICATED CORRUGATED METAL MANHOLES (New Section)

Shop fabricated corrugated metal manholes, shall be constructed in strict accordance with the Drawings and shop drawings as approved by the Engineer, and shall conform to all applicable provisions of these Specifications.

#### 7-05.3(9) MANHOLE AND CATCH BASIN GRADE ADJUSTMENT (New Section)

The Contractor shall initially construct manholes and catch basins of the type specified on the Drawings so as to provide adjustment space of not less than 8 inches or more than 17 inches between the top of the cone or slab and the underside of the frame and cover to street grade or ground surface. The grade sheet furnished by the Engineer shows the approximate top grade for the structure plus or minus 0.2 foot, and the final grade will be set by the Engineer.

Final elevation and slope of the frame and cover shall conform to the restored street surface. No warping of grades in lieu of manhole frame adjustment will be allowed. All joints in the brick or ring adjustment shall be filled with mortar, and the casting shall be seated in mortar placed on the top course. A 3/8 inch thick mortar lining shall be installed inside and out of the adjustment section to provide a smooth, watertight finish.

No separate payment for final adjustment of the frame and cover for new construction will be made and all costs thereof shall be considered incidental and included in the unit contract price for the manhole or catch basin, except as provided for in Section 7-05.5.

#### 7-05.3(10) INLET GRADE ADJUSTMENT (New Section)

The inlet frame may be either cast into a concrete collar or set flange down on a minimum of one row of concrete adjustment blocks and mortared. It shall not, in any case, be grouted to final grade until the final elevation of the pavement, gutter, ditch or sidewalk in which it is to be placed has been established and permission has been given by the Engineer to mortar the casting in place. Location of inlet will be staked by the Engineer. The bottom of the inlet shall be level with the invert of the outlet pipe.

#### 7-05.3(11) MANHOLE CHANNELS (New Section)

Manhole Channels shall be made to conform accurately to the sewer grade and shall be brought together smoothly with well rounded junctions, satisfactory to the Engineer. Channel sides shall be carried up vertically to the crown elevation of the various pipes, and the concrete shelf between channels shall be smoothly finished and warped evenly with slopes to drain.

#### 7-05.3(12) MANHOLE PIPE CONNECTIONS (New Section)

All pipes except OMP entering or leaving the manhole shall be provided with flexible joints within 1/2 of a pipe diameter or 12 inches, whichever is greater, from the outside face of the manhole structure and shall be placed on firmly compacted bedding, particularly within the area of the manhole excavation which normally is deeper than that of the sewer trench. Special care shall be taken to see that the openings through which pipes enter the manhole are completely and firmly rammed full of non-shrink grout to ensure watertightness.

#### 7-05.3(13) PIPE CONNECTIONS FOR CATCH BASINS AND INLETS (New Section)

All new catch basins shall be provided with openings or knockouts for insertion of pipe connections and a trap for the outlet pipe. When connections are to be made to existing catch basins with no available hole or knockout, the Contractor shall core drill or line drill an opening to match the size of pipe to be inserted. After pipes or traps have been placed to their final position, they shall be grouted tight in place in a workmanlike manner to present an inside and outside surface conforming to the Standard Plans. Upstream pipes penetrating the walls of catch basins or inlets shall be placed with the bell facing out such that the bell is placed snug against the outside wall of the structure as the angle of penetration allows.

For "Catch Basin Connection" and "Inlet Connection", see Section 7-08.3(4) and Section 7-08.3(5), respectively.

Where a "knockout" of adequate size is not provided, connections to structures shall be accomplished by core drilling, line drilling or wall sawing. Where line drilling is the method used, the drilled holes must be interconnecting. All openings must provide a minimum of 1 inch and a maximum of 2 inches clearance around the circumference of the pipe. Line drilling shall be accomplished by the use of a small core drill or a rotary hammer. Jackhammers shall not be used.

Pipe leaving or entering catch basins and inlets shall be provided with a flexible joint within 1/2 a pipe diameter, or 12 inches, whichever is greater.



## 7-05.3(14) RELOCATE EXISTING CATCH BASIN OR INLET (New Section)

Work required for relocation of existing catch basin or inlet shall include necessary excavation to remove without damage the existing catch basin or inlet, its frame and grate or cover and transporting to the new location where shown on Drawing or designated by the Engineer, and the excavation, placement backfill and compaction around catch basin or inlet. Backfill and compaction shall be in accordance to Section 7-17.

## 7-05.3(15) REBUILD EXISTING CATCH BASIN (New Section)

Where noted on the Drawing, the Contractor shall rebuild existing catch basin to accommodate a new frame and grate. Work required to rebuild catch basin includes excavation, the removal of the existing frame and grate, leveling bricks, upper portion of catch basin chamber, and installing a new cone section, leveling bricks and new frame and grate. Excavation, backfill, and compaction shall conform to the applicable portions of Section 7-17. Salvage shall be in accordance to Section 2-02.3(7).

## 7-05.3(16) BACKFILL (New Section)

Backfill around the manhole above the pipe zone shall consist of selected native material and shall conform to the applicable provisions of Section 7-17.3(3) "Backfilling Sewer Trenches". Compaction of backfill shall be by means of mechanical tampers to 95% of maximum density in accordance with Section 7-17.3(3)A "Compaction of Trench Backfill."

Backfill and compaction of backfill around a catch basin shall provide adequate foundation support for shallow inlet and outlet connection pipe, and shall meet requirements for backfill and compaction around a manhole as stated above.

## 7-05.4 MEASUREMENT (New Section)

Measurement for "Manhole (Type)" will be per each.

Measurement for "Extra Depth (Type) Manhole," will be by the vertical foot for all depth in excess of 10 feet measured from the invert of the outlet pipe to the top of the casting.

Measurement for "Rechannel Manhole" will be per each.

Measurement for "Catch Basin (Type)" will be per each.

Measurement for "Inlet (Type)" will be per each.

Measurement for "Rebuild (Item)" will be per each.

Measurement for "Relocate (Item)" will be per each.

## 7-05.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 7-05 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Manhole (Type)," per each.
- (2) "Extra Depth, (Type) Manhole," per vertical foot.
- (3) "Rechannel Manhole," per each.
- (4) "Catch Basin (Type)," per each.
- (5) "Inlet (Type)," per each.
- (6) "Rebuild (Item)," per each.
- (7) "Relocate (Item)," per each.

The unit contract price for "Manhole (Type)" shall include all costs for furnishing and installing manholes complete to finish street grade, including excavation, bedding, mortar, non-shrink grout,

brick, block, castings, channeling, ladder, steps, connections to pipelines and backfill with suitable native material for a manhole depth up to and including 10 feet.

The unit contract price for "Extra Depth, (Type) Manhole" shall include all costs for the work required to construct the portion of a manhole in excess of 10 vertical feet deep.

The unit contract price for "Rechannel Manhole," shall include all costs to complete the manhole channeling work as specified in Section 7-05.3(11) when performed in an existing manhole.

Where a newly constructed manhole and cover casting has been completed to the finished grade set by the Engineer, and is later required to be adjusted up or down to a revised grade by the Engineer, the adjustment shall be paid in accordance with Section 7-20.

The unit contract price for "Catch Basin (Type)," shall include all costs for the work required to furnish and install the catch basin including trap, excavation and backfill with native material, adjustment brick and block, mortar, non-shrink grout, plaster, and castings.

The unit contract price for "Inlet (Type)," shall include all costs for the work required to furnish and install the inlet including excavation, brick, block, mortar, and castings.

When directed by the Engineer, Mineral Aggregate Type 17 or such other material acceptable to the Engineer shall be used as backfill and paid for per Section 4-01.5.

Payment for "Extra Excavation," will be per Section 2-03.

Payment for foundation material, when required by the Engineer, will be paid as "Mineral Aggregate (Type)" according to Section 7-17.5.

## SECTION 7-06 - CONCRETE PIPE ANCHORS

## 7-06.5 MEASUREMENT AND PAYMENT

Delete this section and replace with the following 2 sections:

## 7-06.4 MEASUREMENT

Payment for "Pipe Anchor," will be by each.

## 7-06.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-06 will be made at the unit contract price bid for the following item when included in the Bid Form.

- (1) "Pipe Anchor," per each.

The unit contract price for "Pipe Anchor," shall include all costs for the work specified in Section 7-06.

## SECTION 7-07 CLEANING EXISTING DRAINAGE STRUCTURES

## 7-07.3 MEASUREMENT

Delete this section and replace with the following:

Work described in Section 7-07 will not be measured for payment.

## 7-07.4 PAYMENT

Delete this section and replace with the following:

All work described in Section 7-07 shall be considered incidental to the various bid items comprising this improvement. No separate payment will be made.

## SECTION 7-08 MISCELLANEOUS PIPE CONNECTIONS (New Section)

## 7-08.1 DESCRIPTION (New Section)

This work shall consist of excavation, foundation preparation, bedding, backfilling and compacting for the construction of miscellaneous sanitary sewer and drain appurtenances other than those described in Sections 7-04 and 7-17.

## 7-08.2 MATERIALS (New Section)

Pipe used for connections as herein described shall conform to the applicable requirements in Section 9-05.

## 7-08.3 CONSTRUCTION DETAILS (New Section)

## 7-08.3(1) EXCAVATION AND BACKFILL (New Section)

Trench excavation and backfill shall be as specified in Section 7-17.

## 7-08.3(2) CONNECTIONS TO EXISTING STORM AND SANITARY SEWERS (New Section)

When making a connection to an existing storm drain, sanitary sewer line or manhole, the Contractor shall excavate and expose the existing facility where shown on the Drawings. In the event there is no existing tee or wye, refer to Section 7-17.3(2) CUT-IN TEE ON EXISTING PIPE.

## 7-08.3(3) PIPE LAYING, JOINTING AND TESTING (New Section)

Pipe laying, bedding, jointing and backfilling, and pipe connections shall conform to the applicable requirements of Section 7-17. Testing for acceptance as provided in Section 7-17.3(4) will not be required.

## 7-08.3(4) CATCH BASIN CONNECTIONS (New Section)

Catch basin connections are pipe lines connecting outlets of catch basins to a sewer, storm drain, or other facility. Both the alignment and the slope shall be on straight line, unless otherwise approved by the Engineer. In no case will 90 degree bends be allowed.

No connection shall be made to the catch basin spigot pipe until the excavation around the catch basin has been backfilled and compacted to an elevation which will provide support for pipe bedding and the connection pipe. Bedding for catch basin connection pipe shall be Class B bedding.

## 7-08.3(5) INLET CONNECTIONS (New Section)

Inlet connections are pipe connections from drainage inlets to catch basins or other approved outlets. Inlet connections shall be laid upgrade from catch basin openings or other originations in straight alignment and be on a uniform slope. Where a straight alignment, or a uniform slope is not feasible and curves are necessary, the altered alignment shall be made by deflecting each pipe into a smooth curve. Bends shall not be used. Deflection shall not exceed that necessary to maintain a watertight connection at each pipe joint.

Pipe connections shall not be made to a catch basin until the compaction requirements of Section 7-08.3(4) have been completed and approved by the Engineer. Bedding for inlet connection pipe shall be Class B bedding.

## 7-08.3(6) DROP CONNECTION (New Section)

Drop connections, used in conjunction with different types of manholes to allow for abrupt drop in elevation of the sewer line, shall be constructed of Ductile Iron Pipe in accordance with Standard Plan 233. Drop connections shall be constructed at the location indicated on the Drawings and shall match the given design invert elevations.

## 7-08.4 MEASUREMENT (New Section)

Measurement for "Catch Basin Connection," will be by the linear foot of pipe installed between the tee or wye in the receiving main pipe and the inside face of the catch basin.

Measurement for "Inlet Connection," will be by the linear foot of pipe installed between the inside face of the inlet, and the inside face of the catch basin.

Measurement for "Drop Connection," will be by the vertical foot from the invert at the bend to the invert at the tee.

## 7-08.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 7-08 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Pipe, Catch Basin Connection, (Material) (Class), (Size)," per linear foot.
- (2) "Pipe, Inlet Connection, (Material) (Class), (Size)," per linear foot.
- (3) "Drop Connection, (Size)," per vertical foot.

The unit contract price for "Pipe, Catch Basin Connection, (Material) (Class), (Size)," and "Pipe, Inlet Connection, (Material) (Class), (Size)," shall include all costs for the work required to furnish and install the pipe including connections to catch basins or inlets, excavation, backfill, and compaction.

The unit contract price for "Drop Connection, (Size)," shall include all costs for the work required to furnish and install the complete drop connection including the concrete footing, ductile iron spool and fittings at the drop connection and the ductile iron pipe to span to undisturbed native soil.

## SECTION 7-09 PIPE AND FITTINGS FOR WATER MAINS

## 7-09.1 DESCRIPTION

Delete paragraph 1 and replace with the following:

The work included under Sections 7-09 through 7-15 and the materials included in Section 9-30 shall apply to the construction of water distribution and transmission mains and appurtenances for both temporary and permanent installation.

Specification references made herein for manufactured materials such as pipe, hydrants, valves and fittings refer to designations for American Water Works Association (AWWA), United States of America Standards Institute (USASI), American National Standards Institute (ANSI) or to American Society of Testing and Materials (ASTM) which are in effect on the date of advertisement for bids.

The Contractor shall only install new unused materials suitable and approved for potable water supply.

## 7-09.2 MATERIALS

Delete paragraph 1 and list and replace with the following:

Materials shall meet the requirements of Section 9-30 as modified herein.

## SECTION 7-10 TRENCH EXCAVATION, BEDDING, AND BACKFILL FOR WATER MAINS

## 7-10.1 DESCRIPTION

Supplement this section with the following:

The specifications in this section apply to the construction of water distribution mains and appurtenances for both temporary and permanent installation under ordinary conditions.

Waste and borrow sites shall conform to the requirements of Section 1-04.12.

## 7-10.1(01)E FOUNDATION MATERIAL (New Section)

Foundation material shall include all materials placed below the bedding of the pipe to replace unsuitable foundation materials.

## 7-10.2 MATERIALS

Delete this section and replace with the following:

Materials specified as "Mineral Aggregate (Type)" shall be in accordance with Section 9-03.16.

## 7-10.3(01) GENERAL

Delete this section and replace with the following:

Material excavated from trenches and piled adjacent to the trench, or in a roadway or public thoroughfare, shall be piled and maintained so that the toe of the slope of the material is at least 2 feet from the edge of the trench. It shall be piled in such manner as will cause a minimum of inconvenience to public travel, and provisions shall be made for merging traffic where such is necessary. Free access shall be provided to fire hydrants, water valves, and meters, and clearance shall be left to enable free flow of storm water in gutters, other conduits, and natural watercourses.

Free access shall be maintained to all other utility control valves, meters and vaults.

## 7-10.3(05) GRADE AND ALIGNMENT

Delete paragraph 2 of this section and replace with the following:

Unless otherwise specified in the Drawings or Project Manual the depth of trenching for water mains shall be such to give a minimum depth of cover of 36 inches over the top of the pipe for 8-inch and smaller water mains. Depth of cover over larger water mains shall be in accord with the Standard Plan for "Locations for Underground Utilities." Deeper excavation may be required due to localized breaks in grade, or to install the new main under existing culverts or other utilities where necessary. Where profile of pipeline and ground surface is shown on the Drawings, pipeline shall be laid to the elevation shown regardless of depth. Excavation shall be to such depth that the minimum cover over the valve nuts shall be 1 foot.

Supplement this section with the following:

Grade and alignment on ungraded streets will be given from hubs set parallel to the line of the pipe. On graded streets, the grade and alignment shall be taken from established points on the existing curbs or sidewalks, when directed by the Engineer. Trenches for the pipe shall be opened in accordance with the lines and grades given, or to the standard depth of cover provided in the Standard Plan. The Contractor shall transfer lines and grades to the pipe from hubs set by the Engineer or from existing concrete curbs or sidewalks.

## 7-10.3(06) EXISTING UTILITIES

Supplement this section with the following:

In the event of conflict, the Contractor shall remove and restore existing catch basin connections, inlet connections, drains, side sewers, inlets, and other sewerage and drainage facilities. All

restoration shall be constructed to correct City Standards. Mainline sewers and storm drains shall not be damaged, removed or relocated. Watermain pipe shall be installed to clear these utilities.

Existing water mains and fittings encountered during trench excavation and indicated on the Drawings to be removed (or if removal is required by the Engineer) shall be removed and disposed of by the Contractor. All costs for these items shall be considered to be incidental to the various bid items comprising this contract and no separate payment will be made.

Ends of abandoned water main shall be plugged by filling with Class 5(3/4) concrete for a minimum longitudinal length of 12 inches. All costs for these items shall be considered to be incidental to the various bid items comprising the contract and no separate payment will be made.

When utility owned water services occupy the same space as the project trench, the Contractor, in order to avoid damage and the subsequent cost of repairs, may request, with three days notice, that the Seattle Water Department cut the services ahead of the excavating machine and reconnect them after the machine passes. The expense of cutting and reconnecting will be charged to the Contractor.

The Contractor shall carefully do all necessary excavation to fully expose such services. If the Contractor elects to excavate the trench without first exposing the services, the Contractor shall be responsible for all damages to the services by reason of this operation and shall immediately notify the Engineer and arrange for replacement of all damaged services in accordance with Section 1-07.17.

It is anticipated that the Contractor will encounter private water service utilities (water service lines running between the Seattle Water Department union and private residences) during work operations. Records of these utilities are not maintained by the City and therefore do not appear on the Drawings and will not be field located by the Seattle Water Department. It shall be the Contractor's responsibility to ascertain the location of and protect these private utilities from damage.

If it is necessary to provide temporary water supply connections due to conflict between existing private water service pipes and the new water main, it shall be the responsibility of the Contractor to provide temporary services. All costs incurred by the Contractor in providing temporary water service shall be considered incidental to the contract and no separate payment will be made.

In all cases, private water service lines damaged by the Contractor shall be repaired by the Contractor at the Contractor's own expense. The Contractor shall notify the Engineer of any such damage and shall begin repairs immediately and work continuously until water service is restored.

#### 7-10.3(07) TRENCH EXCAVATION

Delete this section and replace with the following:

The Contractor shall perform all excavation of every description and of whatever materials encountered to the depth indicated on the Drawings or specified in the Special Provisions. All excavations shall be made by open cut unless otherwise provided for. The bottom of trenches shall be accurately graded to provide uniform bearing and support for each length of pipe on undisturbed or compacted soil at every point along its entire length, except at the joints.

Bell holes shall be excavated to the extent necessary to permit accurate work in making and inspecting the joints. The banks of the trenches shall be kept as nearly vertical as soil conditions will permit. Where determined necessary by the Engineer to control trench width, to protect adjacent structures, or to provide safe working conditions, the trench shall be properly sheeted and braced. The maximum trench excavation width for pipes 4 inches to 12 inches in diameter shall not exceed 30 inches, and for larger sizes of pipe the trench width shall not exceed that indicated on the Standard Plan for trenching, unless authorized by the Engineer. Standard excavating equipment shall be adjusted so as to excavate the narrowest trench possible.

The length of trench excavation in advance of the pipe laying shall be kept to a minimum, and in no case shall it exceed 500 feet unless otherwise specifically authorized by the Engineer.

The Contractor shall exercise care in excavating the trench and maintaining it so that no damage will occur to any foundation, structure, pole line, pipe line, or other facility because of slough of slopes, or from any other cause. If, as a result of the excavation, there is disturbance of the ground such as to endanger other property, the Contractor shall immediately take remedial action at his expense. No act, representation or instruction of the Engineer or his representatives shall in any way relieve the Contractor from liability for damages or costs that result from trench excavation.

Care shall be taken not to excavate below the depth indicated. Excavation below that depth shall be backfilled with native material, or Mineral Aggregate Type 17, and shall be compacted to the satisfaction of the Engineer at the Contractor's expense.

Grading and other excavations nearby shall be controlled to prevent surface water from flowing into the excavations. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance away from the edges of trenches to avoid overloading and to prevent slides or cave-ins. Unsuitable material, or that in excess to the needs for embankments or backfill, shall be wasted and disposed of by the Contractor.

Excavation for manholes and other structures shall be sufficient to provide a minimum of 12 inches between their surfaces and the sides of the excavation.

In the event the Contractor elects to use pipe bedding, or to use mineral aggregate of any type below the pipe to facilitate dry ditch construction, all costs for furnishing and placing the mineral aggregate shall be borne by the Contractor.

Trench and bell holes shall be kept dewatered until the pipe has been laid, jointed, coated and backfilled.

#### 7-10.3(07)A ROCK EXCAVATION

Delete paragraph 1 and replace with the following:

Rock excavation shall cover the removal and disposal of rock, i.e., ledge rock that requires systematic drilling and blasting for its removal, and boulders exceeding 1/2 cubic yard in volume. Ledge rock, boulders, or stones shall be removed to provide a minimum clearance of 6 inches under the pipe. Solid rock excavation is classified in Section 2-03.1(1).

Delete paragraph 3 and replace with the following:

Material removed shall be replaced with selected native materials from adjacent trenches or with Mineral Aggregate Type 17 in accordance with Section 9-03 and as designated by the Engineer.

#### 7-10.3(07)C CRIBBING AND SHEETING - SHORING (New Section)

The Contractor shall adequately shore trenches to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench. The method of shoring shall be according to the Contractor's design. The Contractor may elect to use a combination of shoring and overbreak, tunneling, boring, sliding trench shields or other methods of accomplishing the work, provided the method meets all applicable local, state and federal safety codes. Damages resulting from improper cribbing or from failure to crib shall be the sole responsibility of the Contractor.

All cribbing and sheeting shall be removed from the trench. Removal shall be accomplished in such a manner as to fulfill the above requirements. Bedding or side support disturbed by cribbing or sheeting removal shall be reconsolidated. If a moveable box is used in lieu of cribbing or sheeting, and the bottom cannot be kept above the springline of rigid pipe or the crown elevation of flexible pipe, the bedding or side support shall be carefully reconsolidated behind the moveable box prior to placing backfill.

The use of horizontal strutting below the barrel of a pipe or the use of the pipe as support for trench bracing will not be permitted.

When, in the opinion of the Engineer, the withdrawal of sheeting from the trench will result in damage to adjacent utilities or other property, the Engineer may order all or a portion of the sheeting to be left in place, in which case it shall be cut off as directed by the Engineer.

#### 7-10.3(08) REMOVAL AND REPLACEMENT OF UNSUITABLE MATERIAL

Delete paragraph 1 and replace with the following:

Whenever in excavating the trench for water mains the bottom of the trench exposes peat, soft clay, quicksand, or other unsuitable foundation material, such material shall be removed to the depth directed by the Engineer and backfilled with foundation material. Foundation material shall be Mineral Aggregate Type 2, or as directed by the Engineer.

Delete paragraph 2 and replace with the following:

Material removed from the trench that is unsuitable for backfill shall be removed and hauled to a waste site. If surplus native backfill material is not available within the limits of the project, as



determined by the Engineer, the Contractor shall furnish Mineral Aggregate of the Type designated by the Engineer in accordance with Section 9-03.

#### 7-10.3(08)A SURPLUS MATERIALS (New Section)

Surplus material obtained from trench excavation and determined to be suitable for use elsewhere on the project by the Engineer shall be used per Section 2-03.3(10).

Surplus material not needed elsewhere on the project and unsuitable material shall be wasted in accordance with Section 1-04.12.

#### 7-10.3(09)A RIGID PIPE

Delete this section and replace with the following:

Class B Bedding material, when specified or required by the Engineer, shall be Mineral Aggregate Type 9 in accordance with the requirements of Section 9-03.

Class B Bedding for ductile iron water mains will not ordinarily be required. When required, bedding material shall be Mineral Aggregate Type 9 in accordance with Section 9-03.

Class B bedding shall include the zone 6 inches below the pipe, around the pipe and up to 6 inches above the pipe.

No tamping will be required for Class B bedding. It shall be compacted by vibrating.

Care should be taken to prevent any damage to the pipe or its protective coating.

#### 7-10.3(09)B FLEXIBLE PIPE

Delete this section.

#### 7-10.3(09)B1 BEDDING FOR POLYETHYLENE ENCASED, TAPE COATED, OR SPECIAL COATED PIPE (New Section)

When specially protected pipe is installed, it shall be bedded in Class B Bedding as specified in 7-10.3(09)A.

Bedding of specially protected pipe shall be conducted at all times in such manner as to prevent damage and abrasion to the protective coating or wrap.

Placing of Class B bedding about the pipe shall be done only in the presence of the Engineer after his final inspection and approval of the specially coated or wrapped pipe. Any damage to the special coating or wrap shall be repaired by the Contractor at the Contractor's expense, as directed by the Engineer.

#### 7-10.3(09)B2 BEDDING FOR POLYVINYL CHLORIDE (PVC) PIPE (New Section)

PVC Pipe shall be bedded in Class B Bedding in accordance with Section 7-10.3(09)A.

#### 7-10.3(10) BACKFILLING TRENCHES

Delete this section and replace with the following:

Prior to backfilling, all form lumber and debris shall be removed from the trench. Sheeting used by the Contractor shall be removed just ahead of the backfilling unless it is ordered by the Engineer to be left in place. Backfill up to 6 inches over the top and both sides of the pipe shall be evenly and carefully placed, but not until all large rocks capable of damaging the pipe or its coating have been removed from the backfill material.

In backfilling the trench, the Contractor shall take all necessary precautions to protect the pipe from any damage or shifting. The Contractor shall backfill from the side of the trench to a maximum uniform depth of 2 feet above the crown of the concrete pipe and 1 foot above ductile iron pipe before starting compaction.

During all phases of the backfilling operations and testing as outlined herein, the Contractor shall protect the pipe installation, provide for the maintenance of traffic as may be necessary, and provide for the safety of property and persons.

The Contractor shall use suitable native excavated material for trench backfill unless notified by the Engineer that the native material is unsuitable. The Engineer will examine excavated native material at the time of excavation to determine its suitability for use as backfill. Native material will be considered suitable for trench backfill if it meets the requirements set forth in Section 2-03.3(14).

Unsuitable backfill material shall be removed from the site, disposed of, and replaced with Mineral Aggregate Type 17 or such other imported material as designated by the Engineer.

The Contractor shall take any necessary steps to protect the excavated material from becoming contaminated with excessive moisture. Any material that becomes unusable due to the Contractor's failure to take adequate measures to provide protection from moisture shall be replaced at the Contractor's expense with Mineral Aggregate Type 17 or such other material as the Engineer will accept.

Where it is required that a blanket of select material or bank run gravel be placed on top of the native backfill, the backfill shall be placed to such elevation as shown on the Drawings, or as the Engineer may direct, and shall be leveled to provide for a uniform thickness of the borrow material. Compaction is required, and it shall be performed prior to placing the borrow material.

#### 7-10.3(11) COMPACTION OF BACKFILL

Delete this section and replace with the following:

Trench backfill shall be spread in layers and be compacted by mechanical tampers of the impact type approved by the Engineer. Water settling will not be permitted. After the initial backfill is placed the remaining backfill material shall be placed in successive layers not exceeding 1 foot in loose thickness, and each layer shall be compacted to the density specified below:

(a) Improved areas such as street and sidewalk areas shall be compacted to 95% of maximum dry density.

(b) Unimproved areas or landscape areas shall be compacted to 90% of maximum dry density.

Compaction control tests shall be performed as specified in Section 2-03.3(14)D.

The procedure and equipment to be used for backfill compaction shall be demonstrated on a test section of pipeline to be designated by the Engineer.

The Engineer will sample excavated material to determine suitability of the native material for backfill use. If native material is found to be compactable and within the tolerance range of moisture content, the Contractor will be required to use the native material for backfilling. The Contractor shall take any necessary steps to protect the excavated material from becoming saturated beyond the critical moisture limits. Any material becoming saturated due to the Contractor's failure to take adequate measures to protect the material from moisture shall be replaced with Mineral Aggregate Type 17 or such other material as the Engineer may accept, by the Contractor at his own expense.

The Contractor shall excavate test pits in the backfill as directed by the Engineer for the purpose of testing the backfill compaction. At the option of the Engineer, density tests may be taken on a lift of compacted backfill immediately prior to placing the next lift. All costs in connection with excavating test pits and from standby time during field density tests shall be considered as incidental to the backfill and no separate payment will be made.

If the required compaction density has not been obtained, the Contractor shall remove the backfill from the trench and recompact using an improved technique, heavier compaction equipment or more passes. This process shall be repeated until the Contractor has established a procedure that will provide the required field density. The Contractor will then be permitted to proceed with backfilling and compacting the remainder of the pipeline under the approved compaction procedure.

In the event routine field densities taken during the course of construction show the specified compaction is not being obtained because of changes in soil types or for any other reason, the Contractor will be required to reestablish his compaction procedure. In no case will excavation and pipelaying operations be allowed to proceed until the specified compaction is attained.

The hauling away of surplus material from the excavation to other areas of the project or disposing of the material offsite shall be considered as incidental to the unit price of each size and type of pipe installed.

## 7-10.4 MEASUREMENT

Delete this section and replace with the following:

Measurement for "Solid Rock Excavation," shall be per Section 2-03.4.

Measurement for "Mineral Aggregate (Type)," shall be per Section 4-01.4.

Measurement for "Extra Excavation," and "Bedding (Class), (Size) Pipe," shall be per Section 7-17.4.

## 7-10.5 PAYMENT

Delete this section and replace with the following:

Payment for "Bedding (Class)(Size) Pipe" will be per linear foot.

The unit price for "Mineral Aggregate (Type)," shall be in accordance with Section 4-01.5.

Payment for "Extra Excavation" and "Bedding (Class) (Size) Pipe" shall be per 7-17.5.

Payment for "Solid Rock Excavation" shall be per 2-03.5.

If no bid item is in the Bid Form for "Mineral Aggregate" of the type designated by the Engineer, "Solid Rock Excavation," or "Extra Excavation," the Contractor shall perform the work as directed by the Engineer, and payment will be made in accordance with Section 1-09.4.

No separate payment will be made for excavating the trench, cribbing, sheeting, shoring, placing and compacting the native backfill material, hauling and placing excess suitable native material elsewhere on the project, or hauling and disposing of excess materials offsite. These costs shall be considered as being included in the unit bid prices for each class, size, and type of pipe.

Where unexpected objects, such as stumps, railroad ties, etc. are encountered in the trench excavation, and such unexpected objects cause the Contractor delays or require Extra Work or equipment for its removal, payment will be in accordance with Section 1-09.4. When the presence of these objects are indicated on the Drawings or Special Provisions, no separate payment shall be made.

No separate payment will be made for furnishing and installing sand cushion and protection of existing utilities and services. These items shall all be considered as incidental to the work of constructing the water main, and all costs thereof shall be included in the payment as specified in Section 7-11.5.

## SECTION 7-11 PIPE INSTALLATION FOR WATER MAINS

## 7-11.1 GENERAL

Delete paragraph 1 and replace with the following:

Pipe shall be installed in accordance with the manufacturer's printed specifications and instructions, and to the standards of the AWWA for installing the type of pipe used. The Contractor shall provide all tools and equipment, including any special tools required for installing each particular type of pipe used unless modified or changed on the Drawings or in the Special Provisions.

Pipe sections shall be joined in such a manner as not to damage the lining or coating. Any damage to the lining or coating shall be repaired by the Contractor at the Contractor's expense. All touch-up coating for outside water main pipe accessories shall be made with epoxy coal tar. Inside parts of the pipe accessories shall be touched up with asphaltic varnish, Royston Roykote #612 XM or approved equal. The method of pulling or jacking the pipe home must allow both vertical and horizontal movement of the pipe for the protection of the gasket.

Water main installation shall not proceed until line and grade hubs have been set and measurements for connection fittings have been made in accordance with Section 7-11.3(09)A.

The Contractor shall install only new, unused materials.

Short lengths of pipe supplied by the manufacturer shall be used whenever possible to provide the proper spacing of valves, tees, or special fittings.

Clearances shall be maintained between water mains and other utilities per Section 1-07.17(1).

## 7-11.2 MATERIAL

Delete this section and replace with the following:

Material shall be as specified in Section 9-30, as modified herein.

## 7-11.3(02) HANDLING OF PIPE

Supplement paragraph 1 with the following:

Methods of handling shall be corrected by the Contractor if the Engineer determines that these methods are damaging to the pipe.

Supplement paragraph 3 with the following:

Ductile iron and cast iron pipe, while suspended above grade, shall be rung with a light hammer to detect cracks.

Delete paragraph 4 and replace with the following:

Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations, and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned, and relaid. A clean whisk broom shall be used for this purpose and for brushing to remove foreign matter prior to joining of pipe ends. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the Engineer to ensure cleanliness inside the pipe.

Supplement this section with the following:

Pipe shall be stacked in such a manner as to prevent damage to the pipe, to prevent dirt and debris from entering the pipe, and to prevent any movement of the pipe. The bottom tiers of the stack shall be kept off the ground on timbers, rails or other similar supports. Pipe on succeeding tiers shall be alternated by bell and plain end. Timbers 4-inch X 4-inch in size shall be placed between tiers and chocks shall be placed at each end to prevent movement. For safety each size of pipe shall be stacked separately.

Handling and shipping of enameled or multilayered polyethylene tape coated ductile iron pipe while being transported and in the field shall be in accordance with the AWWA Standard Specifications C-203, Section 2.14, and as specified herein.

Pipe, at all times, shall be handled with equipment such as stout wide canvas slings and wide padded skids designed to prevent damage to the coating. Bare cables, chains, hooks, metal bars or narrow skids shall not be permitted to come in contact with the lining or coating. When shipped by rail, all pipe shall be carefully loaded on properly padded saddles not less than 12 inches in width. Pipe sections shall be separated so that they do not bear against each other and the whole load shall be securely fastened together and to the cars to prevent movement in transit.

In truck shipments, the pipe shall be supported in wide cradles of suitable padded timbers hollowed out on the supporting surface to fit the curvature of pipe. All chains, cables or other equipment used for fastening the load must be carefully padded.

The Engineer will inspect the pipe and coating after delivery to the jobsite, while the pipe is stored along side the trench, prior to installation by the Contractor. The Contractor shall allow inspection of the coating on the underside of the pipe while suspended from the sling, before the pipe is lowered in the trench. If either the pipe or coating is damaged, the Contractor will be required, at his own expense, to repair the damage to the satisfaction of the Engineer prior to installation.

Pipe stored along the trench side shall be supported by padded wooden timbers placed under the pipe to hold the pipe off the ground, or by other means satisfactory to the Engineer.

#### 7-11.3(03) CUTTING PIPE

Delete this section and replace with the following:

Whenever it becomes necessary to cut a length of pipe, the cut shall be made by abrasive saw or by a special pipe cutter. All pipe ends shall be square with the longitudinal axis of the pipe and the outside shall be bevelled and otherwise smoothed so that good connections can be made without damage to the gasket. Threads shall be cleanly cut. Oxyacetylene torch cutting of ductile iron pipe shall not be allowed.

#### 7-11.3(04) LAYING OF PIPE ON CURVES

Supplement this section with the following:

Maximum deflections at pipe joints and laying radius for various pipe lengths are specified in the Drawings and Special Provisions or, if not, shall conform to the manufacturer's and AWWA Specifications for the given type of pipe.

#### 7-11.3(06) LAYING DUCTILE IRON PIPE WITH POLYETHYLENE ENCASEMENT

Delete the title and section and replace with the following:

#### 7-11.3(06) LAYING AND JOINTING PIPE

#### 7-11.3(06)A LAYING AND JOINTING - MECHANICAL AND RUBBER GASKET (PUSH ON) JOINT PIPE (New Section)

The installation of mechanical joint pipe and rubber gasket joint pipe shall be in accordance with AWWA C600.

#### 7-11.3(06)B LAYING AND JOINTING POLYETHYLENE ENCASED PIPE (New Section)

Pipe with polyethylene encasement shall be installed in accordance with AWWA C105. The method used for encasing the pipe shall be approved by the Engineer. All damage to the polyethylene encasement shall be repaired at the Contractor's expense. Bedding and backfill shall be in accordance with Sections 7-10.3(09), and 7-10.3(10), and 7-10.3(11).

#### 7-11.3(06)C LAYING AND JOINTING MULTI-LAYER TAPE COATED PIPE (New Section)

Pipe shall be hoisted from the trench side into the trench by means of a wide canvas or leather sling. Use of chains, cables, tongs or other equipment likely to cause damage to the lining or to the coating of the pipe will not be permitted. Dragging or skidding the pipe will not be permitted. The Contractor shall allow inspection of the coating on the under side of the pipe while suspended from the

sling. Any damage shall be repaired to the satisfaction of the Engineer before the pipe is lowered into the trench. Bedding and backfill shall be in accordance with Sections 7-10.3(09), 7-10.3(10), and 7-10.3(11).

At all times during construction of the pipeline, the Contractor shall use every precaution to prevent damage to the protective coating on the pipe. No metal tools or heavy objects shall be unnecessarily permitted to come in contact with the finished coating. Workers will be permitted to walk upon the coating only when necessary. In case of such necessity, the workers shall wear shoes with rubber or composition soles and heels. This shall apply to surfaces whether bare, primed or coated. Any damage to the protective coating from any cause, prior to final acceptance of the pipeline, shall be repaired as directed by the Engineer, by and at the expense of the Contractor.

All holidays detected in the field shall be repaired by removing the outerwrap and primary coating from the damaged area, cleaning the exposed surfaces thoroughly, and then applying suitable primer and tape to the exposed area. If required, the repaired area may be outerwrapped with Polyken 956 or approved equal after patching.

If the outerwrap is damaged and a holiday is not found in this area, the Contractor need not repair the outerwrap unless, at the discretion of the Engineer, the damage is deemed to be severe enough to jeopardize the integrity of the coating. If the outerwrap is to be replaced, the damaged outerwrap shall be removed, taking care not to damage the inner coating. Before the outerwrap is replaced, a holiday detector shall be applied to the exposed innerwrap to determine if it has been damaged during removal of the outerwrap. The damaged outerwrap area shall be repaired by applying a patch of Polyken 956 or approved equal, at the discretion of the Engineer.

#### 7-11.3(06)D LAYING AND JOINTING COAL-TAR EPOXY COATED PIPE (New Section)

Specifications for installation of coal-tar epoxy coated pipe shall be as noted in Section 7-11.3(06)C, paragraph 1 and 2.

Holidays detected in the field shall be repaired by grinding to remove the defective area of the coating, and then recoating the area in accordance with AWWA C210, Sections 2.2 and 2.3.

#### 7-11.3(06)E LAYING AND JOINTING POLYVINYL CHLORIDE (PVC) PIPE (New Section)

Laying of PVC pipe shall be in accordance with "Recommended Standard for Installation of PVC Pressure Pipe" (Uni-Bell UNI-B-3-79) Sections 5.3 through 5.3.4.4. Bedding and backfill shall comply with Sections 7-10.3(09)D, and 7-10.3(10).

All valves and fittings shall be supported by concrete cradles; their weight shall not be carried by the PVC pipe. The cradle shall be trench width by 2 feet long by 6 inches thick, and shall be poured against undisturbed earth. The valves and fittings shall be set to design grade and firmly braced while the concrete cradles are poured and cured.

#### 7-11.3(07)A THREADED STEEL PIPE 4 INCHES IN DIAMETER AND SMALLER

Delete this title and section and replace with the following:

#### 7-11.3(07)A THREADED STEEL PIPE LESS THAN 4 INCHES IN DIAMETER

Steel pipe in sizes up to and including 3-1/2 inches shall be connected with malleable iron screwed couplings. Couplings shall be galvanized. Unions or flanges shall be used at all equipment and valves. Cut ends shall be reamed and threads clearly cut. Exposed threads, after jointing, shall be brush-coated with an asphalt varnish, Royston Roskote #612XM or approved equal.

#### 7-11.3(07)B COUPLED PIPE 6 INCHES IN DIAMETER AND LARGER

Delete this title and section and replace with the following:

#### 7-11.3(07)B COUPLED PIPE 4 INCHES IN DIAMETER AND LARGER

Steel pipe 4-inch and larger, for use in underground services, shall be coupled as specified in the Drawings and Project Manual.

Any welding of steel pipe shall be in accordance with AWWA C206.

Bell and spigot joints shall be thoroughly cleaned before assembly, and a vegetable soap solution shall be brushed on the inside of the bell just prior to assembly.

#### 7-11.3(07)C STEEL CASING PIPE INSTALLED UNDER RAILROAD TRACKS (New Section)

Where shown on the Drawings, the Contractor shall install steel casing pipe for the water main by tunneling, jacking or augering without damage to existing streets, roads, highways, railroad track alignment or other utilities.

All joints shall be welded by operators who have been qualified by tests as prescribed by the AWS in Standard Qualifications Procedure to perform the type of work required. The quality of welding shall conform to AWS D1.1-80 Structural Welding Code, Section 3, Workmanship.

Before placing the casing and water main, the Contractor shall submit to the Engineer, for approval, an outline of his construction procedure together with a listing of the equipment for the work. The approval of procedure and equipment by the Engineer shall not relieve the Contractor of responsibility, or waive, or modify any of the provisions of the contract.

Special care shall be taken during the installation of the pipe to ensure that no settlement of adjacent areas occurs. Any such settlement caused by the placement of the pipe shall be the Contractor's responsibility. The Contractor shall repair all areas so affected, as directed by the Engineer, at the Contractor's own expense. In the event that the pipe is damaged during the installation and the defects cannot be corrected to the satisfaction of the Engineer, the Contractor shall be required to remove and replace the pipe at the Contractor's own expense. No additional payment will be made for the replacement or realignment of the casing pipe.

#### 7-11.3(07)D STEEL CASING SEALS AND SPACERS (New Section)

Casing seals shall provide a moisture-proof seal that is resistant to heat, cold, vibration, impact, abrasions, fluids, disbonding, and expansion and contraction of the casing and the water main. Casing seals shall be installed according to the manufacturer's instructions.

The Crossing Insulators (Spacers) shall be composed of polyester fiberglass or polyvinyl chloride (PVC). The material shall be resistant to abrasion and sliding wear. There shall be two Crossing Insulators (Spacers) per length of pipe, spaced no more than 10 feet apart. Crossing Insulators (Spacers) shall be installed per manufacturers instructions.

Casing seals and Crossing Insulators (Spacers) shall be located as shown on the Drawings.

#### 7-11.3(09)A CONNECTIONS TO EXISTING MAINS

Delete this section and replace with the following:

No water system valves on existing mains shall be operated by the Contractor.

The Seattle Water Department will make all connections to charged water mains and pipelines, and will operate all valves to accomplish shutdowns and subsequent reactivations. Draining of existing water mains will be done by SWD staff.

Prior to pipe laying and in the presence of the Engineer, the Contractor shall uncover the existing water main at each point of connection in order to determine any necessary adjustments to the proposed line and grade for the new water main near that point of connection and to verify dimensions, type, location, and condition of the existing water main.

Water mains and appurtenances must be installed completely per contract, and approved, prior to connections being scheduled or made.

The Seattle Water Department requires two (2) working days prior notice to schedule inspections for approval of water main installations. Within two (2) working days after the inspection, the Contractor will be provided with written approval or a list of items to be corrected. Items to be corrected must be reinspected. The response and notification times for reinspection are the same as for the initial inspection.

Approval is contingent on the water main and appurtenances being installed completely and satisfactorily tested per contract documents excluding street, sidewalk and planting strip restorations. Water main and appurtenances include all pipe, fittings, all blocking except temporary

blocking, all hydrants, hydrant pads, blowoff assemblies, valves, flowmeters, chambers, corrosion protection, and coating systems.

Tests are for pressure and water quality, and the requirements are specified elsewhere in this section.

Scheduling of connections with the Engineer is the Contractor's responsibility. After approval of the water mains has been received, the Contractor shall request that the Engineer schedule the shutdown of existing water mains required to complete the connection. The Contractor's request must be submitted to the Engineer a minimum of 3 working days in advance of the desired date of the connection, and is subject to Seattle Water Department approval. The excavation for the connection shall be complete, shored and dewatered, and all required materials and equipment shall be available at the scheduled shutdown. Notifications of the scheduled shutdown will be made by Seattle Water Department personnel to the affected consumers.

The Seattle Water Department will furnish connection fittings, as shown on the Drawings. In addition, prior to and after connection of the new main, the Seattle Water Department will:

- (a) Deactivate water main.
- (b) Out, remove, and dispose of pipe sections as necessary to install the new materials.
- (c) Dewater the pipe, as required, to perform Seattle Water Department connections.
- (d) Install required fittings.
- (e) Reactivate and flush the water main.

All fittings not specifically called out as being furnished by SWD, and other materials and equipment required to complete the connection shall be furnished by the Contractor. The Contractor shall coat, wrap and bond the connection to conform with the requirements of the new water main.

The Contractor shall make all necessary excavations, shorings and backfills and provide any equipment and operators required to move and lower the component parts of the connection into position. All temporary and permanent blocking shall be done by the Contractor.

The Contractor shall swab all connecting pipes with a strong chlorine solution (liquid household bleach 5-6% CL) before connections are made. (If the connecting pipe is longer than one standard length, a satisfactory bacteriological sample must be obtained.)

In addition to those connections shown on the Drawings, segments of a new water main may be placed in service prior to completion of the entire water main. In such cases, connections between the charged and uncharged segments of the new water main will be done by SWD personnel.

Locations of connections between segments of new main are dependent on Contractor's operations and therefore are not shown. All materials for such connections shall be furnished by the Contractor.

Costs of all material, labor and equipment associated with making the connections are incidental to and included in the unit price bid for "Pipe, Water Main, (Material), (Class), (Size), Including Fittings," and no separate payment will be made.

#### 7-11.3(09)B MAINTAINING SERVICE

Delete paragraph 2 and replace with the following:

To supply customers with water during the construction of a project, where any section of pipe has passed a satisfactory hydrostatic and bacteriological test, the Seattle Water Department reserves the right to tap corporation cocks into a section of a new main and install corporation cocks and service connections at such locations as the Seattle Water Department may elect, at no expense to the Contractor. The attaching of any such service connections by the Seattle Water Department shall not be construed by the Contractor as any acceptance by the Owner of any part of the work required under the contract.

#### 7-11.3(09)C WATER SERVICE CONNECTIONS (New Section)

The Seattle Water Department will, at no cost to the Contractor, make all taps for service connections, and will supply and install the service pipe.



The Seattle Water Department will make excavations for the service connections, furnish and install service connections, backfill, compact the trench, and complete temporary patching. The Contractor shall make all repairs for the temporary patching and the permanent street restorations over all trenches per Section 5-07.

The Seattle Water Department normally will schedule and make all service connections within 20 working days after the main is approved and in service.

Where the plans show 4-inch, 6-inch and 8-inch service connections, the Contractor shall furnish and install service connection tees, valves, and valve boxes. The tees shall be mechanical joint (MJ) x mechanical joint x Flange (FLG). MJ x FLG valves with temporary, removable MJ plugs shall be installed on the service connection tees. The MJ plugs will be returned to the Contractor after installation of the water service by the Water Department.

The Contractor shall install valve boxes, on water service valves, at the time the water service valve is installed. Valve boxes disturbed by the Seattle Water Department during water service installation will be reset by the Seattle Water Department. The Contractor shall adjust all valve boxes to final grade prior to final surface restoration, at no additional cost to the Seattle Water Department.

All costs for furnishing and the installation of service connecting tees 4-inch and larger shall be considered to be included in the cost of "Pipe, Watermain, (Material), (Class), (Size), Including Fittings," and no separate payment will be made.

Where existing services are to be transferred from old to new mains, the Contractor shall plan and coordinate the work with that of the Seattle Water Department so that service will be resumed with the least possible inconvenience to consumers. Service tee locations will be field determined by the Seattle Water Department.

The Contractor shall not remove or abandon old pipe until all service connections have been transferred to the new main or temporary service has been provided. Adequate provisions shall be made by the Contractor during construction for the care and protection of mains or services in use.

#### 7-11.3(09)D TEMPORARY WATERMAINS AND SERVICES (New Section)

When called for in the Drawings, the Seattle Water Department will install and maintain temporary water mains and services in such a manner as to provide constant adequate water supply to consumers and to avoid impeding vehicular and pedestrian traffic and access to abutting properties.

The Contractor's schedule shall allow adequate time for the Seattle Water Department to install these facilities; a minimum of 2 weeks written notice shall be provided to the Engineer for scheduling and completion of the temporary water main and service work.

The Seattle Water Department will make all required excavation, backfill, and compaction as well as furnishing the necessary equipment and pipe for temporary water mains.

All temporary water mains will be chlorinated, flushed, and a satisfactory bacteriological sample obtained by the Seattle Water Department prior to placing in service.

#### 7-11.3(10) TRACER TAPE

Delete this title and section and replace with the following:

#### 7-11.3(10) LOCATING WIRE

Locating wire shall be installed directly over all PVC pipe with minimum 2 1/2 feet of cover. The locating wire shall be bonded by exothermic welds to all ductile iron fittings, valves and valve boxes to form an electrically continuous system.

#### 7-11.3(11) HYDROSTATIC PRESSURE TEST

Delete this section and replace with the following:

All water mains and appurtenances shall be tested as soon as possible after they are laid, backfilled and prior to bacteriological testing.

All labor, equipment, pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose and piping, necessary for performing the test shall be furnished and operated by the Contractor.

Pressure recorders and charts, which will be furnished by the Seattle Water Department, shall be used to record the tests.

At points where pressure reaction and movement may occur, such as at bends, tees, and plugs, the pipe shall be properly blocked or braced. Where permanent blocking is not required, the Contractor shall furnish and install temporary blocking and remove it after testing.

Where the Seattle Water Department has water available for testing, it will be furnished without charge. Where water is not available from the Seattle Water Department, the Contractor shall provide water, from an approved source, for testing. To prevent contaminated water from the new main from flowing back into the line supplying the water, two check valves or a double check valve assembly shall be used on the fill line.

Ductile iron water mains and appurtenances shall be tested hydrostatically to: 300 psi for pipe 12 inches in diameter and smaller, and 250 psi for pipe 16 inches in diameter and larger unless otherwise specified.

Polyvinyl Chloride (PVC) water mains (Cl.200) and appurtenances 12 inches in diameter and smaller shall be tested hydrostatically to 300 psi.

Test pressure for other pipe will be as noted in the Special Provisions.

The test pressure shall be applied at the low end of the section of water main being tested. All air in the pipe shall be vented prior to test.

The hydrostatic test pressure shall be maintained until the Engineer has determined that the section of pipe, valves, and fittings are watertight. 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 main will be accepted as a watertight installation. When testing short (less than 18 feet) lengths of main pipe or when testing hydrant pipe, maintaining the test pressure without pumping for 5 minutes with less than 5 psi drop in pressure will be evidence of a satisfactory test.

Sections to be tested shall normally be limited to 1,500 feet. 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 in order to qualify the crew and the material. Pipe laying shall not be continued more than an additional 1,000 feet until the first section has been tested successfully.

Hydrostatic tests shall be performed on every complete section of water main between valves, or as directed by the Engineer. Each side of each valve shall withstand the same test pressure as the pipe, with no pressure active in the section of pipe beyond the closed valve.

All tests shall be made with the hydrant auxiliary gate valves open and pressure against the hydrant valve. After the test has been completed, each gate valve shall be tested by closing each in turn and relieving the pressure beyond. This test of the gate valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked. The Contractor shall verify that the pressure differential across the valve does not exceed the rated test pressure of the valve.

Any visible leakage detected shall be corrected by the Contractor regardless of the allowable leakage specified above. Should the tested section fail to meet the pressure test successfully as specified, the Contractor shall, at his expense, locate and repair the defects and then retest the pipeline.

Prior to calling out the Engineer to witness the pressure test, the Contractor shall have all equipment set up completely ready for operation and shall have successfully performed the test to assure himself that the pipe is in a satisfactory condition.

Defective materials or workmanship discovered as a result of hydrostatic field test shall be replaced by the Contractor at his own expense. Whenever it is necessary to replace defective material or correct the workmanship, the hydrostatic test shall be rerun, at the Contractor's expense, until a satisfactory test is obtained.

#### 7-11.3(11)A TESTING EXTENSIONS FROM EXISTING MAINS

Delete paragraph 1 and replace with the following:



When an existing water main is extended with new pipe to a new valve and the distance from the existing pipe to the new valve is 18 feet or less, the section of new pipe installed between the new valve and the end of the existing main will be made by the Seattle Water Department with pretested, pre-chlorinated pipe, and no hydrostatic test will be required. When the required hydrostatic tests are conducted in the new main section beyond the installed new valve in the closed position, the normal pressure of the existing main may be present against the other side of the new valve.

Delete paragraph 3 and replace with the following:

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, shall be subjected to the required test pressure. The same test shall be made 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 main pipe. The final connection to the existing main shall be made by the Seattle Water Department with pretested, pre-chlorinated pipe, and no hydrostatic test will be required.

#### 7-11.3(12) DISINFECTION OF WATER MAINS

Supplement this section with the following:

The Seattle Water Department laboratory will perform the bacteriological test and report the results to the Engineer. Results will be available 48 hours after samples are delivered to the Seattle Water Department Laboratory. The Seattle Water Department may require bacteriological samples at any time.

#### 7-11.3(12)A FLUSHING

Delete paragraph 1 and replace with the following:

Sections of pipe to be disinfected shall first be flushed to remove any solid or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, a tap shall be provided by the Contractor large enough to develop a velocity of at least 2.5 feet per second in the main. One 2-1/2 inch hydrant opening will, under normal pressure, provide this velocity in pipe sizes up to and including 12 inches. On new water mains, taps required for chlorination, flushing, or temporary or permanent release of air shall be furnished and installed by the Contractor. If a hose bib faucet is installed for bacteriological sampling, it shall be located upstream from the flushing point. If required, taps on existing mains, for the purpose of chlorination or flushing, will be furnished and installed by the Seattle Water Department.

#### 7-11.3(12)B REQUIREMENT OF CHLORINE

Delete this section and replace with the following:

Before being placed into service, all new mains and repaired portions of, or extension to, existing mains shall be chlorinated so that a chlorine residual of not less than (10) mg/l remains in the water after standing 24 hours in the pipe. The initial chlorine content of the water shall be not less than (25) mg/l.

#### 7-11.3(12)C FORM OF APPLIED CHLORINE

Delete this section and replace with the following:

Chlorine shall be applied by one of the methods which follow, to give a dosage of not less than (25) mg/l of available chlorine.

#### 7-11.3(12)D DRY CALCIUM HYPOCHLORITE

Delete this section and replace with the following:

As each length of pipe is laid, sufficient high test calcium hypochlorite (65-70% chlorine) shall be placed in the pipe to yield a dosage of not less than (25) mg/l available chlorine, calculated on the volume of the water which the pipe and appurtenances will contain.

#### 7-11.3(12)F CHLORINE - BEARING COMPOUNDS IN WATER

Delete this section and replace with the following:

A mixture of water and high-test calcium hypochlorite (65-70% Cl) may be substituted for the chlorine gas-water mixture. The dry powder shall first be mixed as a paste and then thinned to a 1 percent chlorine solution by adding water to give a total quantity of 7.5 gallons of water per pound of dry powder. This solution shall be injected in one end of the section of main to be disinfected while filling the main with water.

The amounts of chlorine (Cl) required to give 50 ppm (mg/l) for 100-foot lengths of various diameters of pipe are in the table below.

Pipe Size	Volume Water	Amount 100% Cl	Solution 1% Cl-Water
4 in.	65.3 gals.	0.027 lbs.	1/3 gals.
6 in.	146.5 gals.	0.061 lbs.	3/4 gals.
8 in.	261.0 gals.	0.108 lbs.	1-1/3 gals.
10 in.	408.0 gals.	0.170 lbs.	2 gals.
12 in.	588.7 gals.	0.240 lbs.	3 gals.

#### 7-11.3(12)G SODIUM HYPOCHLORITE

Delete this section and replace with the following:

Sodium hypochlorite, commercial grade (12.5% Cl) or in the form of liquid household bleach (5-6% Cl), 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 main in correct proportion to the fill water so that dosage applied to the water will be at least (25) mg/l.

#### 7-11.3(12)H POINT OF APPLICATION

Delete this section and replace with the following:

The preferred point of application of the chlorinating agent is at the beginning of the pipeline 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 should be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension. Alternate points of application may be used when approved or directed by the Engineer.

#### 7-11.3(12)I RATE OF APPLICATION

Delete this section and replace with the following:

Water from the existing distribution system, or other source of supply, shall be controlled to flow very slowly into the newly-laid pipeline during application of the chlorine. The rate of chlorine gas-water mixture or dry gas feed shall be in such proportion to the rate of water entering the newly-laid pipe that the dosage applied to the water will be at least (25) mg/l.

Sodium hypochlorite, commercial grade (12.5% Cl) or in the form of liquid household bleach (5-6% Cl), 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 main in correct proportion to the fill water so that dosage applied to the water will be at least (25) mg/l.

#### 7-11.3(12)J PREVENTING REVERSE FLOW

Delete this section and replace with the following:

To prevent contaminated water from the new main being disinfected from flowing back into the existing distribution system, 2 check valves or a double check valve assembly shall be used on the line supplying the water.

**7-11.3(12)K RETENTION PERIOD**

Delete this section and replace with the following:

Treated water shall be retained in the pipe at least 24 hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least (10) mg/l.

**7-11.3(12)M CHLORINATING CONNECTIONS TO EXISTING WATER MAINS AND WATER SERVICE CONNECTIONS**

Delete this section and replace with the following:

The chlorinating procedure to be followed shall be as specified in Section 9 of AWWA Standard C601-81, except that all pipe and fittings shall be swabbed with a strong chlorine solution at least as strong as liquid household bleach (5-6% Cl)."

**7-11.3(12)N FINAL FLUSHING AND TESTING**

Supplement this section with the following:

Hydrants on the new main shall also be flushed to remove excess chlorine from the hydrant and hydrant branch.

Delete paragraph 3 and replace with the following:

Before placing the lines into service, a satisfactory report shall be received on samples collected from representative points in the new system. Samples will be collected and bacteriological tests analyzed and reported by the Seattle Water Department.

**7-11.3(13) CONCRETE THRUST BLOCKING**

Delete paragraph 1 and replace with the following:

Concrete thrust blocking, as indicated on the Drawings and Standard Plans, shall be placed at bends, tees, deadends, crosses and as designated by the Engineer. Blocking shall be sized by the Engineer to withstand the test pressures in Section 7-11.3(11). Blocking shall be Class 5 (1-1/2) concrete mix poured in place.

**7-11.3(14) BLOWOFF ASSEMBLIES**

Delete this section and replace with the following:

Water main blowoff assemblies shall be constructed as shown on the Drawings or Standard Plans. A standard meter box shall be installed in non-traffic bearing areas; a Type 187 Ring and Cover shall be used for all other installations subject to vehicular traffic. Care shall be taken in locating the meter box or ring and cover such that it is not in any water course or in any other location subject to drainage or sewerage contamination. Tops shall be set to conform to finished grade. Backfilling and compaction shall conform with Sections 7-10.3(10) and 7-10.3(11).

Drilling and tapping into the water main will be performed by the Contractor except in the event of installation on a charged (in-use) water main, in which case the Seattle Water Department will make the connection.

**7-11.3(15) CORROSION PROTECTION OF DUCTILE IRON PIPE (New Section)**

Where called out on the Drawings, the pipeline contractor furnishing the pipe shall comply with the following:

**Install Electrical Continuity Bonds:** The Contractor shall furnish and install electrical bonds, as specified herein, at all mechanical couplings and all rubber gasket joints. The Contractor shall take special precautions to avoid disturbing bonds, electric cables, and wires for test stations and other cathodic protection equipment connected to, or installed near the pipeline.

**Install Electrolysis Test Stations:** The Contractor shall furnish and install the Electrolysis Test Stations where shown, and as detailed on the Drawings.

**7-11.3(15)A ELECTRICAL JOINT BONDS FOR ALL DUCTILE IRON PIPES AND FITTINGS (New Section)****7-11.3(15)A1 GENERAL (New Section)**

Each length of ductile iron pipe in the pipeline, and each hydrant run, shall be electrically bonded together, and each mechanical joint shall be bonded to the pipe as shown on the Drawings. The Engineer will make adhesion tests of all bonds and bonded joints. Any bonded joint which fail to meet the adhesion test shall be rebonded until a satisfactory test is obtained. Bonding cable shall be as specified in Section 9-30.14 herein.

**7-11.3(15)A2 BOND CONNECTIONS FOR DUCTILE IRON PIPE (New Section)**

Prior to making any bond connection to metal, an area approximately 2 inches by 2 inches square shall be thoroughly cleaned to expose bare metal. The point of connection for the bond shall be centered in the bared area. The bared area shall be filed or ground, to expose uniformly bright metal. Immediately prior to making the bond connection all bared areas shall be cleaned of all dirt, dust, moisture, oil and grease. All bonded areas shall be cleaned in the same manner immediately prior to insulating. All bond connections shall be made with approved exothermic weld type connections as shown on the Drawings, and shall be tested for adhesion as directed by the Engineer.

**7-11.3(15)A3 INSULATED BOND CONNECTIONS (New Section)**

Each bond connection shall be insulated thoroughly with a Royston Handy Cap or approved equal. The cap shall completely cover the cleaned area and provide insulation of the bond connection from the soil environment. The cap must be attached by use of a bonding cement or primer and must contain an elastomeric material under a plastic dome. The elastomeric material must mold completely around the bond wire and weld area. The plastic cap shall be a minimum of 4 inches x 4 inches x 125 mils thick. Bond caps are not required when the connection is covered by heat shrink joint wrapping.

**7-11.3(15)A4 APPLICATION OF HEAT SHRINK PIPE JOINT SLEEVE (New Section)**

After electrical bonds are installed and tested, the entire pipe joint and electrical bond strap shall be protected with a heat shrink joint sleeve. The sleeve shall be wraparound type with a joint closure and shall contain a Thermal Indicator. The sleeve shall be Raychem Thermofit Wraparound Pipe Sleeve WPCF and the closure shall be Raychem WPCP III or approved equal.

**7-11.3(15)B ELECTROLYSIS TEST STATION (New Section)**

Electrolysis Test Stations shall be installed as shown on the Drawings. Specifications of the various items used shall be as follows:

**7-11.3(15)B1 ZINC REFERENCE ELECTRODES (New Section)**

The electrode shall be packaged in a backfill material of 50% gypsum and 50% bentonite clay. The package shall be water permeable and of sufficient size to ensure complete envelopment of the reference electrode.

Materials shall meet the requirements of Section 9-30.11.

**7-11.3(15)B2 TEST STATION (New Section)**

The test station shall consist of a molded fiberglass junction box installed inside a conventional cast iron water meter box.

Materials shall meet the requirements of Sections 9-30.11B and 9-30.11B(1).

**7-11.4 MEASUREMENT**

Delete this section and replace with the following:

Measurement for "Pipe, Water Main, (Material), (Class), (Size), including Fittings", will be per linear foot based on the slope distance from point to point. The point of beginning or ending of measurement in any particular run of pipe shall be the vertical intersection of the center line of the intersecting pipe, or with the beginning or ending of any new pipe laid. No deductions will be made for the linear length of fittings, valves, couplings, etc. contained within the measured length. At changes in pipe size connected by a reducer, the point of measurement shall be taken as the midpoint of the reducer. See Standard Plan.

Measurement for "Blocking, Cement Concrete" will be by the cubic yard of concrete placed as computed by the Engineer.

Measurement for "Blowoff Assembly, (Size)" will be per each installed.

Measurement for "Pipe, Blowoff, (Material), (Size)" will be per linear foot actually installed from the water main tap to the center of the blow-off riser.

Measurement for "Steel Casing Pipe, (Size) Diameter, Tunneler, Jacked or Augered" will be per linear foot actually installed.

Measurement for "Station, Electrolysis Test," will be per each installed complete.

#### 7-11.5 PAYMENT

Delete this section and replace with the following:

Payment will be made at the unit contract price bid for such of the following bid items as are included in the Bid Form:

- (1) "Pipe, Water Main, (Material), (Class), (Size), including Fittings" per linear foot.
- (2) "Blocking, Cement Concrete" per cubic yard.
- (3) "Blowoff Assembly, (Size)" per each.
- (4) "Pipe, Blowoff, (Material), (Size)" per linear foot.
- (5) "Steel Casing Pipe, (Size) Diameter, Tunneler, Jacked or Augered" per linear foot.
- (6) "Station, Electrolysis Test," per each.

The unit price for "Pipe, Water Main, (Material), (Class), (Size), including Fittings" shall be full compensation for the costs of all materials, equipment, and labor required in the excavation, laying, joining, backfilling and compacting native material, disposing of or placing excess native material elsewhere, flushing, testing, and disinfecting of the pipe line. Materials shall include, but are not limited to, the pipe, all fittings, all pipe supports, locating wire, and any items called for in the Special Provisions. Where required, the costs of sand or foam cushioning between the water main and other pipes shall also be included.

All costs in connection with furnishing and installing the mechanical joint sleeves and furnishing and installing pipe supports including pipe hanger rods with nuts, single pipe rolls, steel angles, reinforcing bars, nuts, bolts, washers, mastic, galvanizing, trench excavation, shoring, backfill, compaction, removal of surplus excavation and all other incidental work, shall be included in the unit contract price per linear foot for the new "Pipe, Water Main, (Type)," as described in the Proposal.

No separate payments will be made for the hydrostatic field tests, temporary caps, pipe fittings, plugs, corp stops, temporary blocking/anchorage and the cost of all labor, material, tools, supplies and equipment required to complete the test shall be considered as incidental to the pipeline construction.

Special fittings used but not called for on the Drawings will be paid for at the supplier's invoice cost plus 15 percent for overhead and profit. Special fittings called for on the Drawings but not used will be deducted from the Contractor's final estimate based on the current cost of the supplier of fittings used on the improvement.

The unit contract price for "Blocking, Cement Concrete" shall include all costs to place concrete blocking of the proportions required, including excavation, turnbuckles, shackle rods, steel plates, concrete form work, finishing, removal and disposal of excavation not required for backfill, and any other work that may be necessary for constructing the blocking in place as specified.

The unit contract price for "Blowoff Assembly, (Size)" shall include all costs for furnishing and installing the complete assembly including corporation, fittings, pipes, valve, meter box or ring and cover, and all excavation, backfill with native material and compaction.

The unit contract price for "Pipe, Blowoff, (Material), (Size)" shall include all costs to furnish and install the plastic pipe between the corporation and the blowoff assembly including fittings.

The unit contract price for "Steel Casing Pipe, (Size) Diameter, Tunneler, Jacked, or Augered," per linear foot, shall be full compensation for all labor, material and equipment for the casing pipe in place, including tunneling, excavation and backfill of jacking pits, furnishing and placing sand filler, spacers, and sealing both ends with concrete.

Payment will be made at the price bid each for "Station, Electrolysis Test," which shall include furnishing and installing water meter box, test box, terminal blocks, wires, zinc reference electrodes, removal and restoration of side walks, and all other materials and labor required to complete the job.

No separate payment will be made for Electrical Joint Bonds, but the cost for all labor, material and equipment required for satisfactorily bonding across mechanical couplings and across rubber gasket joints, and all incidentals required to provide satisfactory and complete bonding sets, including but not limited to all required cable, bolts, molds and cold applied tape coating or heat shrink sleeve for any one coupling or any one rubber gasket joint shall be considered as included in the price bid for "Pipe, Water Main, (Material), (Class), (Size), including Fittings".

## SECTION 7-12 - VALVES FOR WATER MAINS

## 7-12.1 DESCRIPTION

Supplement this section with the following:

The Contractor shall install only new, unused materials.

## 7-12.2 MATERIALS

Delete this section and replace with the following:

Materials shall be as specified in Section 9-30, as modified herein.

## 7-12.3 CONSTRUCTION DETAILS

Delete paragraph 1 and replace with the following:

Valve installation shall include valve boxes, valve box extensions, operating nut extensions, lids and plastic foam rings, per the Standard Plans.

Valve chambers or vaults and manhole castings shall be installed by the Contractor as required by the Drawings and/or Special Provisions.

All valves shall be inspected upon delivery in the field to ensure proper working order before installation and shall be free of all rust and dirt. They shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connecting ends furnished. The valves shall also be carefully inspected for injury to the outer protective coatings.

At all places where the coating has been ruptured or scraped off, the damaged area shall be thoroughly cleaned to expose the iron base installation. The cleaned area shall then be recoated with zinc chromate primer. After recoating with the primer, the entire valve shall be field painted with two or more coats of Royston Roskote No. 612XM or approved equal.

An Operating Nut Extension shall be installed when the ground surface is more than 30 inches above the valve operating nut. The Operating Nut Extension shall extend into the top section of the Standard Valve Box and shall clear the bottom of the lid by a minimum of 6 inches. When required, it shall be furnished and installed by the Contractor.

## 7-12.3(1) INSTALLATION OF VALVE MARKER POSTS

Delete this title and section and replace with the following:

## 7-12.3(1) PRECAST VALVE CHAMBERS (New Section)

The concrete base shall be poured-in-place or precast. Poured-in-place base shall be allowed to attain sufficient strength to support the chamber (usually 2 or 3 days), as directed by the Engineer. Precast chambers shall be set on the base in cement mortar with the slotted holes straddling the water main.

The water main shall be wrapped with 2-inch thick plastic foam material at those areas where the main intersects the chamber wall. Any remaining space between the chamber wall and the plastic foam material shall be filled with cement mortar or mortared bricks. In no case shall the water main rest on the chamber wall.

Mortar shall be in accordance with Section 9-30.3K(5).

## 7-12.3(2) CHAMBERS MADE WITH PRECAST CONCRETE BLOCKS (New Section)

Circular or rectangular chambers may be made with solid precast concrete blocks. The base shall first be poured in place. After the base has reached sufficient strength (usually 2 or 3 days), the walls may be constructed of concrete blocks with water-tight cement mortar joints.

Circular chambers shall be constructed with curved manhole blocks. The chamber top shall be tapered in to the dimensions shown on the Standard Plans.

Chambers shall have a cast-in-place or precast concrete top slab suitable for H-20 traffic loading.

## 7-12.3(3) CAST-IN-PLACE CHAMBERS (New Section)

Cast-in-place chambers may be constructed by using forms and poured concrete. Finishing of walls is not required other than the patching of porous spots (rock pockets) and bolt holes. Forms shall be removed for inspection of concrete.

## 7-12.3(4) SETTING RING AND COVER (New Section)

The cast iron frame and cover shall be set to grades furnished by the Engineer. Provisions for future adjustment of frame to changes in grade shall be made by constructing a minimum of 2 courses of brick with mortar joints between the top of the chamber and the bottom of the casting. Brick for this purpose shall be standard clay or concrete brick 2-1/4 inches thick. Bricks shall be plastered in accordance with Section 9-30.3K(9).

## 7-12.3(5) SETTING VALVE BOX (New Section)

Cast iron valve boxes shall be set to position during backfilling operations so that they will be in a vertical alignment with the gate valve operating stem. The lower casting of the unit shall be supported by a plastic foam collar not less than two 2 in thickness, and shall be held in place by carefully compacted backfill. The casting shall not rest directly upon the body of the gate valve or upon the water main. The upper casting of the unit shall be placed in proper alignment and to such an elevation that its top will be at final grade.

Compaction shall be as specified in Section 7-10.3(11).

Plastic foam collars shall be as specified in Section 9-30.2L.

## 7-12.3(6) LADDERS (New Section)

Ladders shall conform to the requirements of Section 9-30.3K(10).

## 7-12.4 MEASUREMENT

Supplement this section with the following:

Measurement for "Valve Chamber, (Type)", "Valve Chamber, Special, (Size)" and "Valve Box, Cast Iron" will be per each.

## 7-12.5 PAYMENT

Delete this section and replace with the following:

Payment will be made at the unit contract price for each of the following bid items included in the Bid Form:

- (1) "Valve, Gate, (Size)," per each.
- (2) "Valve, Butterfly, (Size)," per each.
- (3) "Valve, Gate or Butterfly, (Size)," per each.
- (4) "Tapping Sleeve, (Size) x (Size) and Tapping Gate Valve, (Size)," per each.
- (5) "Valve Chamber, (Type)," per each.
- (6) "Valve Chamber, Special, (Size)" per each.
- (7) "Valve Box, Cast Iron," per each.

The unit contract price for "Valve, (Type), (Size)" shall include all costs for the work required to furnish and install the valve, including painting, jointing, disinfecting, hydrostatic testing, operating nut and extensions.

When the Tapping Sleeve and Tapping Valve will be installed by the Seattle Water Department, payment at the unit bid price for the Tapping Sleeve and Valve shall include furnishing the sleeve and valve at the construction site designated, trench excavation, backfill with native material and compaction.

The unit contract price for "Valve Chamber, (Type)" and "Valve Chamber, Special, (Size)" shall include all costs required to furnish and install the precast concrete, brick and block, or cast-in-place chamber, including foundation, adjustment brick, castings and lid, ethafoam cushion, mortar plastering, valves, support piers, water proofing materials and steps or ladders.

The unit contract price for "Valve Box, Cast Iron" shall include all costs to furnish and install the valve box, including plastic foam cushion.

## SECTION 7-14 HYDRANTS

### 7-14.1 DESCRIPTION

Delete this section and replace with the following:

These specifications are to be used in conjunction with the AWWA Standard C502 for dry barrel fire hydrants for ordinary water works service.

The Contractor shall install only new, unused materials.

### 7-14.2 MATERIAL

Delete this section and replace with the following:

Materials shall be as specified in Section 9-30, as modified herein.

### 7-14.3(01) SETTING HYDRANTS

Supplement paragraph 3 with the following:

The Contractor shall also check the threads on the pumper and hose parts for proper pattern and service capability.

A concrete shear block, as shown on the hydrant detail, shall be constructed if the hydrant is not in a concrete sidewalk. Construction, materials, and finishing shall conform with Section 8-14, Cement Concrete Sidewalk. The shear block shall be set to the grade of the future sidewalk.

### 7-14.3(02)A HYDRANT RESTRAINT

Delete this section and replace with the following:

Hydrants shall be restrained with two 3/4 inch diameter steel shackle rods as shown on the Drawings. Threads will be cut at the ends, or where rod couplers are needed. "All Thread" rod will not be allowed. Shackle rods will be completely coated pursuant to Section 9-30.15.

### 7-14.3(03) RESETTING EXISTING HYDRANTS

Delete this section and replace with the following:

Where, on the Drawings, an existing hydrant is shown for adjustment to conform to new street alignment or grade, the hydrant shall be reset without disturbing the location of the hydrant lateral tee at the main.

The hydrant shall be shackled as specified in Section 7-14.3(02)A.

This work shall be in accordance with the specifications for setting new hydrants.

### 7-14.3(04) MOVING EXISTING HYDRANTS

Delete this section and replace with the following:

When an existing hydrant is shown on the Drawings to be moved, a new tee shall be inserted in the main, and the open part of the abandoned tee shall be securely plugged and shackled or blocked. The hydrant shall be shackled as specified in Section 7-14.3(02)A. The work shall be done in accordance with the specifications for setting new hydrants.

On charged mains, the furnishing and insertion of the new tee, and the plugging and blocking of the existing tee, will be by the Seattle Water Department as Specified in Section 7-11.3(09)A.



**7-14.3(07) NEW HYDRANT ON EXISTING MAIN (NEW TEE) (New Section)**

When a new hydrant is shown on the Drawings to be connected to an existing main, the new hydrant shall be installed as indicated. The hydrant shall be shackled as specified in Section 7-14.3(02)A. All work shall be in accordance with specifications for new work.

Connection and insertion of new tee and sleeve shall be by the Seattle Water Department as specified in Section 7-11.3(09)A.

**7-14.3(08) NEW HYDRANT ON EXISTING MAIN (EXISTING TEE) (New Section)**

When a new hydrant is shown on the Drawings to be connected to an existing main at an existing hydrant tee, the hydrant shall be installed as indicated and shall be shackled as specified in Section 7-14.3(02). All work shall be in accordance with specifications for new work. The connection shall be by the Seattle Water Department as specified in Section 7-11.3(09)A.

**7-14.3(09) RETAINING WALLS FOR HYDRANTS (New Section)**

Where indicated on the Drawings, the Contractor shall furnish and place a broken concrete slab wall around hydrants in accordance with the Standard Plan. Rockery rock may be used in place of broken concrete.

The broken concrete slabs shall be a minimum of 3-1/2 inches in thickness and not less than 3 feet x 1.5 feet in size. The slabs shall be set in level layers of the same thickness, and the exposed faces shall be as smooth as the shape and size of the slabs will permit.

The backfill behind the wall shall be Mineral Aggregate Type 2, in accordance with Section 9-03.

**7-14.4 MEASUREMENT**

Delete this section and replace with the following:

Measurement for "Hydrant, 6-Inch Connection, (Type)" and "Hydrant, 6-Inch Connection with Vertical Extension," will be per each.

Measurement for "Reset Hydrant," "Move Hydrant," and "Reconnect Hydrant" will be per each hydrant reset, moved or reconnected.

Measurement for "New Hydrant on Existing Main (New Tee)" and "New Hydrant on Existing Main (Existing Tee)" will be per each.

Measurement for "Retaining Wall, for Hydrant" will be per square foot of face of wall constructed.

Measurement for "Hydrant Extension, Vertical, 24-inch and Under," and "Hydrant Extension, Vertical, Over 24-inch" will be per each in place, and will include the casting, bolts, nuts, washers and gaskets.

**7-14.5 PAYMENT**

Delete this section and replace with the following:

Payment will be made for such of the following bid items that are included in the Bid Form:

- (1) "Hydrant, 6-inch Connection, (Type)" per each.
- (2) "Hydrant, 6-Inch Connection with Vertical Extension," per each.
- (3) "New Hydrant on Existing Main (New Tee)," per each.
- (4) "New Hydrant on Existing Main (Existing Tee)," per each.
- (5) "Reset Hydrant," per each.
- (6) "Move Hydrant," per each.

(7) "Reconnect Hydrant," per each.

(8) "Hydrant Extension, Vertical, 24-inch, and Under," per each.

(9) "Hydrant Extension Vertical, Over 24-inch," per each.

(10) "Retaining Wall for Hydrant," per square foot.

The unit contract price for "Hydrant, 6-Inch Connection," shall include all costs for the work required to furnish and install the hydrant, including the hydrant tee, auxiliary valve, valve box, restraint system and shackles, gravel drain, concrete blocks, bleeder, coating, painting and shear block, the 6-inch Ductile Iron pipe connecting the hydrant auxiliary gate valve to the water main and all the costs of the work to furnish and install the connecting pipe are included in the unit contract price for "Hydrant, 6-Inch Connection."

The unit contract price for "Hydrant 6-Inch Connection With Vertical Extension" shall include all work required for "Hydrant, 6-Inch Connection" plus all material and equipment and labor necessary to provide the required vertical extensions.

If the location of the hydrant differs from that shown in the Drawings and requires an increase of more than 5 feet of connection pipe, the excess of pipe over 5 feet will be paid for by either "Pipe, Water Main, Ductile Iron, Class 52, 6-Inch," if such a bid item is in the Bid Form or in accordance with Section 1-09.4 if not in the Bid Form.

The unit contract price for "New Hydrant on Existing Main (New Tee)" shall include all costs for work and materials required to furnish and install the new hydrant as specified, the excavation, backfill, and new connection pipe.

The unit contract price for "New Hydrant on Existing Main (Existing Tee)" shall include all costs for work and materials required to furnish and install the new hydrant as specified, including the excavation, backfill, and new connection pipe.

The unit contract price for "Reset Hydrant" shall include all costs for the work required to reset the existing hydrant as specified, including shackling, painting and new connection pipe.

The unit contract price for "Move Hydrant" shall include all costs for work and materials required to move the existing hydrant as specified, the excavation, backfill, and if required, furnishing of tee, sleeve, new connection pipe.

The unit contract price for "Reconnect Hydrant" shall include all costs for the work required to reconnect the existing hydrant, including new tee, shackles, painting, abandoning the existing tee and new connection pipe.

The unit contract price for "Hydrant Extension, Vertical, 24-inch and Under," and "Hydrant Extension, Vertical, Over 24-inch" shall include all costs for all materials and labor necessary to extend the hydrant to the required finished grade in a fully operational and finished condition.

The unit contract price for "Retaining Wall for Hydrant" shall include all costs for the work required to furnish and install the concrete slabs. Rock facing may be used in place of broken concrete.

**SECTION 7-15 - SERVICE CONNECTIONS**

Delete Section 7-15 in its entirety and replace with the following:

The Seattle Water Department will, at no cost to the Contractor, make all taps for service connections, and for supplying, disinfecting, and installing the service pipe.

**SECTION 7-16 - FLOW CONTROL SYSTEMS (New Section)****7-16.1 DESCRIPTION (New Section)**

This work shall consist of excavation, shoring, foundation preparation, bedding, jointing, backfilling and compacting for the construction of a flow control structure and detention pipe for storm water storage. The flow control structure shall consist of manhole structure with a flow control device.

**7-16.2 MATERIALS (New Section)**

Materials shall meet the requirements of the following sections of these specifications:

Manhole Components . . . . .	9-12
Corrugated Steel Pipe . . . . .	9-05.1(2)
Corrugated Aluminum Pipe . . . . .	9-05.1(3)
Frame and Grate . . . . .	9-05.15(1)

**7-16.2(1) FLOW CONTROL STRUCTURE (New Section)**

The Flow Control Structure shall be made from a standard manhole section, diameter as indicated on the Drawings and the Standard Plans for flow control structures.

Where surface water is to enter directly through the cover of the flow control structure, the cast iron frame and grate shall be per Standard Plan 264 and the precast slab shall be per Standard Plan 243a and b, Unit P to fit the diameter of the chamber. In all other cases, Standard Plan No. 230 ring and cover shall be used with a precast slab conforming to Standard Plan Series 200 with a 24-inch round opening. Manhole sections, castings and slabs shall meet the requirements of Section 7-05.

The Control device and connection shall consist of PVC pipe cross with an orifice, a pipe connection, and shear gate with a steel chain. The diameters of the control device and connection shall be the same as the diameter of the outlet pipe as indicated on the plans. The PVC pipe used for the cross and connection shall meet the specifications of ASTM D1785 Schedule 40. The PVC material used for the orifice plate and the shear gate shall be plate material meeting the specifications of ASTM D1784, PVC Class 12454-B. The orifice plate material shall be 1/4 inch thick; the shear gate material shall be 1/2 inch thick. The shear gate pin shall be of the same PVC material as the shear gate. The shear-gate chain shall be 12 gauge galvanized steel straight link chain.

**7-16.2(2) ALUMINUM DETENTION PIPE (New Section)**

Aluminum detention pipe shall be helical corrugated aluminum pipe up to 48 inches in diameter and annular corrugated pipe over 48 inches, meeting the requirements of AASHTO Designation M196 Type I with the gauge as indicated on the plans. The end plate and all end plate reinforcement shall be aluminum alloy 6061-T6 structural plate with the thickness as indicated on the plans. The surfaces that are in contact with concrete shall be painted. The paint shall conform to Federal Specification TT-P-645 (Primer, Paint, Zinc Chromate, Alkyd Vehicle).

**7-16.2(3) STEEL DETENTION PIPE (New Section)**

Steel detention pipe shall be galvanized helical corrugated steel pipe up to 48 inches in diameter and annular corrugated pipe over 48 inches, meeting the requirements of AASHTO Designation M36 Type 1, asphalt coated to requirements of AASHTO Designation M190 Type A with the gauge as indicated on the Drawings. The end plate and all end plate reinforcement will be structural steel plate of the type and thickness as designated on the Drawings.

**7-16.3 CONSTRUCTION REQUIREMENTS (New Section)****7-16.3(1) GENERAL (New Section)**

All work including excavation, foundation preparation, bedding, pipe laying and jointing, backfilling, compacting for the construction of detention pipe and flow control structure shall be in accordance with Section 7-05 and 7-17.

**7-16.3(2) FLOW CONTROL STRUCTURE (New Section)**

The PVC orifice plate shall be fusion welded to the PVC cross with an orifice of the diameter indicated on the Drawings drilled in its center.

The PVC shear pin shall be 3/4 inch in diameter and shall be fastened with a PVC cotter pin and stainless steel washer.

One end of the shear gate chain shall be attached to the shear gate and the other end shall be attached to a galvanized anchor bolt embedded in the leveling block. The chain shall be slack when the gate is closed.

After pipe or castings have been placed in their final positions, openings in the walls of the flow control structure shall be grouted in place to present a smooth, flush inner and outer surfaces.

**7-16.3(3) DETENTION PIPE (New Section)**

Joint coupling bands shall be of the type specified in Section 9-05.1(2)A and 9-05.1(3)A.

Seams in pipes and bands shall be gasketed in accordance with AASHTO Designation M196.

The end plate shall be welded to the end of the detention pipe with a watertight continuous weld.

The end of the detention pipe inside the flow control structure shall be ground smooth of all burrs and sharp edges.

Aluminum in contact with concrete shall be cleaned with a solvent to remove contaminants and then painted with two coats of paint as specified in Section 7-16.2(2).

Bedding for the detention pipe shall be Class B, using Mineral Aggregate Type No. 22 as specified in Section 7-17.3(1)B3.

**7-16.3(4) TEE CONNECTION TO CORRUGATED PIPE (New Section)**

Drainage pipes connected to corrugated detention pipe shall be made through a shop fabricated tee as shown on the Drawings and shall be installed in accordance to Section 7-17.3(2)C2. Tee shall be made to conform to size of detention pipe and sized to accept only rubber joint pipe.

**7-16.4 MEASUREMENT (New Section)**

Measurement for "Flow Control Structure, (Diameter)," shall be by each structure, complete in place.

Measurement for the "Pipe, Detention, (Material) (Size)," shall be by linear foot for the actual length of pipe installed.

Measurement for outlet pipe shall be in accordance with Section 7-08.

**7-16.5 PAYMENT (New Section)**

Compensation for the cost necessary to complete the work described in Section 7-16 will be made at the unit contract prices bid only for the pay items listed or referenced below:

(1) "Flow Control Structure, (Diameter)," each.

(2) "Pipe, Detention, (Material) (Size)," linear foot.

The unit contract price for "Flow Control Structure, (Diameter)," shall include all costs for the work required to furnish and construct the flow control structure including excavation, backfill, gravel bedding or foundation material, the PVC connection pipe and flexible adaptor coupling.

The unit contract price for "Pipe, Detention, (Material) (Size)," shall include all costs for the work required to furnish and install the detention pipe including excavation, backfill, the end plate, grinding smooth the detention pipe's end in the flow control structure, and cleaning and painting the aluminum, or steel surfaces as specified.

If an air vent is shown on the Drawings, all costs for fabricating and installing it shall be included in the unit contract price bid for "Pipe, Detention, (Material) (Size)."

The outlet pipe will be paid for as "Catch Basin Connection" per Section 7-08.5.

Tees will be paid for under Section 7-17.

## SECTION 7-17 - SANITARY SEWERS

Delete this title and replace with the following:

## SECTION 7-17 - STORM DRAINS AND SANITARY SEWERS

## 7-17.1 DESCRIPTION

Delete this section and replace with the following:

This work shall consist of trench excavation, shoring, foundation preparation, bedding, pipe laying, jointing, backfilling, compacting and testing for the construction of storm drains, sanitary sewers, and combined sewers.

All references to "sanitary sewers" shall be construed to mean "storm drains, sanitary sewers, and combined sewers."

## 7-17.2 MATERIALS

Delete the following items from the list of acceptable pipe:

ABS Composite and Asbestos Bonded Corrugated Steel.

Delete paragraph 2 and replace with the following:

All sewer and drain pipe shall have flexible gasketed joints unless otherwise specified.

Delete the following item from paragraph 4:

ABS Composite Sewer Pipe . . . . . 9-05.14

## 7-17.2(1) PROOF TESTS (PREQUALIFICATION) (New Section)

The intent of this requirement is to pre-qualify a joint system, components of which meet the above requirements, as to the water tightness capability of that joint system. This proof test shall be understood to apply to sanitary sewers and storm drains which are to be tested for water tightness prior to acceptance. Material and test equipment for proof testing shall be provided by the manufacturer. When approved by the Engineer, internal hydrostatic pressure may be applied by a suitable joint tester.

Proof Tests shall meet the requirements of the following Sections:

Concrete Sewer and Drain Pipe . . . . .	9-05.7(4)
Vitrified Clay Sewer and Drain Pipe . . . . .	9-05.8
Asbestos Cement Sewer and Drain Pipe . . . . .	9-05.9
PVC (Polyvinyl Chloride) Sewer and Drain Pipe . . . . .	9-05.12
Ductile Iron Sewer and Drain Pipe . . . . .	9-05.13

## 7-17.2(2) MATERIAL CERTIFICATION (New Section)

The manufacturer or fabricator shall furnish appropriate certification, based on manufacturer's routine quality control tests, that the pipe meets the requirements of the pertinent ASTM or ANSI Specification.

## 7-17.3(1)A SEWER TRENCH

Delete the title of this section and replace with the following:

## 7-17.3(1)A TRENCH EXCAVATION

Delete paragraph 3 of this section.

Supplement this section with the following:

Wherever a trench is excavated in paved roadway, sidewalk or other improved area, the surface improvement removal and restoration shall be limited to maximum pay width shown on Standard Plan 284.1 or to the requirements specified in Section 2-02.3(3), whichever is greater. If the Contractor damages or undermines the adjacent improvements outside the maximum pay width as described above, he shall be required to remove and replace those areas at no cost to the Owner.

Vertical trench width in a paved roadway, sidewalk or other improved area shall not exceed the maximum trench width as shown on Standard Plan 284.1. If the Contractor exceeds this width, he will be required to provide at his own expense any approved imported backfill material required outside the trench neat line limits.

Excess excavated trench material shall be removed and disposed of off-site per Section 1-04.12, or if deemed suitable by the Engineer, shall be placed elsewhere on the project in embankments or other improvements as directed by the Engineer.

The control of ground water shall be such that softening of the bottom of excavations, or formations of "quick" conditions or "boils" during excavation shall be prevented. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils.

During excavation and installation of pipelines, and placement of trench backfill, excavations shall be kept free of water. The Contractor shall control surface run-off so as to prevent entry or collection of water in excavations. The static water level shall be drawn down a minimum of 1 foot below the bottom of the excavation so as to maintain the undisturbed state of the foundation soils and allow the placement of any fill or backfill to the required density. The dewatering system shall be installed and operated so that the ground water level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

Before dewatering is started, the Contractor shall submit to the Engineer a statement of the method, installation and details of the dewatering system he proposes to use. Open and cased sumps shall not be used as primary dewatering for excavations deeper than 3 feet below the static water table.

The release of ground water to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines and sewers.

Supplement this section with the following after paragraph 9:

That portion of cribbing or sheeting extending below the springline of rigid pipe, or below the crown elevation of flexible pipe, shall be left in place unless satisfactory means of reconsolidating bedding or side support, disturbed by cribbing sheeting removal, can be demonstrated. If a moveable box is used in lieu of cribbing or sheeting, and the bottom cannot be kept above the springline of rigid pipe or the crown elevation of flexible pipe, the bedding or side support shall be carefully reconsolidated behind the moveable box, prior to placing backfill.

The use of horizontal strutting below the barrel of pipe or the use of the pipe as support for trench bracing will not be permitted.

Supplement this section with the following after paragraph 12:

The trench bottom will be considered to meet this requirement, with or without stabilization, when it has strength sufficient to support a length of the pipe to be used without noticeable deflection when an additional weight equal to the weight of one length of pipe is placed on it.

Where foundation material is required, it shall consist of Mineral Aggregate Type 2, or such other material as directed by the Engineer. The maximum size of aggregate shall not exceed 1 inch per foot of pipe diameter up to a maximum of 3 inches. The material shall be placed to a minimum depth of 4 inches or as may be necessary to provide the required stabilization. Ballast material as herein described may be used as bedding, up to the bottom of the pipe.

Where it is determined by the Engineer that the native material is of such character that it is not likely to be transported by moving ground water, the requirements for gradation to assure minimum void space will not apply.

Where the trench bottom is found to be unsuitable by the Engineer, or when the pipeline grade is lowered in excess of 1 foot, or when the horizontal alignment of the pipe is changed more than 1 foot after the initial trench is excavated, the additional excavation shall be considered as extra excavation.

**7-17.3(1)A1 UNEXPECTED OBJECTS (New Section)**

Unexpected objects, such as stumps, railroad ties, buried pavement, etc., encountered in the trench excavation shall be removed and disposed of by the Contractor. Removal of unexpected objects will be considered incidental to pipe installation unless one or more of the following conditions are met:

- (a) The object(s) cannot be removed by the same equipment or excavation method at hand.
- (b) The trench width or depth must be increased by 2 feet or more.

In the event that any of the above conditions are met, removal of the object will be paid in accordance with Section 1-09.4.

**7-17.3(1)A2 TRENCH EXCAVATION IN SOLID ROCK (New Section)**

Solid Rock Excavation shall cover the removal and disposal of solid rock as defined in Section 2-03.1(1).

Materials removed shall be replaced with suitable excess excavated native materials from adjacent trenches, roadway excavation, or from imported mineral aggregate of the type specified by the Engineer. Payment for imported materials, where required, shall be in accordance with applicable bid items in the Bid Form or Section 1-09.4.

**7-17.3(1)A3 SURPLUS MATERIAL (New Section)**

Surplus material obtained from trench excavation and determined to be suitable material for use elsewhere on the project by the Engineer shall be used per Section 2-03.3(10).

Surplus material not needed elsewhere on the project and unsuitable material shall be wasted pursuant to Section 2-01.2.

**7-17.3(1)B PIPE BEDDING**

Delete the last sentence of paragraph 1.

Supplement Section 7-17.3(1)B with the following:

**7-17.3(1)B1 BEDDING FOR RIGID PIPE (New Section)**

Bedding shall be classified as Class A, Class B, Class C, and Class D. The requirements and limits for the various classes of bedding are as shown in Standard Plan 265.

Where unauthorized excavation has been made below the established grade, the Contractor shall provide, place and compact suitable bedding material to the proper grade elevation at his own expense.

Bedding shall be placed in at least three lifts: The first lift (to provide at least a 4 inch thickness under any portion of pipe 27 inches in diameter and smaller, or 6 inches in thickness under any portion of pipe 30 inches in diameter and larger) shall be placed before the pipe is installed, and shall be spread smoothly so that the pipe is uniformly supported along the barrel. Subsequent lifts, of not more than 6 inches in thickness, shall be installed up to a point 6 inches above the top of the pipe. Lifts shall be brought up together on both sides of the pipe and shall be carefully worked under the pipe haunches by means of slicing with a shovel, vibration, or other procedure approved by the Engineer.

Class C bedding shall meet the requirements outlined for Class B bedding except that bedding material shall be to the spring line of the pipe.

Class D bedding shall consist of carefully excavating the trench to proper grade, overexcavating at the bell sections, and placing and compacting select native material around the pipe and backfilling in accordance with Section 7-17.3(3). Class D bedding, as described, shall be considered as incidental to the various items comprising the improvement. No separate payment will be made.

**7-17.3(1)B2 BEDDING FOR FLEXIBLE PIPE (New Section)**

Material for bedding of flexible pipe such as PVC, ABS, and corrugated metal pipe shall be Class B with the bedding material consisting of Mineral Aggregate Type 22. Bedding shall be placed in more than one lift: The first lift, to provide at least 4 inches thickness under any portion of the pipe, shall be placed before the pipe is installed, and shall be spread smoothly so that the pipe is uniformly supported along the barrel. Subsequent lifts of not more than 6 inches thickness shall be installed to the crown of the pipe and individually compacted to 90% density, as determined by ASTM D698-Method D. A further 6 inches lift of moderately compacted material shall be placed over the crown of the pipe.

**7-17.3(2)A SURVEY LINE AND GRADE**

Delete this section and replace with the following:

Survey line and grade control hubs will be provided by the Engineer in a manner consistent with acceptable practices. The Contractor may use either the "leather board" method or the "laser beam" method to control pipe alignment and grade. Any other procedure shall have the written approval of the Engineer.

When using the "leather board" method the Contractor shall transfer line and grade into the ditch where they shall be carried by means of a taut grade line supported on firmly set leather boards at intervals of not more than 30 feet. Not less than three leather boards shall be in use at one time. Grades shall be constantly checked and in event the leather boards do not line up, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the work.

When using a laser beam to set pipe alignment and grade, the Contractor shall constantly check position of laser beam from surface hubs provided by the Owner to insure laser beam is still on alignment and grade. In the event the laser beam is found out of position, the Contractor shall stop work and make necessary corrections to the laser beam equipment and pipe installed.

**7-17.3(2)B PIPE LAYING**

Supplement this section with the following:

Clearances between sewer or drain pipe and water main shall be maintained per Section 1-07.17(1).

**7-17.3(2)C PLUGS AND CONNECTIONS**

Delete this section and replace with the following:

All fittings shall be capped or plugged with a plug of an approved material gasketed with the same gasket material as the pipe unit; or shall be fitted with an approved mechanical stopper; or shall have an integrally cast knock-out plug. The plug shall be able to withstand all test pressures without leaking, and when later removed, shall permit continuation of piping with jointing similar to joints in the installed line.

**7-17.3(2)C1 FITTINGS (New Section)**

Unless otherwise specified, tee fittings shall be provided in the sewer and drain mains for side sewers, catch basin connections and service drains. Tees shall be 8 inches inside diameter except tees for side sewers, which shall be 6 inches inside diameter unless indicated otherwise in the Project Manual or on the Drawings. All fittings shall be of sufficient strength to withstand all handling and load stresses normally encountered. All fittings shall be of the same materials as the pipe, except when core drilling to insert a tee, which shall be per Section 7-17.3(2)C2. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface.

**7-17.3(2)C2 CUT-IN TEE ON EXISTING PIPE (New Section)**

Where indicated on the Drawings, or by the Engineer, the Contractor shall perform required work to cut a hole and install a tee on an existing sewer or storm drain pipe.

**Concrete Pipe To Existing Concrete Pipe:** Installing tee on Concrete Pipe shall be accomplished by core drilling a full size hole in one operation to accommodate an approved PVC tee insert with a coupling fitting, or a saddle type tee manufactured for that size of pipe 15 inches and smaller on which the tee is being installed.



Pipe sizes of 18 inches and larger on which the tee is being installed shall incorporate a length of concrete pipe cut to size that can be placed in the core drilled hole with its bell end against the outside face of the existing pipe and the barrel end inserted just to the inside face of the existing pipe. The Contractor shall thoroughly clean the bonding areas between the tee and the existing pipe so that the surfaces are free of dirt or dust, grease, oil or other contaminants that may reduce the bond of the grout to the surfaces. Both surfaces shall be coated with Concrese 1001 LPL or an approved equal. The annular space between the tee and the core drilled surfaces shall be tightly packed with non-shrink grout. The connection shall be neatly finished inside and outside the existing concrete pipe.

**Ductile Iron Tee To Existing Pipe:** The existing concrete pipe shall be core drilled with a hole large enough to accommodate the barrel of the specified size of ductile iron pipe and provide a 1 inch space between the ductile iron pipe and the existing pipe for application of grout. A length of ductile iron pipe shall be cut so that it can be placed in the core drilled hole with its bell end against the outside of the existing pipe and the barrel not protruding beyond the inside face of the existing pipe. The Contractor shall clean the outside of the ductile iron pipe, removing loose particles (dust, dirt, oil, or film of any sort) that may reduce the bond of the grout to the pipe. After core drilling, the exposed surface of the existing concrete pipe shall be rough and clean. Both surfaces shall be coated with Concrese 1001 LPL or an approved equal. The annular space between the pipe and core drilled surfaces shall be tightly packed with non-shrink grout. The connection shall be neatly finished inside and outside the existing concrete pipe.

The existing ductile iron pipe shall be core drilled or using arc welding machine cutting a full size hole and mount a tapping saddle type tee manufactured for that size of pipe on which the tee is being installed. The contact area between the saddle and the pipe shall be thoroughly cleaned of all dirt, sand, grit, grease or other foreign matters to ensure continuous contact by the straps.

**Corrugated Metal Tee To Existing Corrugated Metal Pipe:** In corrugated steel and aluminum pipes, a hole shall be sawcut to match a shop fabricated tee as shown on the Drawings.

The flange plate of the fabricated tee shall be corrugated to match corrugation of the pipe to which it is attached. A neoprene gasket or approved equal shall be inserted between the outside face of the existing pipe and the flange plate of the tee and connected by bolting. Corrosion protection shall be provided if the pipe section of the tee is non-corrugated aluminum pipe.

The incoming pipe and the tee shall be connected with stainless steel rigid walled flexible coupling. If the pipe section of the tee is aluminum, corrosion protection shall be provided by isolating the aluminum from the steel by extending the gasket 1 inch beyond the edge of the stainless steel coupling.

This work shall also include necessary excavation, shoring to expose the existing pipe, installing the fitting, backfilling and compaction of trench. All existing small diameter pipe made of non-reinforced concrete or vitrified clay shall be fully exposed for inspection.

The excavation shall be backfilled and compacted per Section 7-17.3(3)A Compaction of Trench Backfill. Maximum density shall be determined by compaction control test specified in Section 2-03.3(14)D.

The Contractor shall notify the Sewer Utility at 625-4335 at least 24 hours prior to beginning cut-in operations. Sewer Utility will inspect the existing pipe before drilling and the cut-in tee during installation.

If the exposed existing pipe is found cracked or deformed, Sewer Utility will either roll in a new pipe or repair the damage at no cost to the Contractor, provided the damage was not caused by the Contractor's operations. If Sewer Utility rolls in a pipe with a tee already on it, no fitting will be required.

#### 7-17.3(2)F JOINTING OF DISSIMILAR PIPE

Delete this section and replace with the following:

#### 7-17.3(2)F JOINTING (New Section)

Where it is necessary to break out or connect to an existing sewer during construction, only new pipe having the same inside diameter will be used in reconnecting the sewer. Where joints must be made between pipes with a mismatched wall thickness, the Contractor shall use a flexible gasketed coupling, adapter or coupling adapter to make a watertight joint. Couplings shall be those manufactured by "Romac," "Fernco," "Smith-Blair," or approved equal.

#### 7-17.3(2)G SEWER LINE CONNECTIONS

Delete this section and replace with the following:

Catch basin, service drain, or side sewer connections to trunks, mains, or laterals, shall be left uncovered until after the Engineer has inspected and approved the work. After approval of the connection, the bedding shall be completed to a point 6 inches above the top of the pipe and the trench backfilled.

#### 7-17.3(2)H SIDE SEWER CONNECTIONS (New Section)

Supplement this section with the following:

Side sewers shall be laid below all watermain and shall meet the requirements for the minimum separation of sanitary sewers and watermain in accordance with Section 1-07.17(1)A.

#### 7-17.3(2)J JACKING, AUGERING OR TUNNELING (New Section)

Where indicated on the Drawings, the Contractor shall install the pipe by jacking, augering or tunneling, or installing the pipe in a casing pipe by a combination of these methods.

When use of a casing pipe is required, the Contractor shall be responsible to selecting the gauge and size required consistent with his jacking or augering operation, and shall be set to line and grade. During jacking or augering operations, particular care shall be exercised to prevent caving ahead of the pipe which will cause voids outside of the pipe. When the carrier pipe is installed within a casing pipe, the carrier pipe shall be skidded into position in an acceptable manner. The annular space between the casing and the pipe shall be filled with light weight concrete.

The faces of the jacking pit shall be constructed by driving steel sheets, or installing timber lagging as the excavation proceeds. The sheets, or lagging, shall extend a minimum of 5 feet below the bottom of the pit except at the pipe sewer. Prior to jacking and augering activities, 5 sets of shop drawings describing these activities, including dimensioning of pit length and size of underground borings and complete description of shoring, shall be submitted to the Engineer for approval. No separate or additional compensation will be made for Plan submittals, or for material used in the jacking operations or for the cost of the backfilling operations, including compaction.

The approval of the procedure and equipment shall not relieve the Contractor of responsibility nor waive or modify any provisions of the contract.

The Contractor shall pump foam concrete inside the steel casing pipe following the installation of the carrier pipe to the line and grade shown on the Drawings. The foam concrete shall have a maximum weight of 65 pounds per cubic foot.

The mix for the foam concrete shall be as follows per each 4 cubic yard batch:

1,707 lbs. Portland Cement  
1,550 lbs. Plaster Sand  
80 gals. Water  
Add foam to make 4 cubic yards

#### 7-17.3(3) BACKFILLING TRENCHES

Delete paragraphs 2 and 3, and replace with the following:

In backfilling the trench, the Contractor shall take all necessary precautions to protect the pipe from any damage or shifting. The Contractor shall backfill from the side of the trench to a uniform depth of 2 feet above the crown of the pipe before starting compaction. See Section 7-17.3(3)A for Compaction Requirements.

During all phases of the backfilling operations and testing as outlined herein, the Contractor shall protect the pipe installation, provide for the maintenance of traffic as may be necessary, and provide for the safety of property and persons.

The Contractor shall use suitable native excavated material for trench backfill unless notified by the Engineer that the native material is unsuitable. The Engineer will examine excavated native material at the time of excavation to determine its suitability for use as backfill. Native material will be considered suitable for trench backfill if it is:

- (a) Capable of attaining the degree of compaction specified in Section 7-17.3(3)A.
- (b) Within reasonable tolerance of optimum moisture content.
- (c) Reasonably free of organic material, clay, frozen lumps, rocks or pavement chunks more than 6 inches in maximum dimension, or other deleterious matter.

Unsuitable backfill material shall be removed from the site, disposed of per Section 1-04.12, and replaced with Mineral Aggregate Type 17 or such other imported material as designated by the Engineer.

The Contractor shall take any necessary steps to protect the excavated material from becoming contaminated with excessive moisture. Any material that becomes unusable due to the Contractor's failure to take adequate measures to provide protection from moisture shall be replaced at the Contractor's expense with Mineral Aggregate Type 17 or such other material as the Engineer will accept.

Where it is required that a blanket of select material or bank run gravel be placed on top of the native backfill, the backfill shall be placed to such elevation as shown on the Drawings, or as the Engineer may direct, and shall be leveled to provide for a uniform thickness of the borrow material. Compaction is required.

#### 7-17.3(3)A COMPACTION OF TRENCH BACKFILL (New Section)

Trench backfill shall be spread in layers and be compacted by mechanical tampers of the impact type approved by the Engineer. The backfill material shall be placed in successive layers with the first layer not to exceed 2 feet above the pipe, and the following layers not exceeding 12 inches in loose thickness, with each layer being compacted to the density specified below:

- (a) Improved areas such as street and sidewalk areas shall be compacted to 95% of maximum dry density.
- (b) Unimproved areas or landscape areas shall be compacted to 90% of maximum dry density.

Compaction control tests shall be performed as specified in Section 2-03.3(14)D.

The procedure and equipment to be used for backfill compaction shall be demonstrated on a test section of pipeline to be designated by the Engineer.

The Contractor shall excavate test pits in the backfill as directed by the Engineer for the purpose of testing the backfill compaction. All costs in connection with excavating test pits and from standby time during field density test shall be considered as incidental to the backfill and no separate payment will be made.

If the required compaction density has not been obtained, the Contractor shall remove the backfill from the trench and recompact using heavier compaction equipment or more passes. This process shall be repeated until the Contractor has established a procedure that will provide the required field density. The Contractor will then be permitted to proceed with backfilling and compacting the remainder of the pipeline under the approved compaction procedure.

In the event routine field densities taken during the course of construction show the specified compaction is not being obtained because of changes in soil types or for any other reason, the Contractor will be required to reestablish his compaction procedure. In no case will excavation and pipelaying operations be allowed to proceed until the specified compaction is attained.

#### 7-17.3(4)A GENERAL

Delete paragraph 1 and replace with the following:

Sewers and appurtenances shall be cleaned and tested after backfilling by either the exfiltration or low pressure air method at the option of the Contractor, except where the ground water table is such that the Engineer may require the infiltration test.

#### 7-17.3(4)D AIR PRESSURE TEST FOR SANITARY SEWERS CONSTRUCTED OF AIR PERMEABLE MATERIALS

Delete Item 2 and replace with the following:

- 2. The allowable rate of air loss shall be .003 cfm per square foot of internal pipe surface, but the total air loss shall be not less than 2 cfm nor more than 3.50 cfm.

#### 7-17.3(4)E1 RECOMMENDED PROCEDURE FOR CONDUCTING ACCEPTANCE TEST BY PRESSURE DROP METHOD (New Section)

- (a) Plug all pipe outlets with suitable test plugs. Brace each plug securely.
- (b) All gauge pressures in the test should be increased by the amount of groundwater pressure at the center of the pipe.
- (c) Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.
- (d) After an internal pressure of 4.0 psig is obtained allow at least 2 minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
- (e) After the 2 minute period, disconnect air supply.
- (f) When pressure decreased to 3.5 psig, start stop watch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. This time interval should then be compared with the time required by specification as computed below.
- (g) List size and length of all portions of pipe under test in table similar to the one that follows. The maximum reach to be tested in one operation shall be the reach between two consecutive manholes.
- (h) By the use of Nomograph, compute K and C. Use scales d and L, read K and C, and enter these values in the table.
- (i) Add all values of K and all values of C for pipe under test.
- (j) If the total of all C values is less than one, enter the total of all K values into the space for "Time Required by Specification."
- (k) If the total of all C values is greater than one, divide the total of all K values by the total of all C values to get  $t_q$ . To make this division with the nomograph, use scales C and D, and read  $t_q$ .

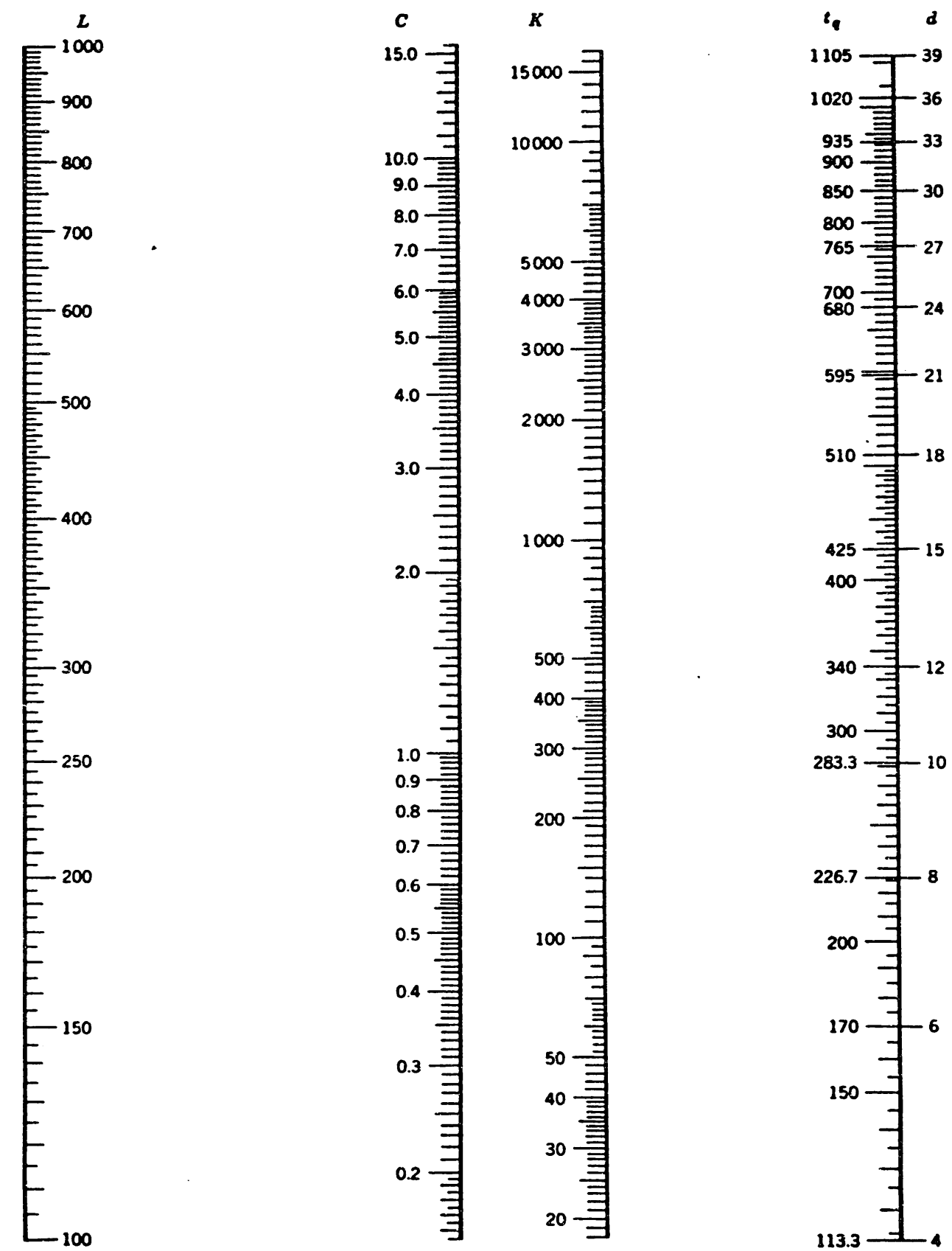
[illegible]

Fig. 1

NOMOGRAPH FOR THE SOLUTION OF  $K = .011d^2L$ ,  $C = .0003882dL$ ,  
 $t_q = K \div C$

## 7-17.3(4)I TELEVISION INSPECTION

Delete this section and replace with the following:

The Engineer will inspect and videotape, using closed circuit television, all sewers and storm drains 6 inches through 48 inches in diameter. Pipe larger than 48 inches in diameter will be inspected visually after testing. Inspection and videotaping will be performed at least twice: once as part of the final acceptance process, and a second time approximately 6 to 11 months after the final acceptance.

Approximately 1200 linear feet of mainline pipe can be videotaped and inspected per day. Except for projects having less than 1200 linear feet of mainline pipe, 1200 linear feet of pipe will be the minimum length of pipe per day the Engineer will schedule for TV inspection. On projects having more than 1200 linear feet of mainline pipe, television inspection shall be scheduled on the basis of one full day per 1200 linear feet of pipe to be inspected. Television inspection and videotaping will not be made until after manholes have been channeled and the pipe cleaned and air tested. On projects with less than 1200 linear feet of pipe, the entire work shall be substantially complete prior to the final acceptance videotaping and inspection.

On projects having more than 1200 linear feet of pipe, TV inspection may be performed prior to the work being substantially complete. The Contractor shall notify the Engineer when pipe sections are ready for TV inspection. The Engineer will require a minimum of 5 working days notice in order to schedule this inspection. The Contractor is requested to be present during all TV inspections and videotaping. The Contractor shall also provide whatever assistance may be necessary to ensure vehicular access and egress for the Owner's equipment when making TV inspections.

Should video inspection during the final acceptance process discover any pipe or appurtenance which has been laid or jointed in nonconformance with the Specifications, the Contractor shall, upon order of the Engineer, correct by repairing or by removing and replacing, at the Contractor's expense, that portion of the pipe found deficient. After the Contractor has made the necessary corrections to the deficient portion of the pipe, the repairs will be verified by additional television inspection. This process will continue, if necessary, until the entire work is finally accepted by the Engineer.

6 to 11 months after the final acceptance, the sewer or storm drain will again be inspected and videotaped. This videotape will then be compared with the videotape made at final acceptance to determine whether or not any changes have occurred in the condition of the pipe since final acceptance. Should there be evidence of inconsistencies as compared to the original installation which, in the opinion of the Engineer, warrant replacement or repair, the Contractor shall, upon order of the Engineer, correct those deficiencies as required under the Contractor's one-year guarantee. After the necessary corrections have been made by the Contractor, the corrections will be verified by additional television inspection.

If the Contractor calls for an initial TV inspection, and the pipe is not clean or has so many deficiencies that the line cannot be fully inspected, the reinspection will be charged to the Contractor, and the cost withheld from monies due to the Contractor.

## 7-17.4 MEASUREMENT

Delete this section and replace with the following:

Measurement for "Extra Excavation" will be by the cubic yard of material actually removed below the pipe bedding, in accordance with the standard trench width neat lines shown on the Standard Plan.

Measurement for "Bedding (Class) (Size) Pipe" will be by the linear foot of pipe actually laid. Measurement will be from center to center of standard manholes or to the inside face of structures.

Measurement for pipe will be by the linear foot of pipe laid and successfully tested, and shall be along the centerline of the pipe through the tees. Measurements will be from center to center of new or rechanneled manholes or to the inside face of structures or manholes not channeled or to the end of pipe where it dead ends beyond manholes. Measurement will be to the nearest 0.1 foot.

No measurement will be made for trench excavation and backfill except for foundation material, extra excavation and imported backfill material.

Measurement for foundation material will be by the cubic yard of Mineral Aggregate Type 2 required to fill the void made by extra excavation and shall be based on neat line width of trench and depth and length as computed by the Engineer, per Section 1-09.1.

Measurement for "Steel Casing Pipe, (Size), Tunneled, Jacked or Augered," will be by the linear foot of pipe actually installed.

Measurement for "Pipe, (Material), Jack/Auger/Tunnel, (Size)," will be by the linear foot of pipe actually installed.

Measurement for tees shall be by each for each size installed.

Measurement for tees cut into existing pipe shall be by each for each size installed.

Measurement for imported Mineral Aggregate, when ordered for trench backfill in lieu of native material by the Engineer, will be by the cubic yard based upon the maximum neat line trench pay width as specified in Section 7-17.3(1)A and the Standard Plan, and the depth designated by the Engineer. Imported Mineral Aggregate used beyond these neat line trench limits will be at the Contractor's expense. The quantity of backfill material shown in the Bid Form is an estimate only, and shall not, under any circumstances, be considered to indicate the quantity which may actually be required.

## 7-17.5 PAYMENT

Delete this section and replace with the following:

Payment will be made at the unit contract price for such of the following bid items as are included in the Bid Form:

- (1) "Extra Excavation," per cubic yard.
- (2) "Bedding, (Class), (Size) Pipe," per linear foot.
- (3) "Pipe, (Use), (Material)(Class), (Size)," per linear foot.
- (4) "Steel Casing Pipe, (Size), Tunneled, Jacked or Augered," per linear foot.
- (5) Pipe, (Material), Jack/Auger/Tunnel, (Size)," per linear foot.
- (6) "Tee, (Material), (Size)," each.
- (7) "Tee, (Size), Cut-In Existing (Material) Pipe," each.

The unit contract price for "Extra Excavation" shall include all costs to remove excavated material, haul and dispose of the material.

The unit contract price for "Bedding, (Class), (Size)," shall include all costs for the work required to furnish and install the bedding to the cross section indicated.

The unit contract price for "Pipe, (Use), (Material) (Class), (Size)" shall include all costs for the work required to furnish and install the pipe of the type and size specified, and including the following:

- (a) Trench excavation (except "Extra Excavation"); haul, stockpiling, backfill, and compaction of native material.
- (b) Removal and off-site disposal of excess excavated native material, or placement of suitable excess excavated native material elsewhere on the project.
- (c) Cribbing, sheeting, and dewatering.
- (d) Removal and disposal of existing pipe encountered in required trench excavation and backfill.

The cost of the Owner's labor and equipment for the videotaping during the final acceptance process and the videotaping 6 to 11 months later to recheck the pipe condition will be borne by the Owner unless additional videotape inspection is necessary to verify corrections or replacement of deficient pipe. The cost of additional television inspection and videotaping to verify repairs or replaced pipe will be borne by the Contractor. The Contractor shall also be responsible for all costs incurred in any television inspection performed solely for the benefit of the Contractor.

The unit contract price for "Steel Casing Pipe, (Size), Tunneled, Jacked or Augered," shall include all costs for the work required for labor, materials, tools, and equipment necessary to complete the work as specified in Section 7-17.3(2)J, including installation and removal of the jacking pit and shoring.

The unit contract price for "Pipe, (Material), Jack/Auger/Tunnel, (Size)," shall be as specified per Section 7-17.3(2)J.

The unit contract price for "Tee, (Material), (Size)" shall include all costs for the work required to furnish and install the tee as specified including plug.

The unit contract price for "Tee, (Size), Cut-In Existing (Material) Pipe," shall include all costs for making graft including core drilling, excavation, backfill, compaction, installing tee and adaptor if necessary. If Sewer Utility rolls in a pipe with a tee, no payment will be made.

Payment for imported material when ordered in lieu of native backfill material by the Engineer will be paid as Mineral Aggregate Type 17 or such other imported material acceptable to the Engineer.

Foundation material when required on the Drawings, or directed by the Engineer, shall be paid as "Mineral Aggregate Type 2" or "Mineral Aggregate Type 14" per cubic yard, per Section 4-01.5.

Where foundation material is not shown on the Drawings and no bid item for "Mineral Aggregate Type 2" or Mineral Aggregate Type 14" is included in the Bid Form, and it is determined by the Engineer that the existing foundation is unsuitable, payment will be made in accordance with Section 1-09.4.

Dewatering of the trench shall be considered as incidental to bid items for the appropriate type of pipe listed in the Bid Form, unless otherwise provided in the Special Provisions.

The work of cleaning and testing, except TV inspection, and furnishing caps and plugs for the tests shall be considered as incidental to the bid items for the appropriate type of pipe as listed in the Bid Form.

All work required in proof testing as specified herein shall be considered as incidental to the bid items for the appropriate type of pipe as listed in the Bid Form.

The Contractor will provide all necessary water for construction and testing purposes, according to the requirements of Section 2-07.

## SECTION 7-18 SIDE SEWERS (New Section)

### 7-18.1 DESCRIPTION (New Section)

This work shall consist of excavation, shoring, foundation preparation, bedding, jointing, backfilling, compacting and testing for the construction of Side Sewers.

A side sewer is considered to be that portion of a sewer line that will be constructed between a main sewer line and a residence or other buildings in which the disposal of sanitary waste originates. It does not include any of the internal piping or connecting appurtenances, the installation of which is controlled by a municipal code, ordinance or regulation.

The general requirements for construction of sewers in other sections of these specifications shall apply for construction of side sewers unless they are inconsistent with any of the provisions of this particular section and the specifications shall apply alike to all side sewers on public rights-of-way and private property.

### 7-18.2 MATERIALS (New Section)

#### 7-18.2(1) PIPE (New Section)

Pipe materials shall meet the requirements for the following sections:

Plain Concrete Storm Sewer Pipe . . . . .	9-05.7(1)
Vitrified Clay Sewer Pipe . . . . .	9-05.8
Asbestos Cement Storm Sewer Pipe . . . . .	9-05.9
PVC Sewer Pipe . . . . .	9-05.12
Ductile Iron Sewer Pipe . . . . .	9-05.13

All pipe shall be clearly marked with type, class, and/or thickness, as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

#### 7-18.2(2) JOINTS (New Section)

Approved jointing shall be flexible gasketing.

Flexible gasketing shall be construed to include rubber, synthetic rubberlike and plastic materials specially manufactured for the joint, pipe size, and use intended and shall be furnished by the manufacturer of the pipe to be used. Jointing materials shall meet the requirements of Section 7-17.3(2)E GASKETED JOINTS.

#### 7-18.2(3) FITTINGS (New Section)

Tees, wyes, bends, couplers, adapters, and transition sections shall conform to the requirements of Sections 7-18.2(1) and 7-18.2(2).

### 7-18.3 CONSTRUCTION REQUIREMENTS (New Section)

#### 7-18.3(1) GENERAL (New Section)

Side sewer construction shall conform to the Standard Plan and all applicable ordinances or regulations with respect to equipment, protective measures, size of pipe, depth of cover, number of users per pipe, permissible connections, inspection, and testing.

Side sewer locations shown on the Drawings shall be subject to relocation in the field after construction starts. Regardless of the Drawing location, the Contractor shall place the tee or wye branch in the main sewer line at the location designated by the Engineer.

The Engineer will stake and indicate the depth for the invert elevation of end pipe at the street margin or property line.

Side sewers shall be laid below the water main and shall meet requirements for minimum separation in accordance to Section 1-07.17(1)A.



**7-18.3(1)A SIDE SEWERS NOT SHOWN ON THE PLANS (New Section)**

In cases where side sewers are not shown on the Drawings, an abutting property owner may, upon approval of the Engineer, make application for side sewer, provided however, that he does so while construction is still underway and provided further that substantially all the necessary equipment for excavating, backfilling and compacting has not been removed from the block by the Contractor. In such cases the Contractor shall complete the side sewer construction at his unit contract prices.

The Contractor will not be required to construct side sewers for which applications are received after completion of construction and removal of equipment from the block containing the applicant's property. Under such a condition, the Contractor may construct the side sewer by negotiating the conditions and price with the applicant and look to him for payment.

If the Contractor elects to construct a side sewer after completion of work in the block and after removal of his equipment therefrom, and do so at his bid price, payment will be made by the owner in the normal manner under the contract.

**7-18.3(1)B SIDE SEWERS SHOWN ON THE PLANS (New Section)****7-18.3(1)B1 PROTECTION OF EXISTING SIDE SEWER (New Section)**

When a newly-constructed pipe line crosses above or beneath an existing side sewer which is shown on the Drawings, it shall be the responsibility of the Contractor to protect the existing side sewer from damage during the course of construction. Damage to the existing side sewer shall be replaced by the Contractor at no cost to the City.

**7-18.3(1)B2 REMOVE AND RE-LAY EXISTING SIDE SEWER (New Section)**

The Contractor shall complete the work in accordance with Sections 7-17. All jointing shall be made in accordance to Section 7-18.3(3)C.

**7-18.3(2) EXCAVATION AND BACKFILL (New Section)**

Excavation and backfilling for side sewers shall conform to the requirements of Section 7-17, excepting that no backfill in excess of that required to hold the pipe in true alignment shall be placed prior to inspection.

**7-18.3(3) PIPE LAYING AND JOINTING (New Section)**

Pipe laying and jointing, except as hereinafter provided, shall conform to the requirements of Section 7-17.

**7-18.3(3)A LINE AND GRADE (New Section)**

Side sewers shall be laid to a line and grade between the main sewer tee branch or wye branch and the right-of-way margin, so as to best serve the property relative to the following conditions, as may be directed by the Engineer:

- (a) Where a vacant property is level with or lower than the street grade, the invert elevation of the side sewer end pipe at the right-of-way margin shall be one foot higher than the elevation of the crown of the main sewer at the location of its tee or wye branch.
- (b) Where an occupied property is higher than the street grade and where the slope will be greater than called for in (1) above, the maximum grade of the side sewer at the right-of-way margin will be established by the Engineer so as to place the side sewer pipe at an elevation that will be below the invert of any proposed storm drain pipe, unless other conditions prevent it. Where a storm drain pipe exists, the clearance between the crown of one and the bottom of the other shall be not less than 6 inches. In either of the above described conditions, the end pipe of the side sewer, when placed at the right-of-way margin, shall be such as to enable a backfill cover over the crown of the pipe of not less than 2-1/2 feet below the established street grade.
- (c) Where an occupied property is level with or lower than the street grade, side sewer pipe shall be laid on a grade not less than 1/4 inch per linear foot wherever possible. If this is not feasible,

the Engineer may authorize the laying of pipe on a grade as little as 1/8 inch per linear foot, but then only if extreme care is used in the selection and placement of bedding, and the jointing of the pipe sections and fittings.

**7-18.3(3)B PIPE LAYING (New Section)**

Bell and spigot pipe shall be laid with the bell end up grade. All pipe laying shall start and proceed up grade from the point of connection at the public sewer or other starting point.

Pipe shall be laid in a straight line at a uniform grade between fittings, or on a uniform horizontal or vertical curvature achieved by deflecting pipe joints within the limits recommended by the manufacturer of the pipe used.

**7-18.3(3)C JOINTING (New Section)**

Where it is necessary to break out an existing side sewer during construction due to grade conflict with a newly constructed pipeline, only new pipe will be used in reconnecting the side sewer. Where joints cannot be made due to dissimilar pipe material or mismatched wall thickness, the Contractor shall use a flexible gasketed coupling to make a watertight joint. Couplings shall be those manufactured by "Romac", "Fernco", or "Smith-Blair" or approved equal.

**7-18.3(4) FITTINGS (New Section)**

All fittings shall be factory-produced and shall be designed for installation on the pipe to be used. Fittings shall be of the same quality and material as the pipe used, except when installing a PVC insert on existing pipe.

The maximum deflection permissible at any one fitting shall not exceed 45 degrees (one-eighth bend). The maximum deflection of any combination of two adjacent fittings shall not exceed 45 degrees (one-eighth bend) unless straight pipe of not less than 2-1/2 feet in length be installed between such adjacent fittings, or unless one of such fittings be a wye branch with a cleanout provided on the straight leg.

Side sewers shall be connected to the tee, wye, or riser provided in the public sewer where such is available, utilizing approved fittings or adapters. Where no tee, wye, or riser is provided or available, connection shall be made by core drilling and installing an approved tee, as specified in Section 7-17.3(2)C1.

**7-18.3(5) CLEANOUTS (New Section)**

Not less than one cleanout shall be provided for each side sewer and/or each total change of 90 degrees of grade or alignment, except that no cleanout will be required at the connection of the side sewer to a riser on the public sewer. A suitably located cleanout in the house piping or plumbing may be considered as a cleanout for the side sewer.

Cleanouts shall be placed at intervals of not more than 100 feet in straight runs. Cleanouts in the line shall utilize a wye branch at the side sewer.

The extension of house sewer cleanouts to grade will be optional with the home owner. When installed to grade, cleanouts shall be full side sewer diameter and shall be extended to a point not less than 6 inches nor more than 12 inches below the finished ground surface and shall be plugged with a removable stopper which will prevent passage of dirt or water. When specified, the Contractor shall install an approved casting to provide ready access to the cleanout stopper.

**7-18.3(6) INSPECTION AND TESTING (New Section)****7-18.3(6)A INSPECTION (New Section)**

Excavation and backfilling for side sewers shall conform to the requirements of Section 7-17, except that no backfilling in excess of that required to hold the pipe in true alignment shall be placed prior to inspection.

Pipes installed and backfilled without visual inspection shall be excavated and exposed for inspection at the Contractor's expense.

**7-18.3(6)B TESTING (New Section)**

All side sewers shall be tested after backfill. Side sewers that are reconstructed or repaired to a length of 10 feet or more shall be tested for watertightness. Testing of newly reconstructed sections of side sewers consisting of a single length of pipe will not be required. Testing shall be performed in the presence of the Engineer in accordance with Section 7-17.3(4).

All side sewers constructed in conjunction with the main sewer shall, for purpose of testing as specified in Section 7-17.3(4), have a 6-inch tee fitting pipe placed at the point where the side sewer crosses the street or other public right-of-way margin. The tee opening shall be positioned perpendicular to the side sewer slope, unless otherwise directed by the Engineer.

When the new side sewer is connected to a new main sewer installed under the same contract, and the side sewer is not tested simultaneously with the test of the main sewer, the Contractor shall furnish and place, at his own expense, an additional 6-inch tee in the first pipe out of the main sewer tee, so that an inflatable rubber ball can be inserted for sealing off the side sewer and thus permit separate tests.

When the new side sewer is connected to an existing main sewer, the Contractor shall furnish and place 2 test tees: one immediately adjacent to the main sewer and a second where the side sewer crosses the street or right-of-way margin. Both test tees will be paid per Section 7-18.5.

The ends of side sewers or test tee openings shall be plugged watertight with materials and by method acceptable to the Engineer.

**7-18.3(7) MISCELLANEOUS REQUIREMENTS (New Section)****7-18.3(7)A1 PIPE AND CONNECTIONS (New Section)**

Side sewer in public right-of-way or utility easement shall be not less than 6 inches in diameter unless otherwise specified. Side sewers on private property shall be not less than 4 inches in diameter. No roof drain, area drain, or subsurface drain shall be connected to a side sewer which is connected to a separate main line sanitary sewer.

Roof drains or private service drains in areas of combined sewer systems shall be run in a separate pipe to the property line before connecting into the side sewer.

**7-18.3(7)A2 PROXIMITY TO WATER SUPPLY LINES (New Section)**

Clearance between side sewers and water mains shall be maintained as specified in Section 1-07.17(1).

**7-18.3(7)A3 PLUGS (New Section)**

Any unused openings to the side sewer shall be closed with a watertight plug fastened in place.

**7-18.3(7)A4 SEPTIC TANKS AND CESSPOOLS (New Section)**

No side sewer shall be constructed through or adjacent to an existing cesspool or septic tank. If the conditions prohibit any other location, the Contractor shall abate the cesspool or septic tank by such means as the Engineer may direct, and by such payment as may be specified or agreed upon.

**7-18.3(8) RESTORATION, FINISHING AND CLEANUP (New Section)**

The Contractor shall restore and/or replace all pavement curbing, sidewalks, landscaping, or other disturbed surface improvements to their original condition in such manner as to meet the requirements of applicable sections. All surplus materials and temporary structures, as well as all excess excavation shall be removed and the entire site of Contractor operations shall be left in a neat and clean condition.

When the course of the work requires any disturbance of private property, the Contractor shall comply with the requirements of Section 1-07.24.

**7-18.3(9) EXTENDING SIDE SEWERS INTO PRIVATE PROPERTY (New Section)**

Unless otherwise provided by local sewer ordinances, the property owners will be permitted to extend side sewers onto their property and connect fixtures thereto, as soon as the main sewer construction has progressed past the point of side sewer construction and leakage tests have been satisfactorily completed, provided the use of the connections will not interfere with the completion of the other parts of the contract work and provided the extension is approved by the Engineer. Such side sewer connections, when authorized by the Engineer, shall not relieve the Contractor of his responsibility to maintain the main sewer until final acceptance of the contract work.

**7-18.3(10) END PIPE MARKER (New Section)**

Location of side sewers shall be marked by the Contractor at the property line by a 2 x 4 wooden stake 4 feet long buried in the ground a distance of 3 feet. The lower end shall have a 2 x 4 cleat nailed to it to prevent withdrawal of the stake. The exposed 1 foot shall be painted traffic white and the depth to the side sewer or tee shall be indicated in black paint on the 2 x 4. In addition, a length of 12 gauge galvanized wire shall be provided to extend from the plugged end of the side sewer or tee. The upper end shall emerge at the stake, but shall not be fastened to it.

**7-18.4 MEASUREMENT (New Section)**

Measurement for "Pipe, (Use), (Material) (Class), (Size)," will be along the pipe from the tee or wye of the main sewer through tees, wyes and other fittings to the street margin or right-of-way margin. Measurement will be to the nearest 0.10 foot.

Measurement for "Tee, Test, (Material), (Size)," will be by each.

Measurement for "Remove and Re-lay Side Sewer" will be by the linear foot.

**7-18.5 PAYMENT (New Section)**

Compensation for the cost necessary to complete the work described in Section 7-18 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Pipe, SSS (Material) (Class), (Size)," per linear foot.
- (2) "Pipe, SS (Material) (Class), (Size)," per linear foot.
- (3) "Tee, Test, (Material), (Size)," per each.
- (4) "Remove and Re-lay Side Sewer, (Material)(Size)," per linear foot.
- (5) Cleanouts on side sewers shall be paid as pipe per linear foot.

The unit contract price for "Pipe, (Use), (Material) (Class), (Size)," and all the above bid items shall include all costs to provide and install the side sewer pipe, including the following items for each class, size, and type of pipe:

- (a) Trench excavation (except "Extra Excavation"), haul, stockpiling, backfill and compaction of native material, and removal and disposal of excess excavated native material.
- (b) Cribbing, sheeting, and dewatering.
- (c) Removal and disposal of existing pipe encountered in required trench excavation and backfill.
- (d) Temporary bypass of sewage, including pumping.

The unit contract price for "Tee, Test, (Material), (Size)," shall include all costs to provide and install the test tee as specified.

The unit contract price for "Remove and Re-lay Side Sewer" shall include all costs for the work specified in Section 7-18.3(1)B2.

Payment for Foundation Material will be per Section 7-17.

Payment for Tees will be per Section 7-17.

Payment for Bedding will be per Section 7-17.

## SECTION 7-19 SEWER CLEANOUT (New Section)

## 7-19.1 DESCRIPTION (New Section)

This section of these specifications shall apply to the construction of sewer clean-outs as shown on the Standard Plan.

## 7-19.2 MATERIALS (New Section)

All materials incorporated into the total clean-out structure shall meet the requirements of the various applicable sections of these Specifications.

## 7-19.3 CONSTRUCTION DETAILS (New Section)

Pipe joints shall be the type specified in Section 7-17.3(2).

The trench excavation shall be made in such a manner as to provide an undisturbed base upon which the pipe shall be placed. Bedding around the wye and under the pipe connecting to the wye shall be thoroughly tamped as directed. Construction shall otherwise conform to the requirements shown on the Standard Plan.

## 7-19.4 MEASUREMENT (New Section)

Measurement for "Sewer Cleanout, (Size)," shall begin at the wye branch and extend to the lamphole casting, as shown on the Standard Plan.

## 7-19.5 PAYMENT (New Section)

Payment will be made in accordance with the following bid item, except on side sewers.

- (1) "Sewer Cleanout, (Size)," per each.

The unit contract price per each for "Sewer Clean-out", shall be full compensation for furnishing and placing the wye, sewer pipe, pipe bands, pipe plug casting, and concrete collar as indicated on the Standard Plan.

## SECTION 7-20 - ADJUSTMENT OF NEW AND EXISTING UTILITY STRUCTURES TO FINISH GRADE (New Section)

## 7-20.1 DESCRIPTION (New Section)

The work covered by this section consists of adjusting existing manholes, catch basins, inlets, valve chambers, water meter boxes, handholes, and similar utility structures encountered during the work to a new grade elevation. The work shall include adjustment by removing or installing ring extensions; by removing and installing adjustment brick; by removing and rebuilding a portion of the existing structure; or by any combination of the preceding methods.

Publicly-owned utility structures shall be adjusted to finished grade by the Contractor. Privately-owned utilities are generally in the streets and road rights-of-way pursuant to franchises or to rights claimed under the laws of the United States of America, or the State of Washington and, therefore, these utility agencies will be responsible for all adjustments and relocations of their own facilities. The Contractor shall schedule the work so that utility adjustments by others can be accomplished without undue delay.

The requirements of this section apply to utility structures constructed from precast concrete sections, masonry brick or blocks, and cast-in-place concrete.

## 7-20.2 MATERIALS (New Section)

Material used in the adjustment of existing utility structures shall meet the requirements for new construction specified in the section applicable to the item being adjusted.

Adjustment ring extensions shall meet the requirements of Section 9-05 and Standard Plan No. 231.

Epoxy, used to secure manhole castings for ring extensions to existing frames shall be Sylvax 818, Manhole Casting Epoxy, or equal as approved by the Engineer.

## 7-20.3 CONSTRUCTION REQUIREMENTS (New Section)

## 7-20.3(1) ADJUSTMENT OF MANHOLES, CATCH BASINS AND SIMILAR STRUCTURES (New Section)

## 7-20.3(1)A GENERAL (New Section)

The Engineer will establish approximate grade elevation for the tops of existing utility structures requiring adjustment. The final alignment and grade elevation shall be established from adjacent roadway surfaces, forms, or such offset hubs as may be provided by the Engineer.

Except where adjustment is to be made by ring extension the Contractor shall, as applicable in any particular case, remove the necessary pavement from around the casting; remove the casting and install or remove adjustment brick; or excavate from around the utility structure, remove such portion as may be necessary, and rebuild the structure to meet the new grade elevation. Pavement removal shall be kept to the minimum amount necessary to facilitate the adjustment. Adjustment to finished grade elevation by whatever method is required shall result in a finished structure meeting the requirements for new construction as specified in Section 7-05.3(9).

When ring extensions are specified the ring extension shall be epoxied securely to the existing frame. The surfaces of the frame that are to receive the epoxy shall be thoroughly cleaned prior to the application of the epoxy.

After the utility structure has been adjusted to grade, all voids around the structure shall be backfilled and compacted with selected native material or if ordered by the Engineer an imported mineral aggregate. Thereafter the casting shall be secured in place with a concrete or asphalt shim, as applicable, and the structure made watertight by plastering with a mortar cement.

Adjustment to finish grade of water meter boxes encountered within the planting strip and sidewalk area shall be made by the Contractor.

Should adjustment to a water meter box necessitate adjustment or relocation of the water meter, the water meter will be adjusted or relocated by the Seattle Water Department. The Contractor shall then make final adjustment of the meter box.

## 7-20.3(1)B UNPAVED STREET GRADING PROJECTS (New Section)

New manholes, catch basins and similar structures constructed in conjunction with street grading projects which are to be surfaced with gravel or crushed stone shall be constructed to a point approximately 8 inches below the subgrade and covered with a temporary wood cover. Existing manholes encountered shall be cut off and covered in similar manner. The Contractor shall carefully reference each manhole so that they may be easily found upon completion of the street work.

After placing the gravel or crushed stone surfacing, the utility structures and utility castings shall be constructed to the finished grade of the roadway surface. Excavation necessary for bringing utility castings to grade shall center about the utility structure and be held to the minimum area necessary. At the completion of the utility structure adjustment, the void around the manhole shall be backfilled with native material, or if ordered by the Engineer, backfilled with an imported mineral aggregate and thoroughly compacted.

Where bituminous surface treatment is to be placed, the manhole castings shall be installed from 1/2 inch to 1 inch higher than the rock surfacing so that the top of the casting will match finished roadway surface.

## 7-20.3(1)C CEMENT CONCRETE PAVING PROJECTS (New Section)

Manholes, catch basins and similar structures shall be constructed or adjusted in the same manner as outlined in Section 7-20.3(1)A except that the final adjustment shall be made and cast iron frame be set after forms have been placed and checked. In placing the concrete pavement, extreme care shall be taken not to alter the position of the casting in any way.

## 7-20.3(1)D ASPHALT CONCRETE PAVING PROJECTS (New Section)

Utility structures requiring adjustment to match finish grade shall be adjusted prior to the start of the final paving operation.

The tops of existing utility structures shall be raised or lowered to match the finish grade. The Contractor shall temporarily shim each structure with asphalt immediately after adjustment to secure the casting at finish grade and to provide a safe and usable surface for traffic. The Contractor shall maintain the shims and shall furnish, install, and maintain warning signs and barricades in accordance with Section 1-07.23 Traffic Control. The Contractor shall remove the shims immediately prior to the start of the paving operations.

Inside surfaces of adjusted structures which are disturbed or damaged by the adjustment, as well as the new adjustment area, shall be plastered to give a smooth, watertight surface.

## 7-20.3(1)E ASPHALT RESURFACING PROJECTS (New Section)

Adjustment of manholes on asphalt resurfacing projects shall meet the requirement of Section 7-20.3(1)D. Unless adjustment rings for castings are provided for in the Special Provisions or Bid Form, existing pavements shall be removed to the extent necessary to remove the manhole casting. The cost of removing the pavement, either asphalt concrete or cement concrete base, shall be considered as incidental to the work of adjusting the manhole.

## 7-20.3(1)F STORM AND SANITARY SEWER OR WATER PROJECTS (New Section)

Manholes, catch basins, gate valve structures and other similar type structures being constructed in conjunction with sewer or water projects on graded or paved streets shall be brought to final grade as outlined previously in these Specifications.

## 7-20.3(1)G ESTABLISHMENT OF GRADE FOR TOP OF MANHOLE (New Section)

The Owner will establish approximate grade for top of manholes, catch basins and similar structures for the various stages of construction; however, these grades will be approximate only. The Owner assumes no responsibility in this regard, except when the final grade is set.

## 7-20.3(2) ADJUSTMENT OF INLETS (New Section)

The final alignment and grade of cast iron frames for new and old inlets to be adjusted to grade will be established from the forms or adjacent pavement surfaces. The final adjustment of the top of the inlet will be performed in similar manner to that described for manholes. On asphalt concrete paving projects using curb and gutters, that portion of the cast iron frame not embedded in the gutter section shall be solidly embedded in concrete also. The concrete shall extend a minimum of 6 inches beyond the edge of the casting and shall be left 1-1/2 inches below the top of the frame so that the wearing course of asphalt concrete pavement will butt the cast iron frame. The existing concrete pavement and edge of the casting shall be painted with hot asphalt cement.

Adjustments in the inlet structure shall be constructed in the same manner and of the same material as that required for new inlets. The inside of the inlets shall be plastered.

## 7-20.3(3) ADJUSTMENT OF MONUMENTS AND CAST IRON FRAME AND COVER (New Section)

Monuments and monument castings shall be adjusted to grade in the same manner as for manholes.

## 7-20.3(4) ADJUSTMENT OF VALVE BOX CASTINGS (New Section)

Adjustment of valve box castings shall be made in the same manner as for manholes.

## 7-20.3(5) FURNISHING CASTINGS (New Section)

Where adjustment of existing utility structures is required and the Drawings or the Engineer direct the existing castings be replaced, the Contractor shall furnish new castings of the type specified. Salvaged castings shall be cleaned and delivered, as directed by the Engineer, to the utility which owns the casting.

## 7-20.4 MEASUREMENT (New Section)

Measurement for "Adjust Existing (Item)," will be by each.

Measurement for "Adjust by Shafting," will be by the vertical foot of adjustment, from original grade to finish grade.

Measurement for "Utility Casting (Type)" will be by each.

## 7-20.5 PAYMENT (New Section) (8-28-86)

Compensation for the cost necessary to complete the work described in Section 7-20 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Adjust Existing Manhole, Catch Basin or Valve chamber," each.
- (2) "Adjust Existing Inlet," each.
- (3) "Adjust Existing Monument Frame and Cover," each.
- (4) "Adjust Existing Valve Box," each.
- (5) "Adjust Existing Manhole, Catch Basin or Valve Chamber With Ring Extension," each.
- (6) "Adjust Existing Inlet With Ring Extension," each.
- (7) "Adjust Existing Monument Frame and Cover With Ring Extension," each.
- (8) "Adjust Existing Valve Box With Ring Extension," each.
- (9) "Adjust Existing Handhole," each.
- (10) "Adjust By Shafting," per vertical foot.
- (11) "Utility Casting, (Type)," each.



The unit contract price for "Adjust Existing (Item)" shall include the costs for all work specified in Section 7-20 except as provided for otherwise hereinafter in Section 7-20.5, necessary to raise or lower the top of an existing utility casting, and structure, from the original grade elevation to a new finished grade elevation, a distance equal to or less than 20 inches.

When "Adjust Existing (Item) With Ring Extension" is specified, the unit contract price shall also include the cost of the ring extension epoxied in place.

When adjustment of an existing utility casting or structure requires a change in grade elevation greater than 20 inches, payment will be made at the unit contract price for "Adjust By Shaftering," the price for which shall include the costs for all work necessary to modify the existing structure and complete the adjustment to the required grade elevation.

The unit contract price for "Utility Casting, (Type)," shall include the costs for all work required to furnish and install new castings of the type specified when existing castings are to be replaced.

Costs for adjustment to finish grade of water meter boxes, excluding adjustment of the water meter itself, shall be included in the prices bid for the various bid items shown in the bid form, and no separate payment will be made.

If a bid item for adjusting existing utility structures is not included on the Bid Form and such work is performed, payment will be made per Section 1-09.4.

Mineral aggregate ordered as backfill in lieu of native material will be paid by the cubic yard per Section 4-01.5.

Restoration of the roadway surface shall be in accordance with the applicable section covering the work involved.

The costs for asphalt or cement concrete used to secure castings prior to paving shall be considered incidental to the work and no separate payment will be made.

All work required to adjust casting to finished street grade of all newly installed utility structures shall be considered to be incidental to the bid items for the appropriate type of utility structure listed in the Bid Form.

## DIVISION 8 MISCELLANEOUS CONSTRUCTION

### SECTION 8-01 ROADSIDE SEEDING

Delete this title and replace with the following:

### SECTION 8-01 EROSION CONTROL

#### 8-01.2 MATERIALS

Supplement this section with the following:

The terms "Planting Soil" and "Top Soil" as used herein shall be synonymous.

#### 8-01.3(1)A CULTIVATION

Delete this section and replace with the following:

Areas to be cultivated shall be indicated on the Drawings or specified in the Project Manual. Areas shall be cultivated to a minimum depth of 6 inches and shall provide a reasonably firm but friable seed bed. Cultivation shall take place no sooner than 2 weeks prior to seeding. When planting soil, fertilizer, or soil conditioners are required, they shall be incorporated into the top 6 inches of subgrade by rototilling.

Cultivation of the soil may be by farm disc, harrow, or other suitable equipment approved by the Engineer. Cultivation shall be done at right angles to the natural flow of water on the slope unless otherwise ordered by the Engineer.

Prior to the cultivation, the Contractor Remove all visible rocks, clods and debris 3 inches or larger in any dimension. Any exposed tree roots in cut slopes shall be neatly pruned at the finished grade of the slope and the cut treated with an approved sealer.

All costs incurred in performing the work specified shall be incidental to and included in such other erosion control bid items included in the Bid Form.

#### 8-01.3(2) TOPSOIL

Supplement Section 8-01.3(2) with the following:

All damage occurring to existing roadbeds, shoulders, walks, curbs, lawn, planting areas or other existing adjacent structures or areas due to the Contractor's operation in hauling and placing the top soil shall be repaired by the Contractor at his own cost and expense to the satisfaction of the Engineer.

#### 8-01.3(2)C TOPSOIL TYPE C (New Section)

Topsoil Type C shall be native topsoil obtained from a source provided by the Contractor outside of the Project Site. Topsoil Type C shall meet the requirements of Section 8-01.3(2)B and Section 9-14.1(2).

#### 8-01.3(4)A SEEDING

Supplement this section with the following:

The rate of application for seed and mulch shall be as specified in Sections 9-14.2, and 9-14.4(2) respectively.

#### 8-01.3(4)B FERTILIZING

Delete this section and replace with the following:

Fertilizer of grade 10-20-20 formulation shall be applied in accordance with the procedures and requirements for seeding in Section 8-01.3(4)A at the rate of 12 pounds per 1,000 square feet.



## 8-01.3(4)C LIMING

Delete this section and replace with the following:

Agricultural lime shall be applied when called for on the Drawings or the Project Manual, and at the rate specified in the Project Manual. The method of application shall be in conformance with all air pollution regulations and shall be approved by the Engineer.

## 8-01.3(5) MULCHING

This section shall be supplemented with the following:

Wood cellulose fiber utilized as mulch shall be applied with seed and fertilizer in one operation by approved hydraulic equipment. The equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogenously mix a slurry of the specified amount of fiber, fertilizer, seed and water. Distribution and discharge lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic discharge spray nozzles which will provide a uniform distribution of the slurry at the rate specified in Section 9-14.4(2).

## 8-01.3(6)A APPLICATION OF ASPHALT EMULSION

Delete this section.

## 8-01.3(10) INSPECTION

This section shall be supplemented with the following:

Acceptance of areas receiving seed, fertilizer and mulch, as required, shall be based on a uniform stand of grass at the time of Final Inspection. Areas failing to show a uniform stand of grass 90 days after the germination or a growing season, whichever is longest, or show damage through any cause prior to Final Inspection shall be re-seeded. Uniform stand of grass shall be defined as any grass area with no bare spots greater than 6 square inches.

## 8-01.3(12) SHEAR BOARDS (New Section) (6-21-85)

Where shear boards are required they shall be furnished and installed by the Contractor in accordance with the details shown on the Drawings. Boards shall be 2" x 8" rough finished lumber. The top edge of the installed boards shall project 2 inches above the grade of the ground.

The shear board shall be spaced at intervals indicated on the Drawings and securely nailed to 2" x 4" stakes. Stakes shall have a minimum penetration into the soil of 2 feet.

## 8-01.4 MEASUREMENT

Delete this section and replace with the following:

Measurement for top soil (planting soil) shall be as specified in Section 8-02.

Measurement for sod as a type of erosion control will be as specified in Section 8-02.

Measurement of erosion control by seeding, hydro-seeding, mulching or, when required, the application of fertilizer, lime and soil binder or tacking agents will be by ground slope measurement in square foot of actual seeding, fertilizing, liming, mulching and applying a soil binder or tacking agent completed and accepted in accordance with the Contract Documents.

Measurement of matting, including clear plastic covering, will be by the square foot measurement of surface area covered and accepted in accordance with the Contract Documents.

Mowing will be measured by horizontal measurement of area mowed each mowing in square feet.

Measurement of shear boards will be by the linear feet of 2-inch by 8-inch rough finished lumber installed.

## 8-01.5 PAYMENT

Delete this section and replace with the following:

Compensation for the cost necessary to complete the work described in Section 8-01 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Erosion Control, Seeding" per square foot.
- (2) "Erosion Control, Hydro-Seeding" per square foot.
- (3) "Erosion Control, Mulching" per square foot.
- (4) "Erosion Control, Matting (Type)" per square foot.
- (5) "Erosion Control, Shear Boards," per linear foot.

Payment for the type of erosion control specified above will include the costs for all work specified in Section 8-01 necessary to complete the type of erosion control work specified.

The unit contract price for seeding, fertilizing, liming, soil binder or tacking agents, when included in the Bid Form, separately or in any combination, shall be full compensation for furnishing all materials, labor and equipment, and all items required to complete the work as specified.

The unit contract price per square foot for mowing, when included in the Bid Form as a separate pay item, shall be full compensation for furnishing all labor, tools and equipment necessary to mow and trim the areas as specified.

Removal of clear plastic covering, when such material is specified as a method of erosion control, will be paid as Extra Work pursuant to Section 1-09.4.

Payment for sodding as a type of erosion control shall be in accordance with Section 8-02.

Payment for furnishing and placing planting soil (top soil) will be as specified in Section 8-02.

**SECTION 8-02 - ROADSIDE PLANTING**

Delete Section 8-02 in its entirety and replace with the following:

**SECTION 8-02 - ROADSIDE PLANTING****8-02.1 DESCRIPTION**

This work shall consist of furnishing, planting, and maintaining for a 365 calendar day landscape establishment period such trees, whips, shrubs, ground cover, seedlings, and sod as specified in the Contract Documents. Work shall be performed as shown on the Drawings and in accordance with these Specifications, accepted horticultural practices, and as directed by the Engineer.

Trees, whips, shrubs, ground covers, seedlings, and sod will hereinafter be collectively referred to as, "plants" or "plant material."

Plant material quantity, size and condition, and spacing shall be as indicated in the Drawings or Project Manual.

All landscaping work shall be performed by a licensed Landscaping Contractor registered in the State of Washington.

**8-02.2 MATERIALS**

The materials for this work shall meet the requirements of the following listed sections of these Specifications:

Planting Soil, Type A . . . . .	9-14.1(1)
Planting Soil, Type B . . . . .	9-14.1(2)
Special Soil Mix . . . . .	9-14.1(3)
Planting Soil, Type C . . . . .	9-14.1(4)
Planting Soil, Type D . . . . .	9-14.1(5)
Seed . . . . .	9-14.2
Fertilizer . . . . .	9-14.3
Mulch . . . . .	9-14.4
Plant Material . . . . .	9-14.7
Sod . . . . .	9-14.7(7)
Irrigation Water . . . . .	9-25.2
Paver Blocks	
Grid Blocks	
Cedar Edging	
Bollards	
Benches	
Tree Grates	

Nomenclature for plant names and varieties shall be in accordance with the latest edition of "Standardized Plant Names" as prepared by the American Joint Committee on Horticulture Nomenclature.

**8-02.3(1) RESPONSIBILITY DURING CONSTRUCTION**

The Contractor shall provide adequate and proper care of all plant material and landscape work done on the project from the time of installation to the end of the 365 calendar day landscape establishment period. The 365 calendar day landscape establishment period will begin on the day the planting and other landscape-related work is declared complete, in writing, by the Engineer. Existing vegetation shall not be disturbed unless required by the Contract Documents or approved by the Engineer.

Adequate and proper care shall include, but is not limited to, keeping all plant material in a healthy growing condition by watering, cultivating, pruning and spraying; keeping all plant material crowns, runners and branches free from mulch at all times; keeping planted and landscaped areas free from insect infestation, weeds and grass, litter and other debris; retaining finished grades in a neat, tidy, uniform condition; adjusting to grade paver blocks which may have settled; and adjusting tree fasteners as needed to prevent strangulation or irregular growth of plant material.

The Contractor shall have sole responsibility for the survival of all plant material from the time of installation to the end of the 365 calendar day landscape establishment period, with the exception of third party damage or vandalism occurring after the start of the 365 calendar day landscape establishment period.

On order of the Engineer dead, diseased, dying or broken plants shall be removed and replaced with healthy plants of the same type and size. Replacement shall be planted within a 10-day period immediately following receipt of the order. Missing plants shall be replaced by the Contractor in the same manner. Removal and replacement shall be at the Contractor's expense except for plant material which, in the opinion of the Engineer, is damaged or turns up missing as a result of third parties or vandalism.

**8-02.3(2) WEED CONTROL PLAN**

Before starting any work as defined in Section 8-02 and 8-03, the Contractor shall submit for approval by the Engineer a weed control plan. The plan shall define the work necessary to produce a weed-free condition (no live top growth or roots) in all planting areas. The weed control plan shall also cover the control of noxious weeds and other vegetation required under the contract, or as directed by the Engineer.

The weed control plan shall show the scheduling of all weed control measures required under the contract including, but not limited to, hand weeding, rototilling, applications of herbicides, noxious weed control, and shoulder slope weed control.

The plan shall be prepared and signed by a licensed pest control consultant and shall include methods of weed control, dates of weed control operations, and the name and application rate of all herbicides. No on-site work shall begin until the plan is approved. Upon approval of the weed control plan by the Engineer, the Contractor shall proceed in accordance with the approved plan. Should the plan become unworkable at any time during the life of the contract, the Contractor shall submit and receive approval of a revised plan prior to proceeding with further work.

**8-02.3(2)A CHEMICAL PESTICIDES**

Application of chemical pesticides shall be in accordance with the manufacturer's recommendations and by an experienced applicator. The applicator shall be licensed by the State of Washington for the class of pesticide utilized. The Contractor shall furnish the Engineer evidence that all operators are licensed and the pesticide used is registered in the State of Washington. The Contractor shall also furnish the Engineer a copy of the manufacturer's recommendations for each pesticide to be used.

The Contractor shall use extreme care to ensure confinement of chemicals within the areas designated. The Contractor shall assume all responsibility for rendering any area unsatisfactory for planting by reason of chemical application. Damage to adjacent areas either on or off the right-of-way shall be repaired to the satisfaction of the Engineer, the property owner, or both, and the cost of such repair shall be borne solely by the Contractor. Chemicals which will leave any residue in the soil toxic to the plant materials specified in the contract for planting or those in adjacent areas shall not be used.

The Contractor shall notify the Engineer at least 24 hours prior to the application of any herbicide, giving the name of the material, rate of application, and where it will be used. Applications of herbicide shall be in accordance with the recommendations of the manufacturer.

Trees shall be sprayed with the proper insecticides as necessary to control disease, infestation by harmful insects and pests, including the complete control of caterpillars.

All chemicals shall be delivered to the job site in unopened containers.

**8-02.3(4) PLANTING AREA PREPARATION**

Areas to receive plant material shall be cleared, grubbed, cultivated and graded prior to planting. Planting areas shall be prepared so that they are weed and debris-free at the time of planting and until Acceptance by the Owner. Planting areas shall include all planting beds, areas around trees, and those areas indicated on the Drawings or designated by the Engineer.

Where it is as necessary to establish the planting area's subgrade by any combination of excavation, fill or embankment construction, the work shall be performed in accordance with the requirements of Section 2-03. The elevation of the compacted subgrade shall take into account the requirements, if any, for adding and incorporating into the natural soil, fill or embankment material, the required quantities of planting soil and soil conditioners, plus 2 inches of mulch. Fills and embankments shall be placed in lifts not exceeding 12 inches, with each lift compacted to 90% maximum density, as determined by the compaction control test specified in Section 2-03.3(14)D.

Planting areas shall be cultivated to a depth of 6 inches and all debris including stumps, sticks, roots and rocks or lumps larger than 3 inches removed before any plants are planted.

After the subgrade of the planting areas have been graded and compacted, planting soil (and fertilizer and soil conditioners, when required) shall be applied over the planting area to a 3-inch depth and rototilled into the subgrade to a depth of 6 inches. Planting soil shall not be placed when the ground or planting soil is frozen, excessively wet or, in the opinion of the Engineer, in a condition detrimental to the work. Planting areas shall then be evenly sloped from the ridge line to a point 2 inches below the surrounding surfaces. The ridge line shall be the approximate centerpoint of the planting area as shown on the Drawings.

The finished grade of planting soil prior to the installation of plant material shall be 2 inches from the top of the sidewalks or curbs to allow for 2 inches of planting mulch.

#### 8-02.3(5) LAYOUT OF PLANTING

Plants shall be placed at spacings and locations shown on the Drawings. Location layout and staking shall be the responsibility of the Contractor, subject to the approval of the Engineer, before planting or construction of each item begins.

The Engineer will make only the field measurements necessary to calculate and verify quantities for payment.

The Contractor shall place the plants starting from the perimeter of the bed area and progressing to the center so that odd dimensions are adjusted at the centers of any planting bed as shown in the Drawings.

Trees to be planted in mowable grass areas shall be located a minimum of 10 feet from the edge of planting beds, fenced line structures, and unmowable ditches unless otherwise specified in the Drawings. Tree locations shown on the Drawings shall be considered approximate, unless shown with stationing and distance. Trees shall be adjusted in location to clear all overhead lines and structures. Where location of existing and new street improvements may require changing the tree locations, the following spacing from street improvements shall prevail:

- (a) Minimum distance from street light pole . . . . . 20 feet
- (b) Minimum distance from hydrant . . . . . 5 feet
- (c) Minimum distance from driveway, alley crossing . . . . . 7 1/2 feet
- (d) Minimum distance from curb . . . . . 3 1/2 feet

The distance given shall be measured from the centerline of the tree to the nearest face of the improvement.

#### 8-02.3(6) PLANTING

Plants brought to the planting site shall be bare root, balled burlap, or in containers, depending on how specified in the planting schedule on the Drawings for the particular type of planting material. No plant material shall be planted until it has been inspected and approved for planting by the Engineer. Plants shall not be planted during freezing weather or when the ground is frozen. Plants shall not be placed in areas that are below finished grade.

##### 8-02.3(6)A TREES AND SHRUBS

Plants brought to the planting site in a bare root condition shall be protected at all times to prevent the roots from drying out during planting operation. Bare root plants shall set in the plant holes with roots spread out in a natural position. Planting soil shall then be worked in and around the roots, filling all voids. Firming or tamping of planting soil around roots shall be done in such a manner as to not damage the roots.

Drainage, conforming to the details shown on the Drawings, shall be provided for all trees and shrubs.

Plant material supplied in containers shall not be removed from the containers until the time of planting at the planting location. Roots of bare root stock shall not be bunched, curled, twisted, or unreasonably bent when placed in the planting hole. In their final position, the plants shall have the same relationship to the finished grade as when growing in the nursery or container.

The plant material shall be handled in such a manner that the root systems are kept covered and damp at all times. The root systems on the bare root plant material shall be dipped in a slurry of silt and water, "puddling", immediately prior to planting. The root systems of container plant material shall be moist at the time of planting.

All burlap material shall have all strings or cords cut and the burlap laid back from the top half of the ball after the plant is placed in its final position, and before completion of backfill. The plants supplied in containers shall be removed from the containers in such a manner to prevent disturbances of the root system or material in which they were planted. The plants shall not be removed from the container by pulling on the main stem. Plants removed from their containers shall be planted without delay in the manner described for balled and burlapped plants. Trees protected in wire baskets shall be planted with the wire baskets in place. After the tree is set in place, the wire around the bare roots shall be cut and folded back. Non-tapered containers shall have 2 vertical cuts the entire depth of the container, made with an approved can shear before the root ball is removed. Plant material supplied in containers shall not be removed from the container until the time of planting at the planting location.

Unless otherwise specified, planting holes for trees shall be dug 12 inches greater on all sides of the diameter of the root ball or natural spread of the roots, and 12 inches under roots or root ball. Holes for shrubs shall be 6 inches greater on all sides and under roots or root ball. Any glazed surface of the planting hole shall be removed by hand methods.

When trees are to be planted in cement concrete sidewalk areas, pits shall be dug at locations shown on the Drawings. The pits shall be a minimum of 4 foot diameter and have a depth of 3 feet. The planting hole for trees and shrubs may be dug with a power-driven auger to within 6 inches of the specified diameter. The outer 6 inches shall be removed by hand methods during planting sequence, and a drain trench, when required, constructed and backfilled. After inspection of the hole by the Engineer, a sufficient amount of backfill shall be placed to position the plant at the correct depth. The plant shall then be placed and the hole backfilled half-way. Fertilizer shall then be placed and stakes driven.

Strings encircling balls and burlapped plants will then be cut and the burlap laid back from the top half of the ball.

The remainder of the hole shall be filled with water and the backfill shall be placed and compacted.

Immediately following completion of the backfill, ties and tree wrap shall be placed per Section 8-02.3(5) and a rain basin constructed in accordance with the details shown on the Drawings and Section 8-02.3(4).

Where settlement occurs, additional backfill shall be placed over exposed roots on the same working day as planting settlement occurs. In their final position, the plants shall have the same relationship to the finished grade as when growing in the nursery or container.

##### 8-02.3(6)B GROUND COVERS, PLANTS AND SEEDLING

This section shall be supplemented by the following:

Holes for ground cover shall be 3 inches greater on all sides and under the roots or root ball. Ground cover shall be removed from containers and planted so that the soil level of the plants is flush with the finished soil grade of the planting area. After plants have been placed, the soil shall be compacted around the root system by firmly pressing around the plant.

##### 8-02.3(7) PRUNING, STAKING AND GUYING

All plants shall be pruned at the time of planting to remove any minor broken or damaged twigs, branches or roots. Pruning shall be done with a sharp tool and shall be done in such a manner as to retain or to encourage natural growth characteristics of plants. Bare root stock shall have damaged or torn roots removed with a clean cut. When the lowest branch on a 2-inch caliper or larger deciduous tree occurs at 3 feet or more from ground level, the trunks shall be wrapped with tree wrapping material.

Top pruning, when required, shall remove all damaged twigs and branches and compensate for loss of roots during planting operation. Top growth removal to compensate for root loss shall not exceed 1/3 of the top growth unless otherwise specified or directed by the Arboriculturist or his representative. Removal of top growth shall be in such a manner as to retain the natural growth characteristics of the plant. Pruning shall produce a clean cut without bruising or tearing the bark and shall be in living wood where the wound can heal over properly.

Deciduous trees shall be staked at the time of planting with a single 5/8 inch diameter deformed steel reinforcing bar 10 feet long. The bar shall be driven into the ground parallel to the tree and at a distance of from 1 to 3 inches from the tree trunk. The bar shall penetrate at least 1 foot of undisturbed soil in a tree pit 3 feet deep, more if tree pit is more shallow. The bar and the tree shall be joined by 3 tree ties formed of 12 gauge wire in one loop which crosses itself between the tree and the bar. Before placing, a suitable length of good quality rubber garden hose shall be slipped over the wire to serve as a tree trunk protector. The wire shall be tied tightly to the deformed bar so as to prevent vertical movement but shall be loosely applied around the trunk. A 1/4 inch space shall be allowed between the hose tie face and the tree trunk. The topmost tie shall be at a height of 5 feet 10 inches with 1 foot 3 inches vertical spacing between the three ties (plus or minus 1 inch).

All trees shall be staked or guyed by the Contractor in accordance with the Tree Planting Details shown on the Drawings or included in the Project Manual and the following requirements. Evergreen trees shall be staked with rough-cut 2 inches x 2 inches x 3 feet long, free from knots or splints. Stakes shall be pointed for driving. Stakes that are damaged by driving shall be removed and replaced. Any tree or shrub thrown out of plumb by wind action or any other cause shall be replanted by loosening the soil around the root system and re-plumbing the tree or shrub by adjusting the position of the root system. Adjustment shall not be made by pushing, pulling or restraining the trunk or stem. If, in the opinion of the Engineer, damage to the root system has occurred as a result of re-plumbing a tree or shrub, the tree or shrub shall be replaced at the Contractor's expense.

Stakes shall be set away from the ball of the tree and driven firmly into the ground so that the point of the stake is 30 inches below the finish ground level. Each stake shall be set equidistant from each other. All stakes shall be driven to a 60° angle from ground level. Trees shall have ties of #12 galvanized braided wire and 1/2 inch soft black rubber hose. The soft rubber hose shall be interlooped around the tree at approximately two-thirds the height of the tree.

Alternate methods of staking will be considered, and if approved by the Engineer, may be used.

#### 8-02.3(8) FERTILIZERS

Unless otherwise specified, fertilizers for trees, shrubs and ground cover shall be 14-14-14 formulation, slow-release type fertilizer thoroughly and uniformly mixed into the planting soil at the following rates:

RATE OF APPLICATION	
TREES	1 pound per tree diameter inch
SHRUBS	1/2 pound per shrub
GROUND COVER	1/4 pound per plant

Other fertilizers may be considered as alternatives but shall only be used upon the approval of the Engineer.

#### 8-02.3(9) PLANTING MULCH

Unless otherwise indicated on the Drawings or specified in the Project Manual, planting mulch shall consist of bark mulch meeting the requirements of Section 9-14.4(3). Planting mulch shall be applied 2 inches in depth.

#### 8-02.3(10) SOIL AMENDMENTS

Soil amendments of the type and quantities specified shall be applied where shown on the Drawings. The soil amendments shall be thoroughly mixed with topsoil to produce a uniform blend as indicated in the Drawings or Contract Documents. All amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, and name. In lieu of containers, amendments may be furnished in bulk, and a certificate from the manufacturer indicating the above information shall accompany each delivery.

#### 8-02.3(11) CULTIVATION AND CLEANUP

Upon completion of planting all excess material shall be removed and disposed of off the project site. Planting areas shall be brought to a uniform grade flush with walks, curbs, pavements and driveways.

#### 8-02.3(12) LANDSCAPE ESTABLISHMENT

**General:** Landscape establishment shall consist of providing adequate and proper care for all plant materials and landscape areas within the project limits during the 365 calendar day landscape establishment period to assure the resumption and continued growth of the transplanted material. The 365 calendar day landscape establishment period shall begin immediately upon written notification from the Engineer of the acceptance of initial planting for the entire project, and shall end 365 calendar days after acceptance of initial planting.

The Contractor shall replace all plants stolen or damaged by acts of others. At the end of the plant establishment period, a plant which does not show normal growth will be rejected and shall be replaced by the Contractor.

**Application of Herbicides and Insecticides:** Applications shall be as specified in Section 8-02.3(2)A.

**Watering:** Plants shall be watered by the Contractor as needed to keep them in a healthy growth. For trees a minimum of 7 gallons per watering is recommended. The Contractor will be responsible for the watering patterns and timing, including setting any automatic sprinkler controls. Automatic irrigation systems shall be operated fully automatic during the plant establishment period. Automatic watering shall be performed during the time period of midnight to 4 a.m. If water restrictions are established, the Contractor shall develop watering schedules in consultation with the Engineer. The Contractor will not be permitted to use City hydrants for watering. Hydrants may be used to fill a water tank or truck pursuant to the requirements of Section 9-25.2. The Contractor shall furnish in writing a watering schedule to the Engineer. Any change in watering schedule shall require 24 hours advance notice to the Engineer. The Engineer shall also be notified immediately of any sprinkler system malfunctions. Sprinklers installed as part of the Work shall be maintained and operated by the Contractor as part of the Landscape Establishment work.

**Mulch:** Mulch material shall be applied and replaced when ordered by the Engineer. The final mulch application shall be made 1 week prior to final inspection.

**Fastenings:** Tree fastenings shall be kept intact and effective in maintaining firm support for plant material. Fastenings shall be adjusted as needed by the Contractor to prevent strangulation or irregular growth. Fastenings shall be removed only when ordered by the Engineer.

**Inspection of Work:** A general cleanup shall be made after any work performed by the Contractor at the project site during the landscape establishment period.

Plants and landscaped areas shall be inspected regularly by the Engineer during the plant establishment period. Should the Engineer determine at any time that the Contractor is not providing adequate and proper care of plant material or is performing substandard landscape establishment work, the Engineer will order the Contractor in writing to correct and remedy such unsatisfactory work or practices. The Contractor shall make the necessary corrections within a 5-day period immediately following receipt of such notice. Notice may be made in writing, by telephone, or communicated in person to the Contractor or the Contractor's representative at the Project Site. Plant material listed as dead, missing, or unacceptable, shall, as applicable, be removed, disposed of, and replaced by the Contractor. Unacceptable and rejected plant material shall be replaced at the Contractor's expense.

About 30 days before the end of the landscape establishment period, the Contractor shall accompany the Engineer or the Engineer's representative on a walking inspection of the project. Conditions found unsatisfactory by the Engineer shall be corrected by the Contractor within a 10 day period immediately following the inspection. Corrective work shall include replacement of dead, missing, or unacceptable plant material.

**Failure to Perform:** If the Contractor fails to perform any of the work required under these plant establishment requirements, the Owner may:

- Cause the work to be done by others and the costs thereof deducted from the Contractor's payment or payments. Should the money due the Contractor be insufficient to cover such costs, the Owner will have the right to recover the balance from the Contractor.
- Withhold a portion, or all, of the Contractor's payment. Money that is withheld for non-performance shall not be recovered by the Contractor. The amount withheld shall be determined by the Engineer.
- Terminate the contract.

The above remedies shall not waive the Owner's rights to pursue other corrective measures or remedies which may be permitted by law.



At the end of the plant establishment period, any plant which, in the opinion of the Engineer, does not show normal growth will be rejected. The final payment will not be made to the Contractor until all corrections and replacements have been made and approved.

#### 8-02.3(13) PLANT REPLACEMENT

The Contractor shall be responsible for growing or providing enough plants for replacement of plant material rejected through the plant establishment period. Rejected plant material shall be replaced as specified in Section 8-02.3(12) and 8-02.5(15).

All replacement plants shall be of the same species and quality as the plants they replace. Plants may vary in size reflecting one season of growth.

#### 8-02.3(14) LAWN INSTALLATION

Lawn installation shall be by sodding unless "Seeded Lawn Installation" is specifically included in the Bid Form.

In areas irrigated by a sprinkler system, lawn installation shall not begin until the sprinkler system is operational. The Contractor shall have the option of sodding in lieu of seeding for lawn installation but at no additional cost to the Owner. However, seeding in lieu of sodding will not be allowed.

Topsoil for both seeded or sodded lawns shall be placed at the depth and locations shown in the Drawings. The topsoil shall be tilled to a depth sufficient to key into the subsoil, raked to a smooth even grade without low areas to trap water and compacted, all as approved by the Engineer.

Barriers shall be erected, with warning signs where necessary, to preclude pedestrian traffic from access to the newly placed lawn during the establishment period or as approved by the Engineer.

#### 8-02.3(14)A SEEDED LAWNS

The following construction sequence and procedure shall be followed:

- (1) Before placing of topsoil, all areas shall be cultivated to a depth of 3 inches unless otherwise specified or ordered by the Engineer. Cultivation of the soil may be done by disc, spring tooth harrow, rototiller, or similar equipment. This operation shall be done at right angles to the natural flow of water on the slopes.
- (b) After the topsoil has been spread to the depth specified, the area shall be mechanically tilled to a depth of 6 inches, then raked by approved hand or mechanical methods to remove all large clods, rocks, debris, and litter over 1 inch in any dimension which shall be disposed of by the Contractor.
- (c) The area shall then be rolled in 2 directions; the second shall be done at right angles to the first rolling. The roller shall be of a standard, lightweight, waterfilled type.
- (d) Rake the area to make it smooth and level. Add topsoil where necessary or as directed by the Engineer.
- (e) The finished grade shall be 1 inch below all curbs, sidewalks, and/or other appurtenances.
- (f) Apply a 10-20-20 fertilizer at the rate of 12 pounds per 1,000 square feet. The fertilizer shall be applied by an approved hand or mechanical method. Application in one direction is sufficient.
- (g) Rake the fertilizer into the surface soil to a depth of 1/2 to 1 inch.
- (h) Roll the area in 1 direction.
- (i) The seed mix and rate of application shall be as specified in the Project Manual.

#### 8-02.3(14)B SODDED LAWNS

For sod installation, the following construction and sequence procedure shall be followed:

- (a) Areas to receive sod shall be cleared and grubbed, and leveled to a depth of 3 inches below grade.
- (b) Before placing of planting soil, areas shall be cultivated to a depth of 3 inches unless otherwise specified, or ordered by the Engineer. Cultivation of the soil may be done by disc, spring-tooth harrow, rototiller, or similar equipment. This operation shall be done at right angles to the natural flow of water on the slopes. Planting soil shall be placed in accordance with the requirements of Section 8-02.3(4).
- (c) Planting soil shall be evenly spread over and cultivated into the top 6 inches of the existing soil, then raked by approved hand or mechanical methods to remove all large clods, rocks, debris, and litter over 1 inch in any dimension. Such clods, rocks, debris, and litter shall be disposed of by the Contractor.
- (d) The area shall then be compacted by rolling in two directions. The second shall be done at right angles to the first rolling. The roller shall be of a standard, light weight water-filled type. The grade after compaction shall be such that the root zone of the sod will be flush with the final grade.
- (e) The area shall be raked to make it smooth and level. Topsoil shall be added when necessary, or designated by the Engineer.
- (f) Immediately prior to placement of sod, a 10-20-20 fertilizer shall be raked into the soil at a rate of 12 pounds per 1,000 square feet. The fertilizer shall be applied by approved hand or mechanical methods. Application in one direction will be sufficient.
- (g) The sod strips shall be placed within 48 hours after being cut. Dry soil shall be moistened by sprinkling prior to the laying of the sod. Sod shall be placed without voids, and have the end joints staggered. The root crown shall be set to the grade of the sidewalk or curb. Butt joints shall be staggered and tightly fitted. On sloped areas, sod shall be laid with the long dimension across the slope, parallel to the top or toe of the slope.
- (h) Following placement the sod shall be rolled with a smooth, water-filled type roller. After rolling, the sod shall be heavily watered by sprinkling. Lawn areas shall be uniformly level.
- (i) When directed by the Engineer, the Contractor shall apply (surface dressing) slow-release form of nitrogen fertilizer derived from urea-formaldehyde at the rate of 0.5 pounds per 100 square feet.
- (j) The Contractor shall commence watering immediately as specified in Section 8-02.3(15). Watering and fertilizing shall be the Contractor's responsibility during the Lawn Establishment period. Watering shall be scheduled to prevent drying of joints between the sod strips.

#### 8-02.3(15) LAWN ESTABLISHMENT

Lawn establishment shall consist of providing adequate and proper care for all public and private lawn areas installed within the limits of the project. The lawn establishment period shall begin immediately after the lawn has been planted and accepted in writing by the Engineer and shall extend through a minimum 30-day period or until the Actual Completion Date, whichever comes first.

During the lawn establishment period the Contractor shall provide adequate and proper care to ensure the continuing healthy growth of the turf. Adequate and proper care shall include the labor, materials, and equipment necessary to keep the planted areas in a presentable condition including, but not limited to, mowing; trimming; removal of grass clippings, litter and debris; edging; fertilization; insecticide and fungicide applications; weed control; repair and reseeding damaged areas; and repairing and keeping in operation irrigation systems installed as part of the Work.

During this period and as a part of the lawn establishment, the Contractor shall accomplish the following minimum requirements:

- (a) Mowing and trimming shall be done as often as conditions dictate. Maximum height of lawn shall not exceed 3 inches. The cutting height shall be 1 1/2-inches with all cuttings removed.
- (b) Trimming and edging shall be performed at least once each month or when designated by the Engineer. Cuttings and removed material shall be disposed of off the Project Site.
- (c) A slow-release form nitrogen fertilizer derived from urea-formaldehyde shall be applied at the end of the Lawn Establishment period at the rate of 4 pounds per 1000 square feet. Fertilizer applied between the period of November 1st and March 1st shall be a 15-10-25 formulation fertilizer. Fertilizer applied between March 1st and October 31st shall be a 24-4-16 formulation fertilizer. Fertilizer shall be thoroughly watered in.



(d) Water application shall be accomplished each week from March through September. Watering shall be done only at night or early morning. An even application of 1 inch of water minimum shall be required over all lawn areas per week. The rate and frequency of water application may be changed, as designated by the Engineer, depending on weather and soil conditions.

(e) Temporary barriers shall be removed after the grasses have developed into a heavy sod mat and only on written permission from the Engineer.

All work performed under Lawn Establishment shall be performed by qualified turf management personnel and shall comply with good turf management practices.

Acceptance of lawn planting as specified herein shall be based on a uniform stand of grass at uniform grade at the time of final inspection. Areas that are bare, have a poor stand of grass, or do not have a uniform grade through any cause shall be re-graded, re-seeded, or re-sodded and re-fertilized at the Contractor's expense. Dead or dying sod or sod with brown spots will be rejected.

#### 8-02.3(16) INSTALLING REMOVABLE PAVER BLOCKS IN TREE CUT-OUTS (New Section)

The Contractor shall install exposed aggregate concrete paver blocks of the size and at the locations shown on the Drawings. Paver blocks shall be installed after the trees have been planted and the tree pits backfilled and compacted to a finished grade 3 inches below the top surface of adjacent sidewalk. A 1-inch bed of compacted sand shall be used as a setting bed for the pavers.

The top surface of the pavers shall be set flush with the adjacent sidewalk and all voids between pavers and sidewalk and between pavers filled with sand. Excess sand and dirt shall be swept up and disposed of off the project site. The Contractor shall ensure that sand and soil is kept out of the gutters and catch basins.

#### 8-02.3(17) GRID BLOCKS (New Section)

The Contractor shall install grid blocks of the type specified in areas shown on the Drawings or designated by the Engineer. Areas receiving grid blocks shall be excavated, graded and compacted to a minimum depth of 8-inches below the top surface of adjacent sidewalks and curbs. After the subgrade has been approved the Contractor shall install a sub-base of mineral aggregate type 1 to a compacted average depth of 6-inches. Compaction shall be to a 95% maximum.

Thereafter, a 2-inch sand setting bed shall be spread and tamped or rolled on top of the crushed rock base. The grid blocks shall then be placed on the sand bed and each block leveled with each adjacent block. The top of the blocks shall be laid flush with the top surface of adjacent sidewalks and curbs. After the blocks have been installed and leveled, planting soil meeting the requirements of Section 9-14.1(4) shall be spread and worked into all voids. The area receiving grid blocks shall thereafter be seeded with grass seed of the type and in the quantity specified in the project manual.

#### 8-02.3(18) CEDAR EDGING (New Section)

The Contractor shall install 2-inch by 4-inch cedar edging for each cut-out as required and indicated on the Drawings. Edgings shall be installed on edge with the top of the form is level with the top of the existing grades or the top of the existing adjacent concrete sidewalks and curbs. Forms shall be secured with 2-inch by 2-inch by 12-inch cedar stakes per detail on the Drawings, driven to the inside of the forms and attached to the cedar edging with eight penny galvanized common nails.

#### 8-02.3(19) BOLLARDS (New Section)

The Contractor shall furnish and install bollards of the type specified on the Drawings. Bollards shall be installed where indicated on the Drawings or designated by the Engineer and in accordance with the requirements specified in the Project Manual and shown on the Drawings.

Bollards shall be installed true to line and grade and set in a plumb position from all angles.

The Contractor shall furnish one padlock with each removable bollard. The padlock shall be as manufactured by Best Lock Company, Lock number 2B672 with bronze body, 2-inch stainless steel shackle, and equipped with construction core or approved equal.

#### 8-02.3(19)A WOOD BOLLARDS (New Section)

Wood bollards shall meet the requirements of Section 9-14.11(1). All metal parts (bolts, nuts, washers, etc.) shall hot-dipped galvanized.

#### 8-02.3(19)B CONCRETE BOLLARDS (New Section)

The Contractor shall construct reinforced concrete bollards where shown on the Drawings. Bollards shall be of the size and shape indicated in the Drawings. Bollards shall be installed in accordance with the Drawings and the requirements set forth in the Project Manual.

Bollards shall be set in excavated holes true to line in grade in a plumb position with backfill thoroughly tamped around them.

Concrete bollards shall meet the requirements of Section 9-14.11(2).

#### 8-02.3(20) BENCHES

The Contractor shall furnish and install benches of the type indicated on the Drawings and specified in the Project Manual. Benches shall meet the requirements of Section 9-14.12. Benches shall be located where indicated on the Drawings or designated by the Engineer. Final location of benches shall be verified and approved by the Engineer prior to placement.

#### 8-02.3(21) TREE GRATES (New Section)

The Contractor shall install tree grates in locations indicated on the Drawings. Tree grates shall meet the requirements of Section 9-14.13 and the Standard Plans.

Two-piece cast-iron tree grates shall be installed with the joining line parallel to the curb.

When specified on the Drawings or the Project Manual, a concrete collar shall be constructed around each tree pit and separated from the surrounding sidewalk by a through joint. The collars shall be reinforced with two number four reinforcing bars on all sides and a 1-inch by 1-inch by 3/16-inch angle-iron frame mitered and welded at the corners and imbedded in the concrete collar with welded-on concrete ties. The angle-iron frame shall be 48 1/2 by 48 1/2-inches inside measurement and shall allow for 1/4-inch clearance on all sides to receive the 48-inch by 48-inch tree grade.

#### 8-02.3(22) RELOCATE TREE (New Section)

The Contractor shall perform the work in accordance with good nursery practice. The tree shall be relocated while in a dormant state (after October 15 or first frost and before April 15).

The tree to be relocated shall be dug by hand or approved machine; use of backhoe will not be permitted. The Contractor shall exercise extreme caution when working within the drip line of the tree to avoid damage to the trunk, branches or root structure. The Contractor shall be held liable for damage to adjacent plant material. The root ball shall be formed with diameter per the following schedule in such a manner so as to encompass the fibrous root system.

Tree Trunk Size	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

The depth of the root ball shall be no less than 1/2 of the diameter listed above. Exposed tree roots, 1-inch diameter and more shall be cut clean before wrapping root ball. The root ball shall be thoroughly wrapped with burlap and laced with 1/4 inch polypropylene rope.

Tree removal work shall be performed with the Arboriculturist present. The Contractor shall handle the tree by the root ball only. Under no circumstances will the Contractor be allowed to lift or remove the tree by the trunk. The tree shall be carefully reset into the designated tree pit and planted in the same manner as a new tree.

The requirements of landscape establishment of Section 8-02.3(8) shall apply to relocated trees. Replacement, if necessary, shall be as set forth in Section 8-02.3(13).

#### 8-02.4 MEASUREMENT

The pay quantities for plant materials will be determined by count of the number of satisfactory plants in each category accepted by the Engineer.

Seeded lawn and sod installations will be measured by ground slope measurement in square yards of actual lawn completed, established, and accepted.

Measurement for "Landscape Establishment", will be by lump sum.

Measurement for "Planting Soil" and "Bark Mulch" shall be per cubic yard measured in the hauling conveyance at the point of delivery. The Contractor shall notify the Engineer at least 24 hours prior to material delivery to ensure the Engineer's presence for measurement at the time of delivery. No payment will be made for material deliveries not witnessed by the Engineer.

Measurement for "Paver Blocks (Size)" will be by each.

Measurement for "Grid Blocks," will be by square feet.

Measurement for "Edging (Material)" will be by the linear foot.

Measurement for "Bollard (Material)" will be by each.

Measurement for "Bench" will be by each.

Measurement for "Tree Grate" will be by each complete grate.

Measurement for "Relocate Tree" will be by each tree removed and replanted.

Measurement for "Relocate Shrub" will be by each shrub removed and replanted.

#### 8-02.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 8-02 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Tree, Evergreen (Size)," per each.
- (2) "Tree, Deciduous (Size)," per each.
- (3) "Shrub, (Type), (Size)," per each.
- (4) "Groundcover, (Size)," per each.
- (5) "Landscape Establishment, Minimum Bid (\$\_\_\_\_\_)" per lump sum.
- (6) "Planting Soil, (Type)" per cubic yard.
- (7) "Mulch, Bark" per cubic yard.
- (8) "Paver Blocks, (Size)," per each.
- (9) "Grid Block," per square foot.
- (10) "Edging, (Material)," per linear foot.
- (11) "Bollard, (Material)," per each.
- (12) "Bench," per each.
- (13) "Tree Grate," per each.
- (14) "Relocate Tree," per each.

(15) "Relocate Shrub," per each.

(16) "Sodding," per square foot.

(17) "Seeded Lawn Installation," per square foot.

The unit contract price for trees, shrubs and ground cover plants shall include the costs for all work specified in Section 8-02 (not otherwise provided for hereinafter) to furnish, plant, fertilize, cultivate and maintain for 1 year the plant material.

The unit contract price for "Landscape Establishment, Min. Bid (\$\_\_\_\_\_)" shall include the costs for all work required by Sections 8-02.3(2), 8-02.3(12), and the cost of replacement plant material in place, if necessary, as required by Section 8-02.3(13).

Payment shall be made at the rate of 25 percent of the bid item lump sum for "Landscape Establishment Min. Bid (\$\_\_\_\_\_)" at the following periods: May 31, July 31, September 30 and the final 25% at the end of the landscape establishment period after the necessary corrections and replacements have been made. The Contractor shall submit a statement on the 25th of May, 25th of July and the 25th of September indicating that he has properly maintained the plantings during that period as required in the Specifications. In the event the Engineer finds that no work or inadequate work was done, the payment may be reduced or forfeited, or the work done by others, as described in Failure to Perform. To prevent unbalanced bids, the price bid for "Landscape Establishment" shall not be less than the minimum price noted in the Bid Form. Bids received on this contract which contain a cost for landscape establishment of less than the minimum bid will be rejected.

Fertilizer and other soil amendments specified in Section 8-02 but not set forth in the Bid Form as a separate Bid Item shall be included in the unit price of the Bid Item for which its use was necessary.

The unit Bid Item price for "Planting Soil" shall include all costs to furnish and place the planting soil as specified.

The unit Bid Item price for "Mulch, Bark" shall include all costs to furnish and install the mulch, bark.

The unit Bid Item price for "Paver Blocks, (Size)," shall include all costs to furnish and install the paver blocks.

The unit Bid Item price for "Grid Blocks," shall include all costs to furnish and place the grid including crushed rock base, sand setting bed, planting soil and seed.

The unit Bid Item price for "Edging (Material)" shall include all costs to furnish and install edging as specified.

The unit Bid Item price for "Bollard (Material)" shall include all costs to furnish and install the type and size of bollard specified.

The unit Bid Item price for "Bench," shall include all costs for the work required to furnish and install the type and size bench specified.

Payment for "Tree Grate" shall include all costs for labor, materials and equipment necessary to furnish and install the specified tree grates.

The unit Bid Item price for "Relocate Tree," or "Relocate Shrub," shall include all costs to remove, protect, store and replant the tree or shrub.

Payment for clearing and grubbing shall be per Section 2-01.

Payment for establishing the subgrade of planting areas prior to actual planting by excavation or embankment construction shall be per Section 2-03.

Payment for fill material of the type specified shall be by the cubic yard per Section 4-01.5.

The unit Bid Item price per square yard for "Seeded Lawn Installation," or "Sodding" shall be full compensation for all costs necessary to prepare the area, plant or sod the lawn, erect barriers, and establish lawn areas, and for furnishing all labor, tools, equipment, and materials necessary to complete the work as specified.

Any incidental work required to complete the seeded lawn installation or sod installation, as specified herein but not specifically mentioned, shall be incidental to, and all costs therefor shall be included in the unit contract price of the bid item.

Any incidental work required to complete the roadside planting specified herein, but not specifically mentioned in these specifications shall be incidental to the roadside planting, and all costs therefor shall be included in the unit contract prices of the bid items.

## SECTION 8-03 - IRRIGATION SYSTEM

## 8-03.1 DESCRIPTION

Delete this section and replace with the following:

This work shall consist of furnishing all materials and labor required to install a sprinkler irrigation system in accordance with these Specifications and the details shown on the Drawings.

The Contractor or subcontractor shall be a licensed lawn-sprinkler contractor. The sprinkler system shall be installed by a journeyman lawn-sprinkler mechanic or journeyman plumber. Electrical work shall be performed by a licensed electrical contractor or subcontractor.

The Contractor shall obtain a plumbing permit from the Seattle/King County Health Department.

The Engineer will conduct periodic inspections to insure that the Contractor is complying with the terms of the contract. The Contractor shall advise the Engineer at least 24 hours before pressure tests are to be conducted and shall have the approval of the Engineer before backfilling.

## 8-03.3 CONSTRUCTION REQUIREMENTS

Delete this section and replace with the following:

Work shall conform to the local plumbing code having jurisdiction. The Contractor shall apply and pay for all permits having to do with the work.

Scaled dimensions are approximate. The Contractor shall check and verify all dimensions on the site before proceeding with any work as part of the contract. Before starting work on the sprinkler system, the Contractor shall carefully note all finish grades. Finish grades changed in the course of the work shall be restored to the original grades and contours.

The Contractor shall furnish the necessary equipment for proper execution and completion of all irrigation work and shall make the connections to the water service. The Seattle Water Department will furnish and install service tap, meter and meter box. Twenty days notice is required for the service tap and the service tap shall be requested through the Engineer.

Where indicated on the Drawings, piping and wire shall be installed in sleeves of plastic pipe of sufficient inside diameter to permit easy withdrawal and re-insertion of the piping or wire. Pipe sleeves shall have a minimum of 12 inches cover for water piping and depth according to the code for electrical wires.

## 8-03.3(4) JOINTING

Delete paragraph 5 and replace with the following:

Due to the nature of PVC pipe and fittings, the Contractor shall exercise care in handling, loading, unloading and storing to avoid damage. The pipe and fittings shall be stored under cover, and shall be transported in vehicle with bed long enough to allow the length of pipe to lay flat, so as not to be subject to undue bending or concentrated external load at any point. Any pipe that has been dented or damaged shall be discarded until such damage has been cut out and the pipe is rejoined with a coupling.

Solvent welded joints shall be given at least 15 minutes set-up time before moving or handling. Pipe shall be partially center-loaded to prevent arching and slipping. No water shall be permitted in pipe until a period of at least 10 hours has elapsed for solvent weld setting and curing.

Backfilling shall be done when pipe is not in an expanded condition due to heat or pressure. Cooling of the pipe can be accomplished by operating the system for a short time before backfill, or by backfilling in the early part of the morning before the heat of the day.

Before pressure testing, solvent welded joints shall be given at least 24 hours curing time.

## 8-03.3(7) ELECTRICAL WIRE INSTALLATION

Delete this section and replace with the following:

Wiring between the automatic controller and automatic valves can share a common neutral. Separate control conductors shall be run from the automatic controller to each valve. A white colored wire shall be used for the neutral as specified in the National Electrical Code. Wire shall be installed adjacent to and attached to the irrigation mains by plastic tape or nylon tie-ups.

Wire shall be common to each valve in the system. A loop shall be provided at each valve in any wire that passes or terminates at that valve. Loop knot end of spare wire at valves where wire dead-ends.

Splice insulation shall consist of electrical conductors twisted and bonded by approved pressure connectors and contained in a rigid plastic epoxy-filled mold. Splices will be permitted only at junction boxes, valve boxes, pole bases or control equipment. A minimum of 2 feet excess of conductors shall be left at junction boxes and automatic control valves to facilitate splicing and inspection.

Electrical service shall be provided to controller enclosure as shown on the Drawings.

#### 8-03.3(8) FLUSHING AND TESTING

Delete this section and replace with the following:

All gauges used in the testing of water pressures shall be certified correct by an independent testing laboratory immediately prior to use on the project. Gauges shall be retested when directed by the Engineer.

Automatic controllers shall be tested by actual operation for a period of two weeks under normal operating conditions. Should adjustments be required, the Contractor shall do so according to the manufacturer's direction and test until operation is satisfactory.

**Mainline Flushing:** All main supply lines shall receive two fully-open flushings, to remove debris that may have entered the line during construction: the first before placement of valves; the second after placement of valves and prior to testing.

**Mainline Testing:** All main supply lines shall be purged of air and tested with minimum static water pressures of 150 psi for 60 minutes without introduction of additional service or pumping pressure. Testing shall be done with one pressure gauge installed on the line, where directed by the Engineer. An additional pressure gauge shall be installed at the pump when directed by the Engineer. Lines which show loss of pressure exceeding 5 psi at the ends of specified test periods will be rejected.

The Contractor shall correct rejected installations and retest for leaks as specified herein.

**Lateral Line Flushing:** All lateral lines shall receive one fully-open flushing prior to placement of sprinkler heads, emitters, and/or drain valves. The flushing shall be of sufficient duration to remove any dirt or debris that has entered the lateral lines during construction.

**Lateral Line Testing:** All lateral lines shall be purged of air and tested under operating line pressures with risers capped and drain valves closed. The operating line pressures shall be maintained for 30 minutes through open valves and pressure regulating devices. Lines which show leaks at the end of the specified test periods will be rejected.

When conditions exist which prevent effective visual inspection of lateral lines, the Engineer may require that the lines be tested by use of pressure gauges. In that event, static water pressure, equal to the operating line pressure, shall be maintained in the lines for 30 minutes with valves closed and without introduction of additional service pressure. Lateral lines which show loss of pressure exceeding 5 psi at the end of specified test periods will be rejected.

The Contractor shall correct and retest lateral line installations that have been rejected. Throughout the life of the contract, the Contractor shall repair, flush, and test, as detailed herein, all main and lateral lines that have sustained a break or disruption of service. Upon restoration of the water service, the affected lines shall be brought up to operating pressure. The Contractor shall conduct a thorough inspection at this time of all sprinkler heads, emitters, etc., located downstream of the break, disruption of service, and/or repair. This inspection is required to ensure that the entire irrigation system is operating properly.

#### 8-03.3(10) BACKFILL

Supplement this section with the following:

Trenches shall be compacted during backfilling.

Before complete backfilling, underground appurtenances, including risers, valves, vacuum breakers, drain valves, etc. shall remain exposed so that they can be located "as built" by the Engineer. The Contractor shall give 24-hour notice to the Engineer each time location or inspection is required. If, for any reason, any part of the sprinkler system is backfilled before being approved for location, testing, or inspection, it shall be uncovered and exposed until approved for backfilling by the Engineer.

#### 8-03.4 MEASUREMENT

Delete this section and replace with the following:

Measurement for Automatic or Manual Irrigation System will be by lump sum.

Measurement for "Hose Bib Assembly" will be by each.

Measurement for "Sleeve, PVC (Sch), (Size)" will be by the linear foot.

Measurement for "Valve Box, Plastic" will be by each.

#### 8-03.5 PAYMENT

Delete this section and replace with the following:

Compensation for the cost necessary to complete the work described in Section 8-03 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Irrigation System, Automatic," lump sum.
- (2) "Irrigation System, Manual," lump sum.
- (3) "Hose Bib Assembly," per each.
- (4) "Sleeve, PVC (Sch), (Size)", per linear foot.
- (5) "Valve Box, Plastic", per each.

The unit contract price for "Irrigation System, Automatic" shall include all costs for the work required to furnish, install, and test a complete working system and including excavation, backfill, controller, valves, sleeves, conduit, wiring and piping.

The unit contract price for "Irrigation System, Manual" shall include all costs for the work required to furnish, install and test a complete working system and including excavation, backfill, valves, sleeves, and piping.

The unit contract price for "Hose Bib Assembly," shall include all costs for the work required to furnish and install the type and size of hose bib assembly specified.

The unit contract price "Sleeve, PVC (Sch), (Size)," shall include all costs for the work required to furnish and install the type and size of sleeve specified.

The unit contract price for "Valve Box, Plastic," shall include all costs for the work required to furnish and install the type and size of valve box specified.

The unit contract prices shall be full compensation for furnishing all labor, materials, tools, and equipment necessary or incidental to the construction of the complete sprinkler irrigation system as shown in the plans or as directed by the Engineer.

All costs of annual inspections and tests performed on cross connection control devices during the life of the contract shall be included in the unit contract prices for the complete irrigation system as shown in the plans or as directed by the Engineer.



**SECTION 8-04 - CURBS, GUTTER, SPILLWAYS AND INLETS**

Delete the title and content of Section 8-04 in its entirety and replace with the following:

**SECTION 8-04 CEMENT CONCRETE CURB, CURB AND GUTTER (New Section)****8-04.1 DESCRIPTION (New Section)**

The work shall consist of providing and installing cement concrete curb, and curb and gutter in conformance with the Drawings, these Specifications and with the Standard Plans.

**8-04.2 MATERIALS (New Section)**

Materials shall meet the requirements of the following sections of these specifications.

Portland Cement . . . . .	9-01
Concrete Aggregate . . . . .	9-03
Reinforcing Steel . . . . .	9-07
Premolded Joint Filler . . . . .	9-04.1
Curing Compounds . . . . .	9-23

**8-04.2(1) CONCRETE (New Section)**

The portland cement concrete shall meet the requirements of Section 5-06. Concrete mix for curbs shall be Class 5 (1-1/2). When doweled curb is constructed, concrete shall be Class 5 (3/4). Slump of the concrete mix shall not exceed 3-1/2 inches.

Grout for doweled curb on existing pavement shall be one part portland cement and two parts clean sand.

**8-04.2(2) REINFORCING STEEL AND STEEL DOWELS (New Section)**

Dowels and reinforcing steel shall be #3 deformed steel billet bars, ASTM A615, Grade 60.

**8-04.2(3) FORMS (New Section)**

Forms may be of wood or metal or any other material at the option of the Contractor, provided that the forms as set will result in a curb, or curb and gutter of the specified thickness, cross section, grade and alignment shown on the Drawings.

**8-04.3 CONSTRUCTION REQUIREMENTS (New Section)****8-04.3(1) GENERAL (New Section)****8-04.3(1)A ERECTING FORMS (New Section)**

Forms, wood or steel, shall be staked securely in place, true to line and grade.

Sufficient support shall be given to the form to prevent movement in any direction, resulting from the weight of the concrete or the concrete placement. Forms for 410A and 410B Curbs shall not be set until the subgrade has been compacted within 1 inch of the established grade. Forms shall be clean and well oiled prior to setting in place. When set, the top of the form shall not depart from grade more than 1/8 inch when checked with a 10-foot straightedge. The alignment shall not vary more than 1/4 inch in 10 feet. Immediately prior to placing the concrete, forms shall be carefully inspected for proper grading, alignment and rigid construction. Adjustments and repairs as needed shall be completed before placing concrete.

**8-04.3(1)B PLACING CONCRETE (New Section)**

The subgrade shall be properly compacted and brought to specified grade before placing concrete. The subgrade shall be thoroughly dampened immediately prior to the placement of concrete. Concrete shall be spaded and tamped thoroughly into the forms to provide a dense, compacted concrete free of rock pockets. The exposed surfaces shall be floated, finished and brushed longitudinally with a fiber hair brush approved by the Engineer.

The rate of concrete placement shall not exceed the rate at which the various placing and finishing operations can be performed in accordance with these Specifications.

If concrete is to be placed by the extruded method, the Contractor shall demonstrate to the satisfaction of the Engineer that the machine is capable of placing a dense, uniformly compacted concrete to exact section, line and grade.

**8-04.3(1)C DOWELS (New Section)**

Dowels shall be placed in the pavement slab as detailed on the Standard Plans.

The dowel bars shall be set while the concrete is still plastic enough to not require hammering them into place.

**8-04.3(1)D STRIPPING FORMS AND FINISHING (New Section)**

The face form of the curb shall be stripped at such time in the early curing as will enable inspection and correction of all irregularities that appear.

Forms may be removed on the day following the pour if the concrete has set sufficiently to retain its true shape and removal causes no chipping or spalling. When forms are removed before the expiration of the curing period, the edges of the concrete shall be protected with moist earth, or sprayed with curing compound. The face of the curb shall be troweled with a tool cut to the exact section of the curb and at the same time maintain the shape, grade and alignment of the curb. The exposed surface of the curb shall be brushed with a fiber hair brush.

**8-04.3(1)E CURING (New Section)**

White pigmented or transparent curing compounds shall be applied to all exposed surfaces immediately after finishing. Transparent curing compounds shall contain a color dye of sufficient strength to render the film distinctly visible on the concrete for a minimum period of 4 hours after application.

If, at any time during the curing period any of the forms are removed, a coat of curing compound shall be applied immediately to the exposed surface. The curing compound shall be applied in sufficient quantity to obscure the natural color of the concrete. Additional coats shall be applied if the Engineer determines that the coverage is not adequate. The concrete shall be cured for the minimum period of time set forth in Section 5-06.3(13)A.

**8-04.3(1)F EXPANSION AND DUMMY JOINTS (New Section)**

Joints shall be constructed in the manner shown on the Standard Plans and at locations to match joints in concrete pavement. In no case shall joints exceed 15 feet center to center. They shall be cleaned and edged as shown on the Drawings and as further specified in Section 5-06. All expansion and construction joints shall extend entirely through the curb section above the pavement surface. Joint filler in the curb shall be normal to the pavement and in full butt contact with pavement joint filler. Joints shall match existing transverse joints or cracks in existing pavement.

**8-04.3(1)G FINISHED WORK (New Section)**

The work shall be performed in a manner which results in a curb or curb and gutter constructed to specified line and grade, uniform in appearance and structurally sound. Curbs found with unsightly bulges, ridges, low spots in the gutter or other defects shall be removed and replaced at the Contractor's expense if the Engineer considers them to be irreparable. When checked with a 10-foot straightedge, grade shall not deviate more than 1/8 inch, and alignment shall not vary more than 1/4 inch.



**8-04.3(2) CURB BLOCK-OUTS AT CURB RAMPS (New Section)**

At intersections where new cement concrete curb is to be constructed and curb ramps are to be provided under the contract, the Contractor shall block out the new curb at the locations of the new curb ramps. The locations and limits of the depressed curb when other than shown on the Standard Plan will be designated by the Engineer.

**8-04.3(3) TYPE 410A CURB (New Section)**

Separate curb shall be constructed as shown on Standard Plan 410A.

**8-04.3(4) TYPE 410B CURB AND GUTTER (New Section)**

Curb and gutter shall be constructed as shown on Standard Plan 410B on a compacted subgrade prepared in accordance with applicable subgrade specifications for cement concrete pavement in Section 5-06. The placing, consolidating, jointing, finishing and curing of the concrete shall comply with the requirements for concrete curb as specified in Section 8-04.3(1), except that the top of the gutter shall be steel troweled and fiber brushed parallel to the curb.

Curb and gutter may be constructed by the extruded method only if such construction is called for in the Special Provisions. When extruded curb and gutter is called for in the Project Manual, it may be extruded as a unit, or the curb may be extruded upon the gutter section in which case steel dowels shall be provided as specified in Section 8-04.3(1)C.

**8-04.3(5) TYPE 410C CURB (New Section)****8-04.3(5)A CEMENT CONCRETE CURB ON EXISTING PAVEMENT (New Section)**

Cement concrete curb constructed on an existing pavement shall be dowelled onto the existing pavement where indicated on the Drawings or designated by the Engineer, as shown on Standard Plan No. 410C.

The dowel bar shall be 10 inches long placed at 18 inches on center using 1 inch drilled holes, 5 inches deep and placed in rigid portion of concrete pavement.

Holes shall be grouted with epoxy grout. When a hole is ready to be grouted, it shall be free from water, particles of concrete, and other foreign material. Care shall be taken in placing the grout to entrap as little air as possible. The grout shall be protected from rapid drying.

**8-04.3(5)B CEMENT CONCRETE CURB ON NEW PAVEMENT (New Section)**

Dowelled curb on new pavement shall be constructed as shown on Standard Plan No. 410C.

The pavement width shall extend to the back of the curb. The pavement where the curb is to be placed shall be roughened or otherwise treated so that a permanent bond will be secured between the curb and the pavement.

Dowels, as detailed in Standard Plan 411 shall be placed at 18 inches on center in the fresh concrete pavement.

**8-04.3(6) MOUNTABLE CURB (New Section)**

Mountable curb shall be constructed with the alignment and configuration as shown on Standard Plan 415.

**8-04.4 MEASUREMENT (New Section)**

Measurement for curb, or curb and gutter of the type specified will be by the linear foot along the face of the curb for the length constructed, including that portion installed through driveways and curb ramps.

Where curb ramps or driveways are "cut in" areas of existing improvements where adjacent curb will remain, no measurement for curb will be made.

**8-04.5 PAYMENT (New Section)**

Compensation for the cost necessary to complete the work described in Section 8-04 will be made at the unit contract prices only for the pay items listed or referenced below:

- (1) "Curb, Cement Concrete", per linear foot.
- (2) "Curb, Cement Concrete, Mountable" per linear foot.
- (3) "Curb and Gutter, Cement Concrete", per linear foot.

The unit contract price for "Curb, Cement Concrete", "Curb and Gutter, Cement Concrete", and "Curb, Cement Concrete, Mountable" shall include all costs for the work required to construct the curb or curb and gutter of the size and type specified, including dowels.

Curb does not include the pavement slab upon which it is placed. That portion of the pavement slab underneath the curb will be paid for as concrete pavement.

The unit contract price for "Curb, Cement Concrete" shall be full payment for all costs of work required to construct either type of curb specified (per Standard Plan 410) on existing pavement or on a new cement concrete pavement.

Cost of dowels, drilling holes, epoxy grout, to install curbs on existing concrete pavement shall be incidental to the price of curbs.

## SECTION 8-05 - INTEGRAL CEMENT CONCRETE CURB

Delete Section 8-05 in its entirety.

## SECTION 8-06 - EXTRUDED CURB (New Section)

## 8-06.1 DESCRIPTION (New Section)

The work shall consist of construction of extruded concrete curb at such locations as shown on the Drawings and to the cross section shown on the Standard Plan.

## 8-06.2 MATERIALS (New Section)

Materials shall meet the requirements of the following sections of these Specifications.

Aggregates . . . . .	9-03
Mineral Filler . . . . .	9-03.8(5)
Blending Sand . . . . .	9-03.8(4)
Asphalt . . . . .	9-02.1(4)
Portland Cement . . . . .	9-01
Reinforcing Steel . . . . .	9-07
Curing Compounds . . . . .	9-23

Extruded asphalt concrete curb shall consist of a hot mix asphalt concrete Class B mix conforming to the provisions of Section 5-04.

Portland cement content shall be a minimum of 6 sacks per cubic yard. Aggregate for cement concrete shall meet the requirements of Grading for Fine Aggregate as outlined in Section 9-03.1(2)B. Transparent curing compound as specified in Section 9-23.3 shall be used. Air-entrained concrete shall be used as outlined in Section 9-23.6 except that air content shall be a minimum of 3 percent and a maximum of 6 percent by volume.

Tie bars shall be deformed steel bars meeting the requirements of Section 9-07.3. The bars shall be free from rust, loose mill scale, dirt, grease or other defects affecting the strength or bond with the concrete.

## 8-06.3 CONSTRUCTION REQUIREMENTS (New Section)

## 8-06.3(1) EXTRUDED ASPHALT CONCRETE CURB (New Section)

The asphalt pavement shall be dry and cleansed of loose or deleterious material. Immediately after cleaning the pavement surface, a tack coat of cut-back or emulsified asphalt shall be applied to the asphalt curb area of the pavement at the rate of .08 to 0.20 gallons per 15 linear feet of curb area, depending on the width of curb and age of pavement. Care shall be taken to prevent applying too wide or too heavy a tack coat.

## 8-06.3(2) EXTRUDED CEMENT CONCRETE CURB (New Section)

The pavement shall be dry and cleansed of loose or deleterious materials.

## 8-06.3(3) EQUIPMENT FOR LAYING CURB (New Section)

## 8-06.3(3)A EXTRUDED ASPHALT CONCRETE CURB (New Section)

The machine for laying the curb shall be of the self-propelled type equipped with a material hopper, distributing screw, and adjustable curb forming devices capable of laying and compacting the hot-mix asphalt concrete to the lines, grades and cross section as shown on the Drawings, and in an even homogenous manner free of honeycombs.

## 8-06.3(3)B EXTRUDED CEMENT CONCRETE CURB (New Section)

The machine for placing the cement concrete curb shall be of the self-propelled type equipped with a material hopper, distributing screw, and adjustable curb forming devices capable of placing and compacting the cement concrete to the exact lines, grades and cross section as shown on the Drawings and the Standard Plans.

## 8-06.3(4) MIXING AND PLACING (New Section)

## 8-06.3(4)A TIE BARS FOR CEMENT CONCRETE CURBS (New Section)

Tie bars shall be spaced 1 foot on each side of every joint. Where angle points occur in curb alignment, additional tie bars shall be placed 1 foot on either side of the angle point.

Tie bars shall meet dimensions as shown on Standard Plans.

## 8-06.3(4)B EXTRUDED ASPHALT CONCRETE CURB (New Section)

The asphalt concrete mixture shall be homogenously mixed to conform with Section 5-04.3(8) and shall be delivered to the hopper of the laying machine at a temperature of not less than 200 degree F. nor more than 300 degree F. Each hopper load of the asphalt concrete mix shall be run through the curb laying machine, properly adjusted to form and properly compact the asphalt concrete curb.

## 8-06.3(4)C EXTRUDED CEMENT CONCRETE CURB (New Section)

The cement concrete mixture shall be homogenously mixed to conform with Section 5-01 when delivered to the hopper of the curb machine. Each hopper load of the cement concrete mix shall be run through the curb laying machine, properly adjusted to form and properly compact the cement concrete curb.

## 8-06.3(5) JOINTS (New Section)

## 8-06.3(5)A EXTRUDED ASPHALT CONCRETE CURB (New Section)

Unless conditions warrant, asphalt concrete curb construction at the specified temperature shall be a continuous operation in one direction so as to eliminate curb joints. However, where conditions are such that this is not possible, the joints between successive days work shall be carefully made in such a manner as to ensure a continuous bond between the old and new sections of the curb. Contact surface of the previously constructed curb shall be painted with a thin, uniform coat of hot bituminous material immediately prior to placing the fresh asphalt concrete curb material against the old joint.

## 8-06.3(5)B EXTRUDED CEMENT CONCRETE CURB (New Section)

Joints in the extruded cement concrete curb shall be spaced at 15-foot intervals or shall match existing transverse joints or cracks in existing pavement. Joints shall be cut vertically and to a depth of 5 inches as shown on Standard Plans. Joints shall not be placed in conflict with curb dowels.

## 8-06.3(7)A EXTRUDED ASPHALT CONCRETE CURBS (New Section)

The newly laid curb shall be protected from traffic by barricade or other suitable means until the heat of the asphalt concrete mixture has been dissipated and the mixture has attained its proper degree of hardness.

## 8-06.3(7)B EXTRUDED CEMENT CONCRETE CURBS (New Section)

Transparent liquid curing compound shall be used. Sufficient pigment shall be present so that the sprayed compound is easily discernible. Application shall be as outlined in Section 9-23.3.

The newly placed curb shall be protected from traffic by barricade or other suitable means until the cement concrete mixture has attained its required strength.

## 8-06.3(8) FURTHER PROVISIONS (New Section)

## 8-06.3(8)A EXTRUDED ASPHALT CONCRETE CURB (New Section)

Section 5-04 of the Specifications shall apply where specific details are required and where such provisions have not been included in this section of the Specifications.

## 8-06.3(8)B EXTRUDED CEMENT CONCRETE CURB (New Section)

Section 5-06 of the Specifications shall apply where specific details are required and where such provisions have not been included in this section.

## 8-06.4 MEASUREMENT (New Section)

The extruded concrete curb will be measured by the linear foot along the front face of the curb and returns.

## 8-06.5 PAYMENT (New Section)

Payment will be made for the following bid item when included and shown in any particular contract:

- (1) "Extruded Curb (Material)" per linear foot.

The unit contract price for the above item shall be full compensation for all costs of labor, tools, equipment and materials and for complete installation in accordance with the Drawings and Specifications.

## SECTION 8-07 PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB

## 8-07.1 DESCRIPTION

Delete this section and replace with the following:

This work shall consist of furnishing and installing precast cement concrete traffic curb and precast cement concrete block traffic curb, of the design and type specified in the Drawings, meeting the requirements of the Standard Plans and Specifications. Traffic curb shall be installed in the locations indicated in the Engineer's Drawings or as designated by the Engineer. The curb face shall be painted with approved traffic paint, either yellow or white, as specified on the Drawings or designated by the Engineer. Precast Traffic Curb shall conform to Standard Plan No. 413. Precast Block Traffic Curb shall conform to Standard Plan No. 414.

## 8-07.3(1) INSTALLING CURBS

Delete the last paragraph and replace with the following:

For both types of traffic curbs, nosing pieces, connecting dividers, and radial sections as detailed in the Drawings, will be required at the ends of the curb lines, at transitions from Type 413C traffic curb to Type 413A traffic curb, and at Type 413A traffic curb installation with radii less than 10 feet.

## 8-07.3(2) PAINTING OF CURBS

Delete this section and replace with the following:

Concrete traffic curbs shall be painted with 2 full coats of approved traffic paint in accordance with Section 9-29.

## 8-07.4 MEASUREMENT

Delete this section and replace with the following:

Precast traffic curb and block traffic curb will be measured in linear foot along the top of the curb and return. The nosing pieces and dividers will be measured as traffic curb.

## 8-07.5 PAYMENT

Delete this section and replace with the following:

Compensation for the cost necessary to complete the work described will be made at the unit contract price bid only for the pay item listed or referenced below:

- (1) "Curb, Traffic, Precast," per linear foot.

The unit contract price for "Curb, Traffic, Precast" shall include all costs for the work required to furnish and install the precast traffic curb and precast block traffic curb.

## SECTION 8-08 - PLASTIC TRAFFIC BUTTONS

Delete the title and content of Section 8-08 in its entirety and replace with the following:

## 8-08 - PLASTIC TRAFFIC BUTTONS AND LANE MARKERS (New Section)

## 8-08.1 DESCRIPTION

This work shall consist of furnishing and installing plastic traffic buttons and lane markers with an epoxy adhesive. Material and installation shall meet the requirements of these specifications and Standard Plan 700.

Location and spacing shall be as indicated on the Drawings or designated by the Engineer. The Engineer will provide necessary control points. The Contractor shall be responsible to do the preliminary spotting of the plastic buttons and lane markers from those control points prior to installation. Approval by the Engineer of the layout shall be obtained before traffic button or markers are installed. Color of traffic buttons and Lane Markers, Type 1, shall match the color of the pavement markings on which they are installed. The color of applicable pavement markings are set forth in Section 8-22.1(2).

## 8-08.2 MATERIALS (New Section)

Plastic traffic buttons and lane markers shall meet the requirements of the following sections of these specifications.

Plastic Traffic Buttons . . . . .	9-21.1
Lane Markers Type 1 . . . . .	9-21.1
Lane Markers Type 2 . . . . .	9-21.2
Adhesive . . . . .	9-26.2

## 8-08.3 CONSTRUCTION REQUIREMENTS (New Section)

## 8-08.3(1) SURFACE PREPARATION (New Section)

Traffic buttons and lane markers shall be bonded to clean and dry pavement with an adhesive as specified herein.

All sand, dirt and loose extraneous material shall be swept or blown away from the marker lane location; and the cleaned surface prepared by one of the following procedures:

Surface dirt within areas to receive traffic buttons and lane markers shall be removed. Large areas of tar, grease or foreign materials may require sand blasting, steam cleaning or power brooming to accomplish complete removal. Application of traffic buttons and lane markers shall not proceed until the cleaned surface has been approved by the Engineer.

## 8-08.3(2) ADHESIVE PREPARATION (New Section)

At the time of use the contents of Packages A and B shall be thoroughly redispersed by mixing. One volume or weight of Package A shall be mixed with one volume or weight of Package B until a uniform gray color is achieved without visible streaks of white or black. Formulation may be revised, if approved by the Engineer.

Catalyst shall be added to the base just before use. Unused mixed adhesive shall be discarded when catalytic action has caused stiffening and reduction of workability or a small ball of jelled resin has formed in the center of the container.

The adhesive shall be maintained at a temperature between 60° and 85° F. before use and during application.

## 8-08.3(3) APPLICATION PROCEDURE (New Section)

Applications of traffic buttons and lane markers to pavement shall not be done if the ambient air temperature is below 40° F.

The mixed adhesive shall be applied to the base of the traffic button and lane marker with a quantity sufficient to overfill all voids between the base of the traffic button, lane marker and the pavement, such that as the traffic button and marker is worked into final position, the excess adhesive is forced out to form a bead rim around the entire perimeter of the traffic button and lane marker.

Traffic buttons and lane markers shall be spaced and aligned as indicated on the Drawings or designated by the Engineer. A displacement of not more than 1/2 inch left or right of the established guide line will be permitted. Improperly placed buttons shall be removed and replaced at the Contractor's expense.

Bonding shall be considered satisfactory when adhesive develops a minimum bond strength of tension of not less than 10 pounds per square inch for 8-inch and 10-inch plastic traffic buttons, and not less than 2 pounds per square inch for lane markers Type 1 and Type 2. Traffic will not be allowed to pass over the traffic buttons and lane markers until the minimum bonding strength has been achieved.

#### 8-08.4 MEASUREMENT (New Section)

Measurement for plastic traffic buttons will be per each.

Measurement of lane markers, Type 1 and Type 2, will be by the unit for each type of marker furnished and set in place.

#### 8-08.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 8-08 will be made at the unit contract price bid only for the pay items listed or referenced below.

- (1) "Lane Marker Type 1", per each.
- (2) "Lane Marker, Type 2", per each.
- (3) "Plastic Traffic Button, Type ( )", per each.

The unit contract price for the above bid items shall include all costs for all work required to furnish and install the traffic buttons and lane markers including surface preparation and adhesives.

No additional compensation will be allowed for removal of existing traffic buttons but the cost thereof shall be considered to be included in the prices bid for the various items comprising this improvement.

#### SECTION 8-09 - LANE MARKERS

Delete Section 8-09 in its entirety. Refer to Section 8-08 "PLASTIC TRAFFIC BUTTONS AND LANE MARKERS."



## SECTION 8-11 - GUARD RAIL

## 8-11.2 MATERIALS

Supplement this section with the following under Beam Guard Rail.

Inspection . . . . . 9-16.3(6)

## 8-11.4 MEASUREMENT

Delete the first paragraph and replace with the following:

Measurement of beam guard rail will be by the linear foot measured along the line of the of the completed guard rail from end to end, including transition sections, expansion sections, and terminal sections.

## 8-11.5 PAYMENT

Supplement this section with the following:

(6) "Relocate Beam Guard Rail", per linear foot.

The unit contract price per linear foot for "Relocate Beam Guard Rail" shall be full compensation for furnishing all labor, tools, equipment necessary to carefully remove and install beam guard rail at location where shown on the Drawings or as directed by the Engineer.

## SECTION 8-12 - CHAIN LINK FENCE AND WIRE FENCE

## 8-12.4 MEASUREMENT

Delete this section and replace with the following:

Chain link fence will be measured by the linear foot of completed fence, along the ground line, exclusive of openings.

Gates will be measured by the unit for each type of gate furnished and installed complete in place.

## 8-12.5 PAYMENT

Delete this section and replace with the following:

Payment will be made for such of the following bid items as are included in the Bid Form:

- (1) "Chain Link Fence (Type)", per linear foot.
- (2) "Double 14 Ft. Chain Link Gate", per each.
- (3) "Double 20 Ft. Chain Link Gate", per each.
- (4) "Single 6 Ft. Chain Link Gate", per each.
- (5) "Wire Fence Type . . . . .", per linear foot.
- (6) "Single Wire Gate 14 Ft. Wide", per each.
- (7) "Double Wire Gate 20 Ft. Wide", per each.

When there is no clearing and grubbing item in the project proposal, the work required to clear the area around the proposed fence shall be considered incidental to the unit price for fence or gate.

The unit contract price per linear foot or per each of the above items, shall be full compensation for furnishing all labor, materials, tools and equipment necessary to construct a complete fence or gate.

**SECTION 8-13 - MONUMENT CASES**

Delete Section 8-13 in its entirety and replace with the following:

**8-13.1 DESCRIPTION (New Section)**

This work consists of furnishing and setting survey monument frame and cover castings, and removing and resetting monument castings which may be covered over, damaged, or otherwise rendered useless due to construction activities.

**8-13.2 MATERIALS (New Section)**

Materials shall meet the requirements of the following section of this Specification:

Monument Frame and Covers . . . . . 9-22

**8-13.3 CONSTRUCTION REQUIREMENTS (New Section)****8-13.3(1) REFERENCE POINTS (New Section)**

The Engineer will reference all monuments in advance of construction and will reset the points and grades at the proper time.

It shall be the responsibility of the Contractor to furnish materials and install required castings in accordance with the Drawings as and where directed by the Engineer. The Contractor shall carefully protect all reference points to the monuments and he shall give the Engineer reasonable notice of the schedule for monument work in order to avoid destruction of the points.

The monument will be furnished and set by the Engineer.

**8-13.3(2) FURNISH AND PLACE MONUMENT CASTINGS (New Section)**

Where indicated on the Drawings or where designated by the Engineer, the Contractor shall furnish and install Type 020 monument frames and covers to the lines and grades established by the Engineer.

**8-13.3(3) ADJUST EXISTING MONUMENT CASTINGS TO GRADE (New Section)**

Existing monument castings shall be adjusted to grades in accordance with Section 7-20.3(1).

**8-13.3(4) RESET OR RELOCATE MONUMENT CASTINGS (New Section)**

When monument castings are required to be relocated or removed and reset, the Contractor shall give the Engineer a minimum notice of 2 working days to allow time for the Engineer to establish offset reference points.

The Contractor shall remove monument castings as required during construction and shall store the castings in a safe place.

Monument castings designed for removal and not reused on the project, shall be carefully removed and salvaged in accordance with Section 2-02.3(7)A.

The Contractor shall give the Engineer a minimum notice of 2 working days before resetting monument castings to allow time for the Engineer to set reference points for locating monument castings.

The monument castings shall be reset by the Contractor in the location designated by the Engineer and at the grade of the street.

The Contractor shall replace lost or damaged castings with new castings at the Contractor's expense.

**8-13.4 MEASUREMENT (New Section)**

Measurement for "Monument Frame and Cover" will be by each.

Measurement for "Reset Monument Frame and Cover" will be by each.

Measurement for "Relocate Monument Frame and Cover" will be by each.

**8-13.5 PAYMENT (New Section)**

Compensation for the cost necessary to complete the work described in Section 8-13 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Monument Frame and Cover" per each.
- (2) "Reset Monument Frame and Cover" per each.
- (3) "Relocate Monument Frame and Cover" per each.

The unit contract price for "Monument Frame and Cover" shall include all costs for the work required to furnish and set the monument castings.

The unit contract price for "Reset Monument Frame and Cover" shall include all costs for the work required to remove, store, and reset the monument castings.

The unit contract price for "Relocate Monument Frame and Cover" shall include all costs for work required to remove, store and reset the monument casting in a new location.

## 8-14 - CEMENT CONCRETE SIDEWALKS

Delete Section 8-14 in its entirety and replace with the following:

## 8-14.1 DESCRIPTION (New Section)

This work shall consist of construction of sidewalks, thickened edge for sidewalk, monolithic curb and sidewalk, curb ramps, and bus shelter pads; plus excavation for the depth of the sidewalk and subgrade preparation for the foregoing items.

## 8-14.2 MATERIALS (New Section)

Materials shall meet the requirements of the following sections of these Specifications:

Cement Concrete Class 5(3/4) . . . . .	5-06
Portland Cement . . . . .	9-01
Aggregates . . . . .	9-03
Premolded Joint Filler . . . . .	9-04.1
Concrete Curing Materials . . . . .	9-23

Slump of the concrete mix shall not exceed 3-1/2 inches.

## 8-14.3 CONSTRUCTION REQUIREMENTS (New Section)

## 8-14.3(1) GENERAL (New Section)

The curb and gutter section shall be placed prior to the placement of the sidewalk section unless otherwise directed by the Engineer.

## 8-14.3(2) EXCAVATION AND SUBGRADE (New Section)

Excavation for sidewalks shall be as described in Section 2-03. Where designated by the Engineer, unsuitable material in the subgrade shall be removed to a specific depth and then backfilled with selected native materials.

It is expected there will be sufficient suitable native material excavated from various portions of the improvement to fill low areas in the sidewalk subgrade and planting strip area when needed and no further payment will be allowed for fill material. Where there is insufficient suitable native material on the project site, the Contractor shall furnish, place and compact Mineral Aggregate, Type 10, pit run sand as required.

Embankments shall be compacted by Method B as specified in Section 2-03.3(14)C. In areas that are inaccessible to normal compaction equipment, approved tampers shall be used.

Before the forms are set, the subgrade shall be graded to within 1 inch of established grade and the area between the sidewalk and the adjacent private property line shall be shaped to line, grade, and section shown on the Drawings.

If the Drawings call for sidewalk drains or the Engineer directs sidewalk drains to be installed, they will be installed before forms are placed. Sidewalk drains shall be installed according to Section 7-01 and the Standard Plan 281.

Quantities for roadway excavation shall be computed to the top surface of the sidewalk and no additions or deductions shall be made for the volume of the sidewalk. Volume of earthwork involved in excavating to the sidewalk subgrade, and for preparation of the subgrade shall be included in the unit price bid for "Cement Concrete Sidewalk."

## 8-14.3(3) FORMS AND FINE GRADING (New Section)

Forms shall conform to requirements outlined in Section 5-06. Wood forms shall be 2" x 4" (nominal) in lengths of not less than 10 feet. Steel forms may be used upon approval of the Engineer. Forms shall be staked to a true line and grade. A subgrade template shall then be set upon the forms and the fine grading completed so that the subgrade will be a minimum of 3-5/8 inches below the top of the forms.

Low areas in the subgrade shall be backfilled with select materials or with suitable native material as directed by the Engineer. The backfill shall then be compacted to the satisfaction of the Engineer and any high areas in the subgrade shall be cut down to meet the subgrade requirements specified above. The subgrade shall be thoroughly dampened prior to the time the concrete is placed.

Forms shall be provided around all street name sign posts and traffic sign posts that are placed in concrete areas. Forms used for this purpose shall be 1 foot square or 1 foot minimum diameter cutout, as approved by the Engineer.

Forms for the curb section of the monolithic curb and sidewalk shall be as defined in Section 8-04.3(1)A.

## 8-14.3(4) PLACING AND FINISHING CONCRETE (New Section)

The concrete shall be spread uniformly between the forms and thoroughly compacted with a steel shod strikeboard. Through joints and dummy joints shall be located and constructed in accordance with the Standard Plan. In construction of through joints, the premolded joint filler shall be adequately supported until the concrete is placed on both sides of the joint.

Whenever castings are located in the sidewalk area, joints shall be installed at the casting location to control cracking of the sidewalk. If spacing of joints or scoring is such that installation of joint material would be unsuitable the Contractor shall install rebar to strengthen the sidewalk section as required by Section 5-06 for castings in the pavement area.

Dummy joints shall be formed by first cutting a groove in the concrete with a tee bar of a depth equal to, but not greater than the joint filler material, and then working the premolded joint filler into the groove. Premolded joint filler for both through and dummy joints shall be positioned in true alignment at right angles to the line of the sidewalk and be normal to and flush with the surface. Where the sidewalk will be contiguous with the curb, it shall be constructed with a thickened edge as shown on the Standard Plan.

After the concrete has been thoroughly compacted and leveled, it shall be floated with wood floats and finished at the proper time with a metal float. Joints shall be edged with a 1/4 inch radius edger and the sidewalk edges shall be tooled with a 1/2 inch radius edger.

Depending on the type, the sidewalk shall be divided into panels by scoring 1/4 inch deep in the manner indicated on the Standard Plans or if designated by the Engineer to match existing adjacent sidewalk.

The surface shall be brushed with a fiber hair brush of an approved type in a transverse direction except that at driveway and alley crossings it shall be brushed longitudinally. The placing and finishing of all sidewalk shall be performed under the control of the Engineer, and the tools used shall meet with his approval. After brush finish, the edges of the sidewalk and all joints shall be lightly edged again with an edging tool to give it a finished appearance.

Additional requirements for placing and finishing concrete in cold weather shall be as outlined in Section 5-06.3(14).

Placing concrete for the curb section of the monolithic curb and sidewalk shall be as specified in Section 8-04.3(1)B.

## 8-14.3(5) CURING AND PROTECTION (New Section)

The curing materials and procedures outlined in Section 5-06.3(13) shall prevail, except that white pigmented curing compounds shall not be used on sidewalks. The curing agent shall be applied immediately after brushing and be maintained for a period of 5 days.

The Contractor shall have readily available sufficient protective covering, such as waterproof paper or plastic membrane, to cover the pour of an entire day in event of rain or other unsuitable weather.

The sidewalk shall be protected against damage or defacement of any kind until it has been accepted by the Owner. Sidewalk which is not acceptable to the Engineer because of damage or defacement, shall be removed and replaced at the expense of the Contractor.

Additional requirements for curing in hot weather shall be as outlined in Section 5-06.3(13)H. Additional requirements for curing in cold weather shall be as outlined in Section 5-06.3(14).

Curing for the curb section of the monolithic curb and sidewalk shall be as defined in Section 8-04.3(1)E.

**8-14.3(6) THROUGH AND CONTRACTION JOINTS (New Section)**

Standard locations for through joints for sidewalks are:

- (a) At street margins produced and at 30-foot or 28-foot intervals.
- (b) To separate concrete driveways, stairways, curb ramps and their landings from sidewalks.
- (c) Around the vertical barrel of fire hydrants, around utility poles and large diameter underground utility cover castings when located in the sidewalk area.
- (d) Longitudinally between concrete walks, curbs, paved planting strips and solid masonry or concrete walls where they abut.
- (e) To match as nearly as possible, the through joints in the adjacent pavement and curb when sidewalk abutts curb.

Transverse contraction joints (dummy joints) shall be constructed with premolded material 1/4 inch by 2 inches wide, and set at approximately 15-foot intervals, or as decided by the Engineer. At no time will joint spacing exceed 15 feet.

Transverse and longitudinal through joints as shown on the Standard Plans shall be 1/2 inch thickness premolded non-extruding joint material, cut to a width equal to the full depth of the concrete where located, plus 1/2 inch. When installed, they shall be placed with top edge 1/8 inch below the finished surface of the concrete, in a perpendicular plane to the surface and with the bottom edge embedded in the subgrades. All joints shall be in straight alignment, except where placed in curved locations as required by the Drawings.

Construction joints for sidewalks shall conform to the applicable requirements for through joints for pavement except for thickness of joint material being 3/16 inch and width of 2 inches. The top edge shall be 1/8 inch below the finished surface of the sidewalk. At no time will joint spacing exceed 15 feet.

**8-14.3(7) CURB RAMP, TYPE 1 (New Section)**

Curb Ramp, Type 1 shall be installed at locations where the contract drawings call for installation of curb ramps along with new sidewalk installed as a part of the same contract.

Curb Ramp locations will be designated on the Drawings or marked in the field by the Engineer. Where curb ramps are to be constructed, the Contractor shall construct monolithic depressed curb and sidewalk as indicated on the Standard Plan. Curb ramps shall be constructed separately from the sidewalk to produce a definite break line between the ramp and the sidewalk. A 3/8 inch non-extruded through joint material shall be installed between the curb ramp and the sidewalk with edging as specified in Section 8-14.3(6).

The triangular shaped siding areas shall be brush finished with brushing parallel to the curb face. The adjacent sidewalk "V" groove scoring pattern shall not extend into the curb ramp siding areas. The inclined plane of the ramp shall have a coarse textured surface similar to the impression which is obtained through the use of a 3/4 inch x 9-11 flattened expanded metal mesh screen pressed into the fresh concrete. A sample of the screen material may be seen at the Construction Office, 702 Municipal Building. The long axis of the diamond shaped impression shall be perpendicular to the curb line.

Where possible, the back terminus of the ramp shall coincide with the street-side edge of the sidewalk or a line projected therefrom. The subgrade for curb ramps shall be graded, compacted and formed to provide a minimum concrete depth of 6 inches adjacent to the curb and tapering to a minimum depth of 3-5/8 inches at the back terminus.

Concrete for Curb Ramps shall not be colored, overlaid or topped. Curb ramps shall be considered as beginning at a point flush with the pavement and terminating at a point flush with the sidewalk or sidewalk landing. The sloping triangular shaped sidings are considered part of the curb ramp.

**8-14.3(8) CURB RAMP, TYPE 2 (New Section)**

Curb Ramp, Type 2, shall be installed at locations where the contract drawing requires removal of existing improvements, and where no new sidewalk is required by the contract documents immediately adjacent to the new curb ramp.

Curb Ramp, Type 2 shall consist of the following:

- (a) Saw cutting existing concrete sidewalk and curb required for curb ramp installation.
- (b) Removal and disposal of all sidewalk, asphalt, sod, etc., plus required excavation in the area of the curb ramp.
- (c) Removal and disposal of all curb, including pavement under the curb, from the area of the curb ramp.
- (d) Removal and disposal of all pavement and asphalt overlay from the face of the curb to the cut line used to remove the curb.
- (e) Installation of the curb ramp as described in Section 8-14.3(7).
- (f) Replacement of all removed pavement to match existing.

**8-14.3(9) BUS SHELTER PAD (New Section)**

The Contractor shall construct a Bus Shelter Pad according to the details shown on Standard Plan 423 or as detailed on the Drawings. Prior to construction, the Contractor shall notify METRO so that the installation of the Bus Shelter by METRO forces shall be coordinated effectively.

**8-14.3(10) DOWELS (New Section)**

Dowels for monolithic curb and sidewalk, where called for in the Special Provisions or directed by the Engineer, shall be as defined in Section 8-04.3(1)C and as shown on the Standard Plan.

**8-14.3(11) STRIPPING FORMS AND FINISHING (New Section)**

Stripping forms and finishing for the curb section of the monolithic curb and sidewalk shall be as defined in Section 8-04.3(1)D.

**8-14.4 MEASUREMENT (New Section)**

Measurement for "Sidewalk, Cement Concrete", will be by the square yard for the surface of concrete walk 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 for the length placed. Measurement for payment of thickened edge will not be made through the curb ramps.

Measurement for "Curb Ramp, Cement Concrete, (Type)", will be per each installed.

Measurement for "Bus Shelter Pad" will be by the square yard.

Measurement for mineral aggregate of the type specified to be used as fill for sidewalk subgrade will be by the ton as recorded on certified weight tickets per Section 1-09.1.

For purposes of measurement and payment, "Monolithic Curb and Sidewalk" shall be considered as three component sections as follows:

- (a) The first component, "Cement Concrete Sidewalk," shall comprise that portion of the combined section beginning 6 inches behind face of curb and shall be the actual square yards of sidewalk constructed.
- (b) The second component, "Curb," shall comprise that portion of the combined section beginning at back of curb and extending to the face of the curb, and shall be the actual linear feet of curb constructed, as measured along the curb face.
- (c) The third component, "Thickened Edge," shall comprise the triangular portion of the combined section below the bottom of sidewalk and butting the back of the curb section. The thickened edge shall be actual length in linear feet of thickened edge constructed.

## 8-14.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 8-14 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Sidewalk, Cement Concrete" per square yard.
- (2) "Sidewalk, Thickened Edge" per linear foot.
- (3) "Curb Ramp, Cement Concrete (Type)" per each.
- (4) "Bus Shelter Pad" per square yard.

The unit contract price for "Sidewalk, Cement Concrete" shall include the costs for all work specified in Section 8-14 and Standard Plan 420 necessary to construct the sidewalk and not otherwise provided for hereinafter.

The unit price for "Sidewalk, Thickened Edge" shall include the costs for all work necessary to construct the thickened edge where required.

The unit contract price for "Curb Ramp, Cement Concrete, Type 1," shall include all costs for the work required to construct the curb ramp as specified including the ramp, the sidewalks, joint materials, and excavation.

The unit contract price for "Curb Ramp, Cement Concrete, Type 2" shall include all costs for the work required to remove existing improvement within area of new curb ramp and to construct the curb ramp at "cut-in" locations as specified in Section 8-14.3(8).

The unit contract price for "Bus Shelter Pad" shall include all costs for all work required to construct the bus shelter pads as specified.

The above unit contract prices shall include the costs for incidental items of work performed under Section 8-14 including, but not limited to, such work as excavation, grading, compacting, joint material, adjusting water meter and handhole boxes to finish grade and all other work called for in the Drawings, required by the Specifications or essential to the construction of the work described in Section 8-14.

Mineral aggregate of the type specified for sidewalk fill will be paid per ton in accordance with Section 4-01.5.

Sidewalk drains will be measured and paid per Section 7-01.

Payment for monolithic curb and sidewalk or monolithic curb, gutter and sidewalk shall be paid for by the individual bid item described in Section 8-14.4.

Relocations of signs will be measured and paid in accordance with Section 8-21.

## SECTION 8-16 - CONCRETE SLOPE PROTECTION

## 8-16.3(3) POURED IN PLACE CEMENT CONCRETE

The third paragraph of this section is revised to read:

The third paragraph of this section is revised to read:

The newly constructed concrete shall be finished by means of a wood float and shall be straited with a rustication joint as shown in the plans.

## 8-16.3(4) PNEUMATICALLY PLACED CONCRETE

The eighth paragraph of this section is revised to read:

Finishing: The newly constructed concrete shall be finished by means of a wood float and shall be straited with a rustication joint as shown in the Drawings.



## SECTION 8-18 - CEMENT CONCRETE STAIRWAYS, LANDINGS AND STEPS (New Section)

## 8-18.1 DESCRIPTION (New Section)

This work shall consist of constructing, on a prepared compacted subgrade, cement concrete stairways, landings, and steps, and such subsidiary work as may be necessary, including the construction of handrails, in accordance with the requirements of these Specifications and in conformity with the lines, grades, and cross sections indicated on the Drawings, Standard Plans, or established by the Engineer.

## 8-18.2 MATERIALS (New Section)

Materials shall meet the requirements of the following sections of these Specifications.

Non-structural Cement Concrete	5-00
Joint Materials	9-04
Reinforcement	9-07
Curing Materials	9-23

The concrete mix shall be Class 6 (3/4) for steps and stairways. Landings shall be Class 5 (3/4).

Galvanized steel pipe railing shall be fabricated from standard weight steel pipe meeting the requirements of ASTM Designation A 120. After fabrication the railings shall be hot-dipped galvanized per ASTM A 123.

Aluminum paint for handrails shall be Formula D-1-57 aluminum paint meeting the requirements of Section 9-08.2.

Wood for railings shall be as indicated on the Drawings.

## 8-18.3 CONSTRUCTION REQUIREMENTS (New Section)

## 8-18.3(1) SITE PREPARATION AND GRADING (New Section)

At locations where cement concrete stairways, landings, or steps are to be constructed the area shall be cleared, grubbed, excavated and graded in accordance with Sections 2-01 and 2-03 to the limits indicated on the Drawings or staked by the Engineer.

## 8-18.3(2) SUBGRADE PREPARATION AND FORMS (New Section)

The necessary subgrade preparation and compaction required in the construction of cement concrete stairways, landings, and steps shall meet the requirements for pavement subgrade preparation set forth in Section 2-06.

Forms shall meet the requirements of Section 5-06.3(7) except that wood side forms shall be not less than 2 inches nominal in thickness and shall be free from warps or bends.

## 8-18.3(3) REINFORCING STEEL (New Section)

Reinforcing steel for cement concrete stairways shall be placed as shown on the Standard Plan. The steel shall be assembled and securely tied with annealed wire of not less than No. 16 gauge at each bar lap or crossing and be rigidly supported above the subgrade in the plan location during the concrete placement.

## 8-18.3(4) HANDRAIL (New Section)

Handrails shall be of welded steel pipe construction fabricated and installed as indicated on the Standard Plans or the Drawings. Welds shall be made by certified welders and each weld shall be ground and buffed to a smooth surface. Rails shall be hot dip galvanized according to ASTM A 123-84 after fabrication. If field welds are required, they shall be coated with a zinc alloy solder to a minimum thickness of 2.0 mils per ASTM A 780.

Either the railing shall be placed completely assembled at the time when stairway concrete is placed, or recesses shall be provided in the concrete for grouting the railing posts after the concrete has been placed, finished, and cured. The installed railing shall be in true alignment, on proper grade, and with posts plumb.

## 8-18.3(5) PLACING CONCRETE, FINISHING AND CURING (New Section)

Concrete for stairways and landings shall be Class 6 (3/4) unless otherwise provided in the Special Provisions or ordered by the Engineer. Placing, finishing and curing shall conform to the applicable requirements in Section 5-06.3, as they would apply to cement concrete stairway construction.

Front and side edging of stair treads shall be to a radius of 1/2 inch.

Landings for stairways shall be marked as specified for concrete sidewalks in Section 8-14 except that transverse and longitudinal markings shall be modified as necessary to result in uniform size of squares in each landing. Where gutters are along the side of the stairways, the gutter portion of stairway landing shall be smooth finished without markings to conform with the stairway gutter.

## 8-18.3(6) GUTTER (New Section)

Where Type 440 stairway is specified, or where a gutter is specified, a concrete gutter shall be constructed in accordance with the detail on the Standard Plan. The gutter shall be constructed along the stairway, and adjacent to the concrete walk or landing that joins flights of stairs, connecting the stairway gutters.

## 8-18.3(7) STEPS (New Section)

Steps shall be of concrete and shall have maximum 7-inch risers, minimum 11-inch treads, and shall be the width of the existing sidewalk or as designated by the Engineer.

## 8-18.4 MEASUREMENT (New Section)

Excavation for stairways, landings, and gutters will be measured by the cubic yard of common excavation in accordance with Section 2-03.

Measurement of "Steps, Cement Concrete" and "Stairway, Cement Concrete, Special" will be by the square foot of tread surface installed.

"Stairway, Cement Concrete, Type 440" will be measured by the linear foot for the horizontal distance from a point 2 feet 2 inches from the back of the top tread to a point 2 feet 2 inches from the face of the bottom riser.

Handrail of the type specified will be measured by the linear foot on the slope for the continuous length of the completed railing from the vertical centerline of the top post to the vertical centerline of the bottom post.

Concrete landings or walkways outside the stairway measurement limits will be measured as "Sidewalk, Cement Concrete" by the square yard in accordance with Section 8-14. Asphalt walks will be measured in accordance with Section 5-04.

Gutter will be measured by the linear foot on the slope for the gutter sections installed along stairways and along landings or concrete walks between stairways.

## 8-18.5 PAYMENT (New Section)

Compensation for the costs necessary to complete the work described in Section 8-18 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Stairway, Cement Concrete, Type 440," per linear foot.
- (2) "Stairway, Cement Concrete, Special" per square foot.
- (3) "Handrail, (Type)," per linear foot.

(4) "Steps, Cement Concrete," per square foot.

(5) "Gutter, Cement Concrete, Type 440," per linear foot.

The unit contract price for "Stairway, Cement Concrete, Type 440," shall include the costs for all work described in Section 8-18, and not otherwise provided for separately hereinafter, necessary to construct a 5-foot concrete stairway in accordance with Standard Plan No. 440, including gutter.

The unit contract price for "Stairway, Cement Concrete, Special" shall include the costs for all work described in Section 8-18 and not otherwise provided for separately herein necessary to construct a stairway in accordance with Standard Plan No. 440, except with a width of other than 5 feet.

The unit contract price for "Handrail (Type)" of the type specified shall include the costs for all work required to furnish, fabricate and install the handrail along the stairway or sidewalk as specified by the contract documents.

The unit contract price for "Steps, Cement Concrete," shall include the costs for all work required to construct concrete steps as specified.

The unit contract price for "Gutter, Cement Concrete," shall include the costs for all work described in Section 8-18 to construct a gutter section along the edge of stairways in accordance with the cross section indicated on Standard Plan No. 440.

Excavation for stairways, landings, and gutter sections will be paid as common excavation in accordance with Section 2-03.

Concrete landings and walkways will be paid as "Sidewalk, Cement Concrete," in accordance with Section 8-14.

Reinforcing steel shall be considered as incidental to the unit cost for stairway construction.

## SECTION 8-19 - CEMENT CONCRETE DRIVEWAY AND ALLEY RETURN (New Section)

## 8-19.1 DESCRIPTION (New Section)

This work shall consist of cement concrete driveway and alley returns constructed at the locations shown on the Drawings and where directed by the Engineer, and shall be in accordance with these Specifications and the Standard Plans.

The number of private driveways may be increased over that shown on the Drawings, if required by the Engineer. Sufficient notice of the additional installations will be given by the Engineer to enable the Contractor to schedule the private driveways along with other construction in the same general area without moving equipment back for the purpose.

The particular type of driveway or alley return to be used shall be that which is specified in the Drawings and included in the Bid Form.

Alley returns shall be constructed in all respects as specified and shown in the Standard Plan No. 430 and 431. The alley return thickness shall be 8 inches. The alley return and the curb shall be poured monolithically.

## 8-19.2 MATERIALS (New Section)

The portland cement concrete, joint filler, reinforcing steel and curing materials shall conform to requirements outlined in Section 5-01 Non-Structural Portland Cement Concrete. The concrete mix shall be as specified for Class 6 (1-1/2), or Class 6 (3/4) and the slump of the concrete shall not exceed 3-1/2 inches.

## 8-19.3 CONSTRUCTION REQUIREMENTS (New Section)

## 8-19.3(1) EXCAVATION AND SUBGRADE (New Section)

Where directed by the Engineer, unsuitable material in the subgrade shall be removed to a specific depth and backfilled with select materials which shall be compacted by Method B, as specified in Section 2-03.3(14)C. Payment for excavation below grade and additional selected materials will be paid for under the unit contract prices for "Common Excavation" and "Mineral Aggregate (Type)" specified for ballast.

Subgrade preparation for driveways and the required compaction shall conform to the applicable requirements in Section 2-06.3(2) to provide a firm, unyielding subgrade, acceptable to the Engineer.

## 8-19.3(2) FORMS AND FINE GRADING (New Section)

Forms for the straight sections of the driveway or alley return shall have a minimum thickness of 2 inches and be equal to the nominal depth of the concrete. Plywood or 1 inch lumber may be used on radii. All forms shall be securely staked and blocked to true line and grade.

A template shall be set upon the forms and the subgrade shall be fine graded to conform to the required section. The subgrade shall then be compacted to the approval of the Engineer. Prior to placement of the concrete, the subgrade shall be thoroughly dampened.

## 8-19.3(3) PLACING AND FINISHING CEMENT CONCRETE DRIVEWAY (New Section)

The concrete shall be spread uniformly between the forms and thoroughly compacted with an approved type of strikeboard. Through joints and contraction joints shall be located and constructed in accordance with applicable Standard Drawings. In the construction of through joints, the premolded joint filler shall be adequately supported until the concrete is placed on both sides of the joint.

Contraction joints (dummy joints) shall be formed with a tee bar by first cutting a groove in the concrete to a depth equal to, but not greater than the joint filler material and then working the premolded joint filler into the groove. Premolded joint filler for both through and dummy joints shall be positioned in true alignment and at right angles to the center line of the driveway or alley return.

After the concrete has been thoroughly compacted and leveled, it shall be floated with wood floats and finished at the proper time with a metal float. Joints shall be edged with 1/4 inch radius edger and the driveway or alley return edges shall be tooled with 1/2 inch radius edger.

The surface shall be brushed in a transverse direction in relation to the center line of the driveway or alley return with a fiber hair brush of approved type.

Driveways and alley returns shall not be constructed at the same time the pavement is placed unless authorized by the Engineer.

#### 8-19.3(4) CURING AND PROTECTION (New Section)

The curing materials and procedures defined in sections 5-06 and 9-23 shall be used. The driveway and the alley return shall be protected against damage or defacement of any kind until acceptance by the Owner. Any driveway or alley return not acceptable, in the opinion of the Engineer because of damage or defacement, shall be removed and be replaced by the Contractor at his expense.

Before placing any concrete, the Contractor shall have on the job site enough protective paper to cover the pour of an entire day, in event of rain or other unsuitable weather conditions.

#### 8-19.4 MEASUREMENT (New Section)

Measurement for cement concrete driveway and alley return will be by the square yard for the class and thickness of driveway actually placed, measured from the back of the curb to the back of the sidewalk.

#### 8-19.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 8-19 will be made at the unit contract prices bid only for the pay item listed or referenced below:

- (1) "Driveway, Cement Concrete (Thickness)," per square yard.
- (2) "Driveway, Cement Concrete, HES, (Thickness)," per square yard.

The unit contract price for "Driveway, Cement Concrete (Thickness)," and "Driveway, Cement Concrete, HES, (Thickness)," shall include all costs for the work required to construct the driveway as specified herein.

Alley return will be paid for as "Driveway, Cement Concrete (Thickness)."

Excavation for driveways and alley returns shall be considered incidental to the construction of the driveway, and no payment will be made to the Contractor therefor.

Payment will not be allowed for over excavation nor for the additional material required below the set grade resulting from negligence of the Contractor.

#### SECTION 8-20 - ILLUMINATION, TRAFFIC SIGNAL SYSTEMS, AND ELECTRICAL

Delete Section 8-20 in its entirety. Refer to sections elsewhere as follows:

- 8-30 STREET LIGHTING SYSTEM
- 8-31 TRAFFIC SIGNAL SYSTEM
- 8-32 POLES, PEDESTALS AND FOUNDATIONS
- 8-33 CONDUIT AND TRENCHING

**SECTION 8-21 - PERMANENT SIGNING**

Delete Section 8-21 in its entirety and replace with the following:

**8-21.1 DESCRIPTION (New Section)**

This work shall consist of furnishing and installing new traffic signs and posts, street designation signs, installing City furnished street name signs, and bus zone signs, relocating existing traffic signs, street name signs, and posts in accordance with the Drawings, these Specifications, and as designated by the Engineer.

**8-21.2 MATERIALS (New Section)**

Signing materials and fabrication of signs shall meet the requirements of Section 9-28 of these Specifications.

**8-21.3 CONSTRUCTION REQUIREMENTS (New Section)****8-21.3(1) SIGN INSTALLATION (New Section)****8-21.3(1)A TRAFFIC SIGN (New Section)**

The multiple panel signs and sign structures shall be installed in accordance with the Drawings and signing details in the Appendix.

The sign shall be mounted level and face in the direction indicated on the Drawings or designated by the Engineer.

When mounting a sign on a wood post or wood pole, 5/16-inch x 3-1/4-inch galvanized or cadmium plated lagscrews shall be used, with 1/8-inch thick x one-inch O.D. nylon washers.

When mounting a sign on a steel pole 0.1793 inch or thicker, the "drill & tap" method or rivnuts shall be used, with 5/16-inch stainless steel bolts and 1/8-inch thick x 1-inch O.D. nylon washers. For a steel pole less than 0.1793 inch, 5/16-inch stainless steel rivnuts shall be used. On an aluminum pole, 5/16-inch bolts and aluminum rivnuts shall be used. Stainless steel sign banding shall not be used, unless approved by the Engineer.

Field repair of galvanized surfaces of drill holes shall be by galvanized repair paint meeting the requirements of Federal Specification MIL-P-21035 (Ships) paint, high zinc dust content, galvanizing repair.

When mounting a 9-inch x 12-inch or larger sign on a parking meter post, the Contractor shall use 1/4-inch x 3-1/2-inch galvanized bolts and nuts, and 1-inch O.D. nylon washers. A smaller sign on a parking meter post shall be mounted with 1/4-inch x 3/4-inch galvanized self-tapping screws with 1-inch O.D. nylon washers.

Signs mounted on span wire or mast arms shall be mounted as indicated on the Drawings and traffic signing details. Sag in the span shall be maintained between 5 percent and 8 percent. Clearance between the bottom of the sign and the roadway centerline shall be maintained at 17 feet. Use standard signal mounting hardware & span wire assemblies, per Section 8-18. For mast arm mounting use aluminum C3X2.1 by "Drill & Tap" method.

**8-21.3(1)B STREET NAME, STREET DESIGNATION, AND BUS ZONE SIGNS (New Section)**

Street name, street designation, and bus zone signs shall be mounted as indicated on the traffic signing details in the Appendix of the Project Manual.

**8-21.3(2) SIGN POST INSTALLATION (New Section)**

Wood sign post holes shall be of sufficient dimensions to allow placement and compaction of backfill material completely around the posts. Selected backfill material shall be placed and compacted to meet the requirements of Section 2-03. The area disturbed during wood sign post installation shall be

surfaced to match the surrounding surfaces. Where wood sign post is to be installed in existing paved concrete areas, a neat 12-inch x 12-inch cut-out shall be provided by saw cutting, or an 8-inch diameter hole shall be provided by core drilling.

Where new sidewalks or paved planting areas are to be constructed, the Contractor shall provide blockouts for installation of street name sign and traffic sign posts. Location of the sign posts shall be as specified on the Drawings or where designated by the Engineer. Blockout shall be 12-inch x 12-inch or 12-inch diameter, with a depth to match proposed paving.

After the post is installed, the cutout or blockout shall be capped with 3/4 inch to 1-1/2 inch material similar to the surrounding paved surface, with a crown of 3/4 inch to shed water away from the post. See Standard Plan No. 624 for details.

When required, parking meter posts shall be installed as indicated in the traffic signing details on the Drawings.

When required, street name sign and bus zone sign posts shall be installed in an 8-inch diameter post hole with Class 5 concrete base, as indicated in Standard Drawing No. 622.

**8-21.3(3) SIGN COVERING (New Section)**

As indicated on the Drawings or when designated by the Engineer, the Contractor shall cover certain signs and uncover to facilitate and control the operation of the project. The covering shall be of sufficient size to entirely cover the sign unless otherwise designated by the Engineer, and shall extend over the edges of the sign and be fastened on the back. Adhesive tape shall not be used on the face of the sign. Other methods of covering may be used if approved by the Engineer.

**8-21.3(4) SIGN RELOCATION (New Section)**

As indicated on the Drawings or designated by the Engineer, the existing sign and sign post shall be relocated to the new location. If temporary stockpiling of existing signs and posts is necessary prior to resetting, stockpiled signs and posts shall be protected from loss or damage. Removal of signs and posts required for sign relocation shall be in accordance with Section 2-02.

When existing street name post or bus zone post are to be relocated, all old concrete caps and bases shall be removed from the base of these posts.

Reinstallation of existing signs and posts required for sign relocation shall be in accordance with the requirements for new installation. A new sign post shall be installed where indicated on the Drawings or designated by the Engineer.

**8-21.4 MEASUREMENT (New Section)**

Measurement for "Sign, Traffic" will be by the square foot of sign.

Measurement for "Sign, Street Designation" will be by each.

Measurement for "Sign, Street Name, (City Furnished), Street Name Post Mounted" will be by each. One unit of measurement will consist of all street name sign blades together with all block number plates for mounted on street name sign post.

Measurement for "Sign, Street Name, (City Furnished), Steel/Aluminum Pole Mounted" will be by each. One unit of measurement will consist of 2 street name sign blades together with 2 block number plates mounted on steel or aluminum pole.

Measurement for "Post, Traffic Sign", "Post, Parking Meter," and "Post, Street Name", and "Post, Bus Zone" will be by each.

Measurement for "Relocate Sign, Traffic", "Relocate Sign, Street Name," and "Relocate Sign, Bus Zone", will be by each.

Measurement for "Sign Covering" will be by the square foot of sign covered.

## 8-21.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 8-21 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Sign, Traffic," per square foot.
- (2) "Sign, Street Designation," each.
- (3) "Sign, Street Name (City Furnished), Street Name Post Mounted," each.
- (4) "Sign, Street Name (City Furnished), Steel/Aluminum Pole Mounted," each.
- (5) "Sign, Bus Zone (City Furnished), each.
- (6) "Post, Traffic Sign," each.
- (7) "Post, Parking Meter," each.
- (8) "Post, Street Name," each.
- (9) "Post, Bus Zone," each.
- (10) "Relocate Sign, Traffic," each.
- (11) "Relocate Sign, Street Name," each.
- (12) "Relocate Sign, Bus Zone," each.
- (13) "Sign Covering," per square foot.

The unit contract price for "Sign, Traffic" and "Sign, Street Designation" shall include all costs for the work required to furnish the sign and mounting hardware and mount the signs as herein specified.

The unit contract price for "Sign, Street Name (City Furnished), Street Name Post Mounted" shall include all costs for the work required to mount the City furnished street name sign blades and block number plates. The City will furnish the sign mounting hardware.

The unit contract price for "Sign, Street Name (City Furnished), Steel/Aluminum Pole Mounted" shall include all costs for the work required to mount one unit of City furnished street name sign blades and block number plates. The Contractor shall furnish the mounting hardware as shown on Standard Plan.

The unit contract price for "Sign, Bus Zone (City Furnished)", shall include all costs for the work required to mount the City furnished bus zone sign including the mounting hardware.

The unit contract price for "Post, Traffic Sign," "Post, Parking Meter," "Post, Street Name," and "Post, Bus Zone" shall include all costs for the work required to furnish and install the post as specified including foundation, select backfill and surface restoration.

The unit contract price for "Relocate Sign, Traffic," "Relocate Sign, Street Name," and "Relocate Sign, Bus Zone" shall include all costs for the work required to remove and relocate the traffic sign, street name sign or bus zone sign including posts as specified. If a new post is installed on the new location, the post will be paid for separately.

When relocating street name signs to a newly installed street name sign post, the relocation cost shall be incidental to the cost of installing the post. The unit contract price for "Post, Street Name" shall include all costs for installing City furnished street name sign as specified hereinabove.

Where Drawing calls for relocating street name sign to an existing Steel or Aluminum Pole, the Contractor will be paid for relocating the street name signs under bid item "Relocate Sign, Street Name." This shall include removal of street name signs, mounting on the pole, furnishing and installing mounting brackets and hardware per Standard Plan.

The unit contract price for "Sign Covering" shall be full compensation for all costs of furnishing and installing the covering material as specified. Removal of sign covering shall be considered incidental to the unit price bid for sign covering. Covering any signs for the convenience of Contractor's activities prior to new channelization shall be at the Contractor's expense.

All costs for the erection and maintenance of temporary warning, and detour signs necessary to protect and safeguard the public from injury or damage shall be the responsibility of the Contractor, and shall be considered incidental to the construction and no separate payment will be made therefor.

## SECTION 8-22 - PAVEMENT MARKING

Delete Section 8-22 in its entirety and replace with the following:

## SECTION 8-22 - PAVEMENT MARKING

## 8-22.1 DESCRIPTION (New Section)

## 8-22.1(1) GENERAL (New Section)

This work shall consist of furnishing and installing pavement markings upon the roadway surface at locations shown in the Drawings, or where designated by the Engineer, in accordance with these Specifications in the Standard Plans. Pavement markings shall be for channelization, warnings, instructions, or curb usages.

## 8-22.1(2) PAVEMENT MARKING DESIGNATIONS (New Section)

Pavement markings are defined as follows:

ITEM DESIGNATION	DESCRIPTION	USAGE
I. PAINT		
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)	Center line (Minor arterials)
L-4	Solid 4-inch yellow stripe with parallel dashed 4-inch yellow stripe (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-5	Dashed 4-inch white stripe (10 feet paint with 20 feet skip)	Lane line
L-6	4-inch white stripe	Approach line, edge line, guide line
L-7	4-inch white stripe	Parking stall line
L-8	8-inch white stripe	Barrier line, crosswalk and crosshatch
L-8A	16-inch white stripe	Stop bar
L-8B	24-inch white stripe	Stop bar
L-10	6-inch white curb stripe	Passenger load zone
L-11	6-inch red curb stripe	Tow-away zone
L-12	6-inch yellow curb stripe	Truck zone, load and unload zone
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 Pedestrian symbol
- L-28 Bicyclist symbol (include arrows)
- 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

## II. THERMOPLASTIC (DENOTED BY "T" SUFFIX)

- L-8T 8-inch white stripe Crosswalk
- L-8AT 16-inch white stripe Stop bar
- L-8BT 24-inch white stripe Stop bar
- L-17T Left and right arrow combination
- 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 (include arrows)
- 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

## III. PRESSURE SENSITIVE TAPE (DENOTED BY "S" SUFFIX)

- L-10S 4-inch white curb tape Passenger load zone
- L-11S 4-inch red curb tape Tow-away zone
- L-12S 4-inch yellow curb tape Truck zone, load and unload zone
- 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, motorcycle stall, barrier area

### 8-22.2 MATERIALS (New Section)

Materials for pavement markings shall be paint or plastic material as noted in the Bid Form, and shall meet the requirements of Section 9-29 of these Specifications.

### 8-22.3 CONSTRUCTION REQUIREMENTS

#### 8-22.3(1) PRELIMINARY SPOTTING

Delete this section and replace with the following:

The Engineer will provide the preliminary layout 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 upon with the Contractor, which will enable the Contractor to complete the preliminary spotting of the pavement marking alignment before painting begins. Control points for crosswalks will be marked on the curbs only. Control points for stop lines will be marked on the curb and at the center line. Control points for legend and symbols shall be the responsibility of the Contractor. Legend and symbols shall be located in accordance with the Drawings or as designated by the Engineer. Approval by the Engineer shall be obtained before installation begins. Preliminary spotting to guide the striping machine is required for all longitudinal lines except where a clearly visible separation is present.

Permanent pavement markings such as crosswalks, stop lines, center lines and lane stripes shall be installed by the Contractor within five days, weather permitting, after preliminary layout of the control points has been completed by the Engineer. Temporary pavement marking tape for centerline or lane lines or other pavement markings, if required by the Engineer, shall be installed in accordance with Section 5-04.3(17). Temporary pavement marking tape shall meet the requirements of Section 9-29.4.

#### 8-22.3(2) PREPARATION OF SURFACES (New Section)

Surface dirt and all contaminants within the areas to receive pavement markings shall be removed. Large areas of tar, grease or foreign materials may require sandblasting, steam cleaning, power brooming, or chemical stripping to accomplish complete removal. Grass obstructing curb painting shall be trimmed to the back edge of the curb and the curbs cleaned of foreign material before painting.

Existing pavement markings shall be completely removed. Cleaning and removal methods used shall not damage the pavement surface to a depth or width greater than that required to provide adequate bond between the pavement and the pavement marking material. The pavement surface shall be approved by the Engineer before application of the markings.

## 8-22.3(3) PAINTED PAVEMENT MARKING (New Section)

## 8-22.3(3)A GENERAL (New Section)

Equipment used in the application of the pavement markings shall be designed and operated to produce painted pavement markings of uniform quality meeting the requirements specified.

Traffic paint shall be applied at a rate of not more than 100 square feet per gallon (approximately 15 mils wet thickness). This rate is effectively 16 gallons of paint per mile of SOLID 4-inch wide line, which will be the basis for the measurement of yield. A tolerance not to exceed minus 10 percent will be allowed for film thickness or yield in paint application.

On "ladder type" crosswalks, pedestrian and bicyclist symbols (including arrows), white sharp sand shall be spread over fresh paint at a rate of approximately 1 pound per 20 square feet.

## 8-22.3(3)B TOLERANCES FOR STRIPES (New Section)

The allowable tolerances for line striping are as follows:

- (a) Length of Stripe: The longitudinal accumulative error within a 30-foot length of lane line shall not exceed plus or minus 4 inches.
- (b) Width of Stripe: The width of stripe shall not vary more than plus or minus 1/4 inch.
- (c) Lane Width: The lane width, which is defined as the lateral width from the edge of pavement to the center of the lane line or between the centers of parallel and successive lane lines, shall not vary from the widths shown in the Drawings by more than plus or minus 4 inches.

## 8-22.3(4) THERMOPLASTIC PAVEMENT MARKING (New Section)

## 8-22.3(4)A TYPE "A" INSTALLATION (New Section)

The thermoplastic pavement marking shall be applied to an initially dry pavement surface after sufficient time has elapsed to insure that the primer, if required, has adequately dried and further curing of the primer will not adversely affect the thermoplastic material.

Thermoplastic material shall be applied in accordance with the manufacturer's recommended temperature ranges for ambient air temperature, pavement temperature, and temperature of the molten material.

Hot-laid thermoplastic material shall be applied to the pavement by a gravity or an extrusion method, or a combination of both. If the stripe width is obtained by more than one application, the adjacent applications shall be fused together with no apparent overlap or gap.

Glass beads shall be applied separately to the thermoplastic material as it is being placed. The glass beads shall be uniformly distributed over the entire width of thermoplastic material so that objectionable irregularities in the material's reflectorization will not be present. This independent application of beads shall be applied uniformly at the rate of 1 pound for every 50 square feet of pavement marking. The dispenser shall be located behind and controlled simultaneously with the pavement marking extrusion die such that the beads will be imbedded in the pavement marking to a depth of at least 1/2 the bead diameter.

## 8-22.3(4)B TYPE "B" INSTALLATION (New Section)

Type "B" prefabricated thermoplastic material shall be applied to the pavement in a manner which will provide a uniform surface over the various widths required. At application, the ambient air temperature shall be within the range recommended by the manufacturer.

Type "B" thermoplastic material may be supplied complete with a precoated, factory applied adhesive or it may be furnished with separate adhesive as recommended by the manufacturer. Whether precoated or supplied separately, the adhesive shall be such as to allow the thermoplastic material to be repositioned on the pavement surface before permanently fixing it in its final position with a downward pressure.

When completed, the pavement markings shall not be less than 0.06 inches (1.5 millimeters) in thickness, exclusive of any precoated adhesive material, and shall have a uniform cross-sectional configuration.

If the required pavement marking width is 12 inches or more, it may be fabricated from 12-inch or 6-inch wide material. Longitudinal splices will be permitted, provided the gap at any splice does not exceed 1/16 inch.

Excess thermoplastic material left on the pavement shall be removed prior to continuation of the operation.

## 8-22.3(5) PRESSURE SENSITIVE TAPE PAVEMENT MARKING (New Section)

Application procedures for pressure sensitive tape shall be as recommended by the tape manufacturer.

## 8-22.4 MEASUREMENT (New Section)

Measurement for "Pavement Marking, Paint, (Width) Stripe," will be by the linear foot of stripe, except dashed center lines and dashed lane lines will be measured as continuous lines with no deduction for the unpainted area caused by the skip pattern specified.

Measurement for "Pavement Marking, Paint, Legend/Symbol," will be by each legend or symbol.

Measurement for "Pavement Marking, Thermoplastic, 8-inch stripe," will be by the linear foot.

Measurement for "Pavement Marking, Thermoplastic, Legend/Symbol," will be by each legend or symbol.

The legends "ONLY" and "OK" will be measured as 1 unit each.

The symbol "Bicyclist" with "Arrows" will be measured as 1 unit each.

Stop lines, 16 or 24 inches wide and comprised of multiple 8-inch wide stripes, will be measured by the linear foot of 8-inch stripes.

Measurement for "Pavement Marking, Pressure Sensitive Tape," will be by the linear foot of tape.

## 8-22.5 PAYMENT (New Section)

Payment will be made for such of the following bid items as are included in the Bid Form:

- (1) "Pavement Marking, Paint, (Width) Stripe," per linear foot.
- (2) "Pavement Marking, Paint, Legend/Symbol," each.
- (3) "Pavement Marking, Thermoplastic, 8-inch Stripe," per linear foot.
- (4) "Pavement Marking, Thermoplastic, Legend/Symbol," each.
- (5) "Pavement Marking, Pressure Sensitive Tape," per linear foot.

The unit contract prices for the above listed bid items shall be full compensation for furnishing all labor, tools, material, and equipment necessary or incidental for the completion of the work as specified.

## SECTION 8-30 - STREET LIGHTING SYSTEM (New Section)

## 8-30.1 DESCRIPTION (New Section)

The work consists of furnishing and installing a complete and functional electrical/street lighting system as indicated on the Drawings and as specified herein.

## 8-30.1(1) GENERAL (New Section)

All final connections or energizing of electrical street lighting systems to overhead secondary or to secondary in vaults or handholes will be made by City Light at no cost to the Contractor.

Required permits for electrical work other than street lighting and signals shall be obtained and paid for by the Contractor at Construction and Land Use, 5th Floor Municipal Building, City of Seattle, per Section 1-07.6.

## 8-30.1(2) APPLICABLE CODES (New Section)

The work shall be performed in accordance with the applicable provisions of the following codes:

- (a) City of Seattle Department of Lighting Material Standards, Construction Standards, and Requirements for Electrical Service Connection.
- (b) State of Washington Electrical Construction Code, Chapter 296-44 WAC.
- (c) State of Washington Electrical Workers Safety Rules, Chapter 296-45 WAC.
- (d) National Electrical Code.
- (e) City of Seattle Electrical Code Supplement.
- (f) Edison Electric Institute (EEI).
- (g) National Electric Safety Codes.

The Contractor shall be familiar with wires and voltages present within the construction area in the application of these requirements.

## 8-30.1(3) SHOP DRAWINGS (New Section)

The Contractor shall submit shop drawings for the following items in accordance with Section 1-05.3.

- Luminaires (Include photometrics and socket position)
- Lamps
- Photoelectric Cells
- Bracket Arms
- Wire
- MI Cable and Accessories
- Wire Connectors
- Ground Rods
- Ground Clamps
- Fuse Kits
- Splice Kits
- Switch Board Mat and encapsulant
- G.F.C.I. Outlets (Hospital grade)
- Cabinets/Panels (Shop drawings for electrical cabinets, panels, and enclosures shall include but not be limited to the following:)
- (a) Wiring schematic
- (b) Size and layout, indicating approximate size and placement of equipment
- (c) Full description of materials, including breakers and fuses
- (d) UL/CSA Certification
- (e) All vents shall be screened

## 8-30.1(4) GUARANTEE (New Section)

All material supplied under this Specification shall be guaranteed against defective workmanship and material for a period as indicated in Section 1-05.10. The Contractor shall be responsible for the return and replacement cost of any material or equipment found to be defective within the guarantee period, including labor, freight, shipping and delivery costs. All material returned to the supplier under the guarantee shall be repaired or replaced and returned to the City of Seattle within 30 days of receipt.

## 8-30.1(5) DEFINITIONS (New Section)

All technical words and phrases used within these Specifications shall be interpreted as defined in the I.E.E.E. Standard Dictionary of Electrical and Electronic Terms.

## 8-30.1(6) FIELD TESTING (New Section)

Prior to completion of the work, the Contractor shall make the following tests on all electrical circuits:

- (a) Test for grounds in each circuit by physically examining the installation to ensure that all required ground jumpers, devices and appurtenances do exist, that they are mechanically and electrically firm, and that they meet the requirements of Article 250 of the National Electrical Code.
- (b) Insulation resistance test (with all readings recorded when requested by the Engineer). The insulation test shall be performed after all field connections have been made.
- (c) A functional test in which it is demonstrated that each and every part of the system functions as specified or intended herein. The functional test shall be performed after all field connections are made.

## 8-30.1(7) FINAL INSPECTION (New Section)

As soon as practicable after the completion of the entire work, it will be examined by the Lighting Department and the Engineer. The Contractor will be notified when the examination is to be made.

If the inspection reveals defects in the work, such defects shall be repaired or unsatisfactory work be replaced as the Engineer designates before final acceptance. No extension of the contract time will be granted because of the time required to remedy such defects.

The Contractor will be charged with the actual cost to the City due to any retesting made necessary by such faults.

## 8-30.2 MATERIALS (New Section)

Materials shall meet the requirements of the following section of these specifications:

Illumination and Electrical Materials . . . . . 9-31

All materials furnished by the Contractor shall be new, unused and free from defects. Hardware not specifically called out, but required to complete the work shall be considered incidental to the contract and shall be furnished and installed by the Contractor at no additional cost to the City. Hardware shall be industrial/utility grade.

All steel shall be stainless or hot dipped galvanized.

All electrical equipment including luminaires, lamps, photoelectric cells, bracket arms, wire, etc. shall be permanently marked with manufacturer's name and appropriate ratings.

## 8-30.3 CONSTRUCTION DETAILS (New Section)

**8-30.3(1) GENERAL (New Section)**

The work required for installation of electrical/street lighting system shall be done as shown on the Standard Plans, the construction standards and in accordance with the following provisions.

All galvanizing shall be per ASTM 123 and 153.

Only state certified electricians shall perform electrical work.

Wire clearances shall be according to Seattle City Light requirements and the City and State law.

To maintain safe traffic conditions, existing luminaires shall remain in service until cut-over to new luminaires can be accomplished. Roadways shall not be opened to traffic without all the required lighting system operating properly.

All welding of steel and aluminum structures shall be in conformance with AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals", Section 1.4.2 for Steel and Section 1.5.5 for Aluminum. All steel structures shall be protected as required in Section 1.4.3 of the above referenced book.

Field repair of galvanized surfaces shall be coated with a heated zinc alloy solder to a minimum thickness of 2 mils, in accordance with ASTM A780.

Where the wiring diagram indicates installation of a fuse or ground rod, in-line fuse holders and fuse or ground rod shall be installed as specified herein.

**8-30.3(2) LUMINAIRES (New Section)**

The luminaire glassware, reflector and lamp shall be thoroughly cleaned before installation on the tenon, on the bracket arm. The luminaire shall be secured and adjusted according to the manufacturer's recommendations. The luminaire refractor will be level in the transverse roadway axis and parallel to the roadway grade in the longitudinal roadway axis, after the pole has been plumbed with all loads added, according to Construction Standard D12-9.

Alignment of luminaires shall be approved by the Engineer prior to final turn-on at each location.

Date of installation shall be marked on the bottom of the photoelectric cell with indelible marking pen. The lamp shall have the installation date etched in the metal base.

The photoelectric cell receptacle shall be adjusted such that the photoelectric cell faces north.

**8-30.3(3) BRACKET ARMS (New Section)**

Bracket arms shall be installed at the locations indicated on the Standard Plans. Mounting point of the bracket on wood poles shall be located as necessary to provide the required mounting height of the luminaire above the pavement surface as indicated on the Standard Plans. The mounting height shall be adjusted to provide required wire clearances.

Wood pole bracket arms shall be attached by one through bolt and two lag bolts. Through bolts on wood poles shall be cut off so no more than 4 threads nor less than 3 threads are left exposed beyond the captive nut. The exposed end shall be treated with galvanizing repair paint approved by the Engineer. This through bolt shall not be used to mount any other hardware.

At locations where the existing bracket arm is to be used, any yellow tape present on the arm shall be removed. (This tape was used to indicate luminaires intentionally disconnected in late 1977 to conserve energy.)

Bracket arms on steel poles shall be attached with galvanized steel bolts.

Bracket arms on aluminum shall be attached with stainless steel bolts.

**8-30.3(4) RELOCATING EQUIPMENT (New Section)**

When equipment is to be relocated, the Contractor shall furnish and install the necessary materials, hardware and equipment required to complete the new installation. The new hardware required to complete the installation shall be of the same quality and type as hardware required in these specifications for other new work.

**8-30.3(5) WIRING, FUSING AND SPLICING (New Section)**

The Contractor shall provide wiring from luminaire terminal boards to in-line fuseholders and to the source of secondary power. (Note: for MI cable, refer to Section 8-30.3(6).)

The Contractor shall coil 8 feet of wire at the source of secondary power to allow for connections by Seattle City Light. The Contractor shall coil 3 feet of excess conductor in all Type 1, 2, 3 or 4 Handholes.

Each "hot" conductor shall have an in-line fuseholder and fuse located as indicated on the Drawings. Poles fed underground shall be fused in the pole base and shall have sufficient slack wire so that the fuseholders can be withdrawn through the pole handhole for servicing.

Wire attached to the side of a pole, not enclosed in conduit, shall be covered with plastic molding.

Caution shall be exercised in working near and within City Light Vaults. Voltages present are as high as 26,000 volts, and the vault wiring will not be de-energized while the Contractor is working. City Light safety watch standards shall be adhered to while working in vaults. Call Seattle City Light at 625-3320 for Safety Watch 48 hours in advance of entry into a City Light Vault. (There is no charge for a safety watch during regular work hours.)

When conductors, either cable or single, are being installed, care shall be exercised not to exceed tension limitations recommended by the manufacturer. Conductors may be pulled directly by hand. If conductors are pulled by mechanical means, a dynamometer with drop-needle hand shall be used on every pull. On mechanical pulls, either the insulation shall be stripped off each conductor, and conductors formed into a pulling eye and firmly taped before pulling; or a cable grip shall be used. The pulling force shall be applied directly to the conductor.

Secondary insulator racks required for new construction shall be per Material Standard 6905.1 and installed per Construction Standard D9-8.

Where new cable will be installed in existing conduits which contain wire, the Contractor shall protect existing wiring from damage due to pulling new cable. Cable pulling compound shall be used to minimize cable pulling tensions and adverse effects on existing insulation, jackets and shields. Care shall be exercised in pulling cable into poles and pedestals since sharp metal edges may be present.

Aluminum wire and connectors shall be prepared and coated with an oxide-inhibiting compound.

Where triplex wire is installed overhead to feed only one street light, the two hot heads shall be tied together (brothered) at each pole.

Wire insulation shall be removed by a method that will not "ring" or notch the wire. "Ringing" shall be cause for rejection of the splice.

Spliced joints shall be made mechanically and electrically secure. Splices shall not be permitted inside conduit. Each individual splice or termination of extra leads shall be insulated and made waterproof.

For above ground splices, the connector shall be torqued to the manufacturer's recommended level. Exposed metal shall be wrapped with plastic electrician's tape. The splice and termination of extra leads shall be covered with rubber base insulating and waterproofing tape as specified in Material Standard 7364.7. This tape shall be worked around the wire insulation to insure a water tight assembly. The splice assembly shall be protected with two layers of electrician tape.

For below ground splices, connectors shall be tightened or crimped in accordance with the manufacturer's specifications. Only approved crimping tools shall be used to compress crimp splices. The metal splice shall be centered in the enclosure. The encapsulant shall be mixed and installed in accordance with manufacturer's recommendation. The encapsulant shall completely fill the enclosure and be free of voids and impurities.

**8-30.3(6) MINERAL INSULATED (MI) CABLE (New Section)**

Mineral Insulated (MI) cable shall be installed as described in the NEC Section 330-B with the following exceptions:

- (a) The cable shall be supported every 3 feet and within 12 inches of each gland. These measurements are along the wall and not along the cable. Supports shall be in line so as to support cable in a straight line.





**8-30.3(8) REMOVAL AND SALVAGE OF EXISTING EQUIPMENT (New Section)**

Refer to Section 2-02.3(3)G.

**8-30.4 MEASUREMENT (New Section)**

Measurement for "Luminaire, High Pressure Sodium, (Wattage)" will be by each.

Measurement for "Bracket Arm (Length)" will be by each.

Measurement for "Relocate Luminaire," "Relocate Bracket Arm", and "Relocate Luminaire and Bracket Arm" will be by each.

Measurement and payment for removed electrical items will be included in sections 2-02.4 and 2-02.5.

Measurement for "Wiring, Street Lighting" will be by Lump Sum.

**8-30.5 PAYMENT (New Section)**

Compensation for the cost necessary to complete the work described in Section 8-30 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Luminaire, High Pressure Sodium, (Wattage)," each.
- (2) "Bracket Arm (Length)," each.
- (3) "Relocate Luminaire," each.
- (4) "Relocate Bracket Arm," each.
- (5) "Relocate Luminaire and Bracket Arm," each.
- (6) "Wiring, Street Lighting", Lump Sum.

The unit contract price for "Luminaire, High Pressure Sodium, (Wattage)" shall include all costs for the work required to furnish and install the luminaire, including the fuse, hardware, photoelectric cell and wiring to the fuseholder at the secondary source or at the base of the pole.

The unit contract price for "Bracket Arm (Length)" shall include all costs for the work required to furnish and install the bracket arm, including hardware.

The unit contract price for "Relocate (Item)" shall include all costs for the work required to remove the item and reinstall the item at the new location, including hardware, and cleaning and relamping relocated luminaires.

The contract lump sum price for "Wiring, Street Lighting," shall include all costs for the work required to furnish and install wiring for the street light system as specified from the service point to the luminaire fuseholder, including taps, splices, tape, fuseholder, excess wire for connections, and any other material for a complete lighting system.

**SECTION 8-31 - TRAFFIC SIGNAL SYSTEM (New Section)****8-31.1 DESCRIPTION (New Section)**

The work consists of furnishing and installing a complete traffic control system of controllers, signals and appurtenances as indicated on the Drawings.

**8-31.1(1) GENERAL (New Section)**

The Contractor shall familiarize himself with the wires and voltages present within the construction area in the application of the requirements herein.

If, for any reason, one or more vehicular or pedestrian signals should go dark or fail to function properly as a result of the Contractor's work, the Contractor shall immediately call for and be responsible to pay for any required Police control of the intersection. The Contractor shall also immediately notify the Engineer and the City Signal Maintenance Office (625-4103) of the nature of the problem. Unless otherwise designated by the Engineer, the Contractor shall immediately undertake the necessary repairs with qualified electrical workers. The Engineer may require the work to be done by City forces. The Contractor shall be responsible for all costs incurred.

**8-31.1(2) DEFINITIONS (New Section)**

All technical words and phrases used within these Specifications shall be interpreted as defined in the National Electrical Manufacturers' Association Publication TS 1-1983.

**8-31.1(3) APPLICABLE CODES (New Section)**

All electrical work shall be done by state certified electricians. The work shall be performed in accordance with the applicable provisions of the latest edition of the following codes:

- National Electrical Code
- State of Washington Electrical Workers Safety Rules
- State of Washington Electrical Construction Code
- City of Seattle Department of Lighting Requirements for Electrical Service Connection

**8-31.1(4) SHOP DRAWINGS AND REFERENCE MATERIALS (New Section)****8-31.1(4)A SHOP DRAWINGS (New Section)**

The Contractor shall submit shop drawings in accordance with Section 1-05.3 for the following:

- (a) Controller Assembly (components & cabinets)
  - (1) Controller Wiring Schematic (Typical for each type)
  - (2) Control Cabinet Wiring Diagram (Typical for each type)
  - (3) Control Cabinet Size and Layout (Each type)
  - (4) Full functional description of the controller including program diagram with instructions for program timing.
- (b) Signal Heads and Mounting Assemblies
- (c) Cable and Wire
- (d) Pole Line Hardware
- (e) Interior Illuminated Signs

## (f) Miscellaneous

- (1) Telephone Station Protector
- (2) Pedestrian Push Button
- (3) Aerial Terminal Compartments
- (4) Ground Rods

The Contractor shall submit two "as built" wiring diagrams to the Engineer for each signalized intersection prior to requesting the Engineer's approval for turn-on or cut-over.

## 8-31.1(4)B REFERENCE MATERIAL (New Section)

At or before delivery of the controller for testing, the Contractor shall deliver 5 complete sets of operation manuals, maintenance manuals, controller assembly wiring and program diagrams, and parts list with each controller assembly. 1 set of controller assembly wiring and programming diagrams shall be installed in a plastic envelope within each cabinet.

The method of programming the controller shall be completely detailed and shall include a description of making any changes or adjustments in the program. The Conditions under which the programming may be accomplished (i.e., flashing or full operation) shall also be detailed.

A complete description of all software shall be furnished for each model of controller proposed. The description shall include all steps of the various programs as well as all inputs and outputs.

## 8-31.1(5) CONTROLLER ASSEMBLY TESTING REQUIREMENTS (New Section)

## 8-31.1(5)A GENERAL (New Section)

Controller assemblies will undergo testing by both the manufacturer and the City of Seattle Engineering Department. Certified Testing by the manufacturer will not result in immediate acceptance of the equipment by the City nor will it indicate the City Specifications have been met and approved.

## 8-31.1(5)B MANUFACTURER'S TEST PROCEDURE (New Section)

The manufacturer shall perform the following testing on system equipment in the prescribed manner and certify that each complete controller assembly has successfully met or exceeded all the requirements set forth herein.

- (a) Physical and functional testing of all controller units, system equipment, auxiliary equipment and the complete controller assembly. This shall include but not be limited to the items covered in the City of Seattle "Functional Test Procedure for Controller Assemblies" (included in the Appendix).
- (b) A minimum of 72 hours of burn-in of all controller units, controller assemblies and signal system control equipment including auxiliary equipment.
- (c) Each controller assembly type shall be environmentally tested in accordance with NEMA Standards Number TS1 for Traffic Control Systems, Part 2 "Environmental Standards and Test Procedures". The Environmental test shall be made by an independent laboratory.

The Contractor shall submit the manufacturer's certified test results prior to delivery of the controller assembly to the City for functional testing.

If a failure occurs in any step of the testing, the manufacturer shall record the failure and take corrective measures. If a failure occurs in the same controller unit or any other major segment (i.e., signal conflict monitor unit, load switching unit, detector units, coordination units, etc.) of the controller assembly more than once, that unit or segment of the assembly shall be completely replaced by a new unit. Repairs shall be made as soon as practicable and testing shall resume to ensure the continuity of the test.

A failure shall be defined as any occurrence which results in other than normal operation of the equipment. A failure is considered to be, but not limited to the following:

- (a) If the controller unit sequences improperly or exhibits improper interval or phase without proper call through remote switch, time clock or start-up routine.
- (b) If indicator lights give false representation.
- (c) If any timing is disrupted or deviates more than  $\pm 100$  milliseconds from its setting.
- (d) If any load switch produces an incorrect signal indication.
- (e) If the conflict monitor, after receiving a simulated green-green and walk-walk conflict for each phase or other monitored anomalies, fails to perform in the prescribed manner.
- (f) If any auxiliary equipment does not operate properly.

## 8-31.1(5)C CITY OF SEATTLE FUNCTIONAL TEST PROCEDURE (New Section)

The functional test by the City of Seattle will require at least 3 working days of satisfactory operation.

The Contractor shall deliver the controller assembly to the City of Seattle Engineering Department Traffic Control Shop at 1010 - 8th Avenue South in Seattle. The City will then initiate a functional test using the City's "Functional Test Procedure for Controller Assemblies". The Contractor shall witness or acknowledge the final output test of the controller assembly by the City prior to accepting the cabinet for installation.

A failure shall be defined as any occurrence which results in other than normal operation of the equipment, and shall include but not be limited to the failure items listed under Section 8-31.1(5)B.

If any part of the controller assembly fails to meet the Specifications or operates in other than normal operation, the test shall be discontinued. The Contractor shall then make immediate arrangements to correct or modify the equipment within 5 days upon written notice from the City. If repairs or replacement cannot be made within 5 days the Contractor shall remove the controller assembly from the Traffic Control Shop and make repairs or replacements within 30 days. Upon return of the controller assembly and anytime thereafter the functional test will again be initiated and all costs incurred for re-testing will be borne by the Contractor. In addition, no extension of the contract time will be granted because of the time required to make repairs or replacements.

The Contractor shall pay all shipping costs and packaging or crating cost incurred by the City in returning equipment which does not meet Specifications or is found to be defective.

## 8-31.1(6) FIELD TESTING (New Section)

The Contractor shall make the following tests on all new electrical circuits. If requested by the Engineer, test equipment shall be certified before and after the tests:

- (a) Test for continuity of each circuit.
- (b) Test for grounds in each circuit which consists of the physical examination of the installation to ensure that all required ground jumpers, devices and appurtenances do exist and are mechanically firm, meeting the requirements of Article 250 of the National Electrical Code.
- (c) A megger test on each circuit between the conductor and ground with all switchboards, panel boards, fuse holders, switches, receptacles and over current devices in place and all readings recorded. The megger test shall be performed with all wiring installed but connections not made to controller, conflict monitor, load switches, or other plug connected accessories. The Contractor shall furnish the Engineer with 3 copies of the test results identifying observed readings with their respective circuits prior to any checkout of the installation to be turned on or cut over.

The insulation resistance on all electrical circuits whose nominal voltage is between 115 volts and 600 volts other than direct burial cable shall not be less than 6 megohms between the conductor and ground on those circuits with total single conductor lengths of more than 2,500 feet, nor less than 8 megohms for those circuits with single conductor length 2,500 feet or less.

For those circuits below 115 volts nominal and all direct burial circuits, the insulation resistance shall not be less than 2 megohms to ground, except not less than 10 megohms for loop wire.

Any change in the above stated minimum readings must be approved in writing by the Engineer. Only those factors based on dielectric properties of conductor insulation, splicing insulations, terminal strips, etc., will be cause for consideration of variance.

- (d) A functional test (intersection check-out) in which it is demonstrated that each and every part of the system functions as specified or intended herein. The functional test will be performed after all field connections are made to the controller cabinet.

Any fault in any material or in any part of the installation revealed by these tests shall be replaced or repaired by the Contractor in a manner approved by the Engineer, and the same test shall be repeated at the Contractor's expense, until the system is approved by the Engineer.

#### 8-31.1(7) FINAL INSPECTION (New Section)

As soon as practicable after the completion of the entire work, it will be examined by the Engineer. The Contractor will be notified when the examination is to be made. The Contractor shall submit, at this time, any as-built wiring diagrams for field wiring and/or controller assembly wiring revisions.

If the inspection reveals any defects in the work as specified and as detailed on the Drawings, such defects shall be repaired or unsatisfactory work be replaced as the Engineer may direct before final acceptance. The cost of all such repairs and replacements shall be borne by the Contractor, and no extension of the contract time will be granted because of the time required to remedy such defects.

#### 8-31.1(8) GUARANTEE (New Section)

All work and equipment supplied by the Contractor under this Specification shall be guaranteed against defective workmanship and material as indicated in Section 1-05.10. The Contractor shall be responsible for the return and replacement cost of any material or equipment found to be defective within the guarantee period, including labor, freight, shipping and delivery costs. All equipment returned to the supplier under the guarantee shall be repaired or replaced and returned to the City of Seattle within 30 days of receipt.

#### 8-31.2 MATERIALS (New Section)

Materials shall meet the requirements of the following section of these specifications:

Signals . . . . . 9-32

All materials to be furnished by the Contractor shall be new and free from defects.

#### 8-31.3 CONSTRUCTION DETAILS (New Section)

##### 8-31.3(1) INTERSECTION CHECK-OUT AND TURN-ON PROCEDURES (New Section)

###### 8-31.3(1)A TRAFFIC CONTROL (New Section)

The Contractor shall provide uniformed Police control at any time an intersection is dark or inoperative, such as during controller change-out, cable installation, signal turn-on or cut-over, or similar circumstances. The Contractor shall have all traffic controls (i.e., pavement markings, channelization and signing) in place prior to requesting Engineer's approval for turn-on or cut-over.

To maintain safe traffic conditions, existing signals shall remain in operation until a simultaneous cut-over to the signal can be accomplished.

At the time of turn-on of new signals, temporary "SIGNAL AHEAD" signs shall be placed upstream on all approaches. These signs shall remain in place for not less than 7 nor more than 21 calendar days. All signs shall be highly visible and placed in a safe and secure location.

At the time of cut-over of revised signals having phasing which is different from the old signal operation (i.e., added phase, split phase, etc.) temporary "TRAFFIC REVISION" signs shall be placed upstream on all approaches. These signs shall remain in place for not less than 7 nor more than 14 calendar days. At a cut-over of revised signals having phasing which is the same as the old signal operation, no temporary signing is necessary. All signs shall be highly visible and placed in a safe and secure location.

##### 8-31.3(1)B CHECK-OUT PROCEDURE (New Section)

The Contractor shall call for an intersection check-out after completing the controller cabinet installation along with all other signal equipment complete with wiring connections. The Contractor shall be present and assist with the check-out by energizing each field circuit and assisting as necessary to verify completeness of the installation except for the controller unit and auxiliary units of the controller assembly. If the intersection is found to be incomplete or inadequate, the Contractor will be notified of the deficiencies and will be charged the actual costs to the City for the unsuccessful review of the intersection. The only inspection the Contractor will not be billed for is the one which indicates the signal system is ready for flashing or cut-over.

##### 8-31.3(1)C TURN-ON/CUT-OVER PROCEDURE (New Section)

Upon satisfactory check out of an intersection, the Contractor, after conferring with the Engineer, will tentatively schedule a cut-over from the old signals or a turn-on of a new installation. A request to "turn-on" new signalized intersection or "cut-over" modifications to existing signalized intersection shall be submitted in writing to the Engineer at least 3 working days prior to the proposed date of an existing signal cut-over, and 8 working days prior to the proposed date of a new signal turn-on. The Contractor shall submit an as-built wiring diagram to the Engineer prior to cut-over or turn-on.

Turn-ons and cut-overs will not be permitted on Friday, Saturday, Sunday, Monday, Holidays or a day before a holiday. Only one turn-on or cut-over will normally be permitted in a single day. Turn-on or cut-over work shall be scheduled and completed between the hours of 9:30 AM and 3:30 PM. The Engineer will confer with the Traffic Engineer and Signal Electrician before authorizing a cut-over or turn-on.

The City will deliver to the site and plug into the controller cabinet, the controller unit and the auxiliary units. The Contractor shall verify all connections and proceed with energizing the controller assembly. The signal timing for the controller unit will be done by the City. The Contractor shall not energize the signals until the Engineer is on site and has authorized the Contractor to proceed. To maintain safe traffic conditions, existing signals shall remain in operation until a simultaneous cut-over to the signal can be accomplished, unless an alternate procedure is approved in writing by the Engineer. New signals shall not obscure existing traffic controls.

The Contractor shall be present at such turn-on time, with materials and tools necessary to correct any malfunctions which may occur. Turn-on shall not take place if any subsequent work will necessitate turning off the signal system.

All new vehicular and pedestrian signals and illuminated signs shall be covered (sacked) completely with a 6 mil opaque polyethylene sheeting until the new signals are ready to be energized. A small diameter hole (i.e., 1 inch) shall be cut into the opaque plastic cover in front of each vehicular signal lens and a 1 inch by 3 inch slot in front of each pedestrian signal lens to allow for a visual check of indications during performance testing.

Immediately after turn-on or cut-over all existing vehicular and pedestrian signals that have been deactivated shall be sacked or removed. The old signal heads shall not obscure the new traffic controls at any time.

##### 8-31.3(1)D TECHNICAL ASSISTANCE (New Section)

The Contractor shall ensure that the Controller Assembly supplier shall provide technical assistance at the time of turn-on of the intersection.

Notice of 8 days shall be given by the Contractor to the manufacturer's representative prior to the time of turn-on of an intersection to enable attendance at the turn-on. Assistance by the manufacturer will not relieve the Contractor of responsibility of rendering whatever assistance may be necessary at the time the controller assemblies are tested by the City to correct any possible defects.

##### 8-31.3(2) CONTROLLER ASSEMBLY (New Section)

The Contractor shall install all cabinets, controllers, and auxiliary equipment as indicated on the Standard Plans.

Auxiliary equipment added to existing controller cabinets shall be installed as indicated on the Drawings and as specified herein. The Engineer shall be notified 48 hours in advance of energizing of the unit in order that he may be present.

After signing the City's functional test report, the Contractor shall pick up the controller cabinet at 1010 8th Avenue South for installation.

### 8-31.3(3) SIGNAL HEADS, VEHICLE AND PEDESTRIAN (New Section)

#### 8-31.3(3)A GENERAL (New Section)

Signal heads shall not be installed at any intersection earlier than 14 calendar days prior to turn-on or cut over.

Mounting shall be bracket, mast arm, post top, span wire, or clamshell as indicated on the Drawings. Signals mounted on post tops shall utilize standard 4-inch slipfitters. Bracket-mounted signal heads shall utilize the signal bracket assembly and conform to mounting indicated on the Drawings. The bracket assembly shall be installed in line with the pole center line.

Attachments such as visors, backplates or adapters shall conform to and readily fasten to existing mounting surfaces without affecting the weatherproof and light integrity of the signal.

Electrical service shall be neatly formed to the supporting structure with only sufficient slack for wind effect when span wire mounted.

All new vehicular and pedestrian signals shall be covered (sacked) completely with a 6 mil black polyethylene sheeting until the new signals are ready to be energized.

Alignment of vehicular and pedestrian signal heads shall be approved by the Engineer prior to final turn-on on each signalized location.

#### 8-31.3(3)B VEHICLE SIGNAL HEADS (New Section)

The bottom of the vehicle signals mounted on mast arms or span wire shall be 16-1/2 to 18 feet above street grade. Vehicle signals mounted on brackets or post top shall be 10 to 15 feet above sidewalk grade.

The signal shall mount to standard 1-1/2 inches fittings as a single section, as a multiple section head, or in combination with other signals. The signal section shall be provided with an adjustable connection that permits incremental tilting of at least 0 to 10 degrees above or below the horizontal while maintaining a common vertical axis through couplers and mounting. Terminal connection shall permit external adjustment about the mounting axis in 5-degree increments. The signal shall be mountable with ordinary tools and capable of being serviced without tools.

Signal heads located over the roadway shall not be in conflict physically or visually with trolley wires, span wires, electrical wires or any other hardware existing or proposed for the location. 3-foot, edge to edge, clearance shall be maintained between signal heads and trolley wires. Span wires and tether lines within 4 feet of trolley lines shall be properly insulated.

When balance adjusters are required, the vehicular heads shall be adjusted in the field such that persons standing on the pavement, four times the speed limit in feet back from the stop bar, shall see the brightest image of the red section. Heads shall be plumbed as viewed from the direction in which they face.

Optically programmed type traffic signal heads shall be programmed before the traffic signal system turn-on. Programming shall be performed with a representative of the traffic signal head manufacturer present. The Contractor shall make arrangements with the representative to assure timely completion of the programming.

Vehicle signal heads shall be attached to the mast arm with a signal coupling unit as detailed. Mounts shall include elevator plumbizer units, between the red and yellow lenses, or as necessary to provide roadway clearance. The top (red) section of all heads on one mast arm shall be positioned to same distance from the center of the mast arm.

Vehicle signal heads shall be attached to the span wire by means of a cable clamp, balance adjuster when required, and suspension fittings as shown on the Span Wire Vehicular Signal Installation details. The sag in the span wire after loading shall not exceed 5 percent or be less than 3-1/2 percent of the total span. Span wires shall be attached to the poles such that the signal head mounted at the lowest point on the span will not require a pipe extension. The top (red) section of all heads shall be level on the same span.

For optically programmed signals which are span wire mounted, a tether cable with connections and hardware as recommended by the signal head manufacturer shall be used to secure the bottom of the optically programmed signals. Tethering shall provide and maintain proper optical visibility of all indications. The tether cable clamp shall be designed and installed to release under severe wind loads and impact. The tether cable shall be insulated and shall be installed a minimum of 18 feet above the roadway.

#### 8-31.3(3)C PEDESTRIAN SIGNAL HEADS (New Section)

Pedestrian signal heads shall be aligned to focus on the center of the far end of the crosswalk which it is associated with and at a point 5 feet above the sidewalk landing.

Pedestrian signal heads shall be mounted so the bottom of the housing is 8 feet above the sidewalk, unless otherwise noted.

The Contractor shall use a "Clamshell" type mounting assembly for neon pedestrian signals. Where horizontal orientation does not present a signal head conflict, both heads shall be mounted at the same elevation above grade.

#### 8-31.3(4) PEDESTRIAN PUSH BUTTON AND SIGNS (New Section)

The Contractor shall provide and install all pedestrian push buttons, signs and mounting hardware. Required signs shall be as shown on the Drawings.

The signs and push buttons shall be mounted on the vehicle signal poles, pedestrian signal poles, or pedestrian push button posts as indicated on the Drawings.

The sign and push button assembly shall be located on the pole shaft as shown on the detail drawing. The sign shall point in the direction of the crosswalk for which the associated push button is intended.

#### 8-31.3(5) DETECTOR LOOPS (New Section)

##### 8-31.3(5)A LOOP WIRE (New Section)

Vehicle detector loops will be marked-out on the roadway by the Contractor as shown on the Drawings and as detailed in Standard Plan 530A. The Contractor shall not saw cut for detector loops until the location has been verified by the Engineer.

At least 48 hours notice shall be given to the Engineer indicating when and where saw cutting is imminent.

One continuous unbroken length of loop wire shall be used to form a loop of the number of turns shown on the loop schedule in the Drawings. The loop wire shall be laid in a saw slot which has been cleared of debris and moisture by a jet of compressed air. The wire shall be placed by tamping it into the saw cut with a blunt wooden stick, using care to avoid abrading or damaging the insulation. In order to reduce abrasion of the loop wire in the saw cut, the following steps shall be taken:

- all corners of the saw cut that the loop wire is to be bent around shall first be rounded by filing.
- the loop wire shall be taped a minimum of two turns at each saw cut corner.

In concrete installations the saw cut shall be filled with a quick drying high strength highway concrete patching material, Jet Set, manufactured by Miller Manufacturing, Inc., or approved equal. No saw cuts shall be made closer than 3 feet to the edge or joint (unless crossing the joint) of a non-laterally supported concrete slab.

In asphalt installations, the loop wire shall first be covered with 1/4 inch of fine grain sand, then the remainder of the slot filled with hot liquid asphalt, ASTM D312 Type III 175° melting point. The asphalt-filled loop wire cuts shall be sealed while the asphalt is still warm by painting with Special Tack Coat (STE-1) asphalt and immediately covering the asphalt paint strip with clean, dry paving sand. The painted asphalt strip shall be centered directly over the sawcut and shall not exceed a width of 3 inches. Sealing shall not be performed when the pavement is damp.



At those locations where cuts are made on a slope and tar runs and puddles, the Contractor shall, starting at the low end, pour the tar and have a follower place 2-inch masking tape on the road surface over the cut to hold the tar in place while the tar sets. The masking tape shall be removed after the tar becomes rigid.

When placing the loop across asphalt or concrete pavement joints or cracks, a 12-inch minimum length of 5/16 inch ID x 1/8 inch wall, pure gum natural tubing shall be sliced open, and shall be so placed as to envelop the loop wires where the loop wires intersect the roadway joint or crack. This must clear the joint or crack by 6 inches minimum on each side. The ends, and the entire length of the tubing, shall be taped with 2 layers of electrical tape to prevent asphalt or concrete from entering the conduit.

Where loop installation conflicts with existing operational loops, the new loops shall be installed no sooner than 24 hours prior to signal cut-over. The Contractor shall notify the Engineer 24 hours prior to cutting the existing loop so that phase can be placed in a recall mode.

Loop wire, from the loop to lead-in splice, shall be twisted a minimum of 3 turns per foot. Care shall be taken so that the twists are uniform.

A minimum of 48 inches of loop wire shall be brought into the handhole and spliced to the lead-in wire with a soldered, waterproof splice.

#### 8-31.3(5)B LOOP LEAD-IN CABLE (New Section)

Connections between the loop wire at the handhole and the detector amplifier unit in the controller cabinet shall be by means of a continuous unbroken length of loop lead-in cable.

The conductors of the loop lead-in cable shall be twisted together approximately 3 turns per foot. Connections of the loop wire to the lead-in wire shall be made only in a hand hole with a waterproof splice as indicated on the Drawings.

Each loop shall have its own shielded loop lead-in cable to the controller cabinet. Connections for parallel, series or series-parallel wiring of detector loops shall be made in the controller cabinet per the wiring diagram.

The cable shield and drain wire shall be grounded to the system ground at the controller cabinet only. The cable shield between cabinet and splice shall be continuous throughout intermediate junction boxes and shall be insulated to prevent grounding in any junction box or in any conduit. No more than 6 inches of the shield shall be removed from the ends of the loop lead-in cable.

Each loop lead-in wire shall have a permanent cloth or plastic tag with the label number shown on the loop detector wiring chart. Tags shall be placed at all accessible points on the system.

The shielded loop lead-in cable splice to the loop wire shall be made in the nearest traffic handhole as indicated on the Drawings. No splices will be allowed except splicing the loop wire to the shielded lead-in cable in the traffic handhole. The splices between the loop wire and the lead-in shall be soldered, taped and encapsulated as indicated on Standard Plan 530B.

Adjacent loops connected to the same detector channel shall be connected to obtain magnetic fields of the same direction.

The loop magnetic polarity test may be used to determine the loop wire polarity if the loop winding polarity is not marked during installation. The Contractor shall be responsible for damage to the loop wires due to overheating during the loop magnetic polarity test.

#### 8-31.3(5)C INDUCTANCE TESTING AT THE HANDHOLE (New Section)

Before splicing the loop wire to the loop lead-in cable, an inductance test shall be performed by the Engineer to insure the inductance is within the acceptable range of plus or minus 15 percent of the calculated inductance. If the inductance does not fall in the acceptable range, then the Contractor shall make such corrective measures as necessary until the desired readings are obtained. Inductance reading shall be recorded on the As-Built Plans showing the reading for each loop.

#### 8-31.3(5)D LOOP CONTINUITY TESTING (New Section)

The completed loop and lead-in configuration after splicing shall be checked for continuity, using a suitable tester that will not exceed the voltage rating of the lead-in and loop wire rating.

The Contractor shall also perform a megger test on the loop and lead-in configuration to determine that the resistance to ground is 10 megohms or greater. If resistance to ground, prior to placing the tar or epoxy is less than 10 megohms, all splices and wires should be checked for insulation damage and corrective measures taken. After the slot has been sealed, the Contractor shall perform the resistance and continuity tests again. If the continuity and resistance tests do not meet the previous requirements, the Contractor shall make such corrective measures as necessary until the desired readings are obtained.

#### 8-31.3(5)E INDUCTANCE TESTING AT THE CONTROL CABINET (New Section)

After all splices are complete and the continuity test is complete, the Engineer shall test the inductance of the loop and loop lead-in cable at the controller cabinet to insure the inductance is within the acceptable range of plus or minus 15 percent of the calculated inductance. If the inductance does not fall in the acceptable range, then the Contractor shall make such corrective measures as necessary until the desired readings are obtained. Inductance reading shall be recorded on the As-Built Plan showing the reading for the total loop plus lead-in.

#### 8-31.3(6) INTERIOR ILLUMINATED SIGN (New Section)

Interior illuminated signs shall be covered (sacked) completely with a 6 mil opaque polyethylene sheeting until the sign is ready to be energized and the Engineer authorizes the Contractor to remove the sheeting.

The sign shall be mounted as indicated on the Standard Plan. The sign shall be mountable with ordinary tools and capable of being serviced without tools. The bottom of the sign at the lowest point on the span shall be a minimum of 16-1/2 feet and a maximum of 18-1/2 feet above the roadway.

The sign shall be adjusted in the field as directed by the Engineer. Signs shall be plumb as viewed from the direction in which they face.

#### 8-31.3(7) INTERIOR ILLUMINATED CROSSWALK SIGN (New Section)

The Contractor shall call for an intersection check-out after completing the control unit cabinet installation along with all other equipment and wiring connections. The Contractor shall be present and assist with the check-out by energizing each field circuit and assisting as necessary to verify completeness of the installation. If the crosswalk sign unit is found to be incomplete or inadequate, the Contractor will be notified of the deficiencies.

The Contractor shall have all traffic controls (i.e., pavement markings, channelization and signing) in place prior to the Engineer approving the crosswalk sign for turn-on.

The crosswalk sign unit shall be provided with an adjustable connection that permits incremental tilting of at least 10 degrees above or below the horizontal while maintaining a common vertical axis through couplers and mounting. Terminal connection shall permit external adjustment about the mounting axis in 5 degrees increments.

The crosswalk sign unit shall be attached to the span wire by means of 2 cable clamps, balance adjusters and suspension fittings as indicated on Standard Plan 601B. The sag in the span wire after loading shall not exceed 5 percent or be less than 3-1/2 percent of the total span. Span wires shall be attached to the poles such that the Crosswalk Sign Unit mounted at the lowest point on the span will not require a pipe extension. The bottom of the Crosswalk Sign Unit at the lowest point on the span shall be a minimum of 16-1/2 feet and a maximum of 18-1/2 feet above the roadway.

Cable feeding the span wire mounted crosswalk sign unit shall be securely attached to the span wire by means of preformed lashing spaced no more than 18 inches apart. The preformed lashing rods shall be of the proper size to hold the cable snug against the span wire with no intervening gaps between the cable and the span wire and shall give a neat appearance without displaying obtrusive pigtails. Drip loops shall be left at the point of entrance to signal heads and conduit entrance fittings to allow moisture to drip from the cable rather than run down the cable into the entrances. Where the drip loop from the pole outlet to the span wire exceeds 18 inches, the cable shall be secured to the pole with large preformed lashing rods to give a neat appearance.



**8-31.3(8) INTERCONNECT CABLE (New Section)**

Aerial interconnect cable runs shall be installed 24-1/2 feet above street grade on the street side of the pole.

The Contractor shall match the sag as closely as possible with wires already on poles to ensure reduction of movement in windstorms and adjacent wire conflict.

All cable pulled through service entrances or underground ducts shall be lubricated with an approved cable pulling compound.

The Contractor shall use grip or "come-along" to grip the jacketed messenger when pulling and tensioning. Pulling and tensioning shall be done in such manner as to not damage the jacket. When separating the messenger from the jacketed conductor assembly for dead-ending or splicing the web shall be split in the middle.

At corners and run ends, the messenger strand shall be dead-ended with either automatic strand vices or preformed guy grip dead-ends. When dead-ending with strand vices, the Contractor shall cut the strand and remove the jacket from the steel strand. Exposing enough strand so that the ends of the strand coming through the chuck of both strand vices can be overlapped and bonded together to form a continuous ground. A 1 bolt guy clamp shall be used to bond the strand ends together.

Interconnect cable shall not be spliced. Interconnect cable shall be run continuously between terminal strip of controllers and aerial terminal compartments.

The shield of all cables entering an aerial terminal compartment shall be terminated on a common terminal. The shield shall be connected on the terminal strip of the controller at the start of a system and then connected at alternate controls only along the route of the system.

The installation of controllers and the connection to the energized interconnect cable shall be done starting at the master control point and going to the end of the system. Where the interconnect cable branches at a subsequent intersection, the branch shall be completed before proceeding past the branch point. When controllers are to be connected into new or existing systems, care shall be taken not to disrupt the integrity of the entire system.

Enough cable shall be pulled into control cabinets to allow a minimum of 1 foot of cable stripped of jacket after all trimming and connections are completed.

**8-31.3(8)A TELEPHONE INTERCONNECT CONNECTION (New Section)**

The Contractor shall notify the Engineer at least 4 weeks, and not more than 6 weeks, in advance of the expected turn-on in order that the Engineer can request the Pacific Northwest Bell to install the two pair interconnect drop to the telephone station protector.

The Contractor shall have the telephone station protector and associated wiring complete to the controller so that the phone connection can be installed and tested when the request is made.

**8-31.3(9) SIGNAL WIRING (New Section)****8-31.3(9)A CONDUCTOR INSTALLATION (New Section)**

The Contractor is responsible for making all signal and lighting circuits fully functional after pulling in new cables.

Care shall be exercised in pulling cable into poles and pedestals since sharp metal edges may be present.

When conductors, either cable or single, are being installed, care shall be exercised not to exceed tension limitations recommended by the manufacturer. Conductors may be pulled directly by hand. However, if conductors are pulled by any mechanical means, a dynamometer with drop-needle hand shall be used on every mechanical pull.

On mechanical pulls, insulation shall either be stripped off the individual conductors, and conductors formed into a pulling eye and firmly taped before pulling; or a cable grip shall be used. The pulling force applied directly to the conductor; i.e., when pulling eyes are used or when the conductor is formed into a loop, shall be limited to 0.008 pound per circular MIL area of copper conductor. When a

cable grip is applied over nonmetallic sheathed cables, the maximum pulling force shall be limited to 1,000 pounds; provided this is not in excess of the force as calculated above.

To limit the sidewall pressure at bends in duct and conduit runs, the pulling force in pounds shall not exceed 100 times the radius of the bend in feet or the manufacturer's recommendation, whichever is less. Adequate lubrication of the proper type to reduce friction in conduit and duct pulls shall be utilized as necessary. The grease and oil-type lubricants used on lead sheathed cables shall not be used on nonmetallic sheathed cables.

In existing conduits where new cable will be installed which contain existing traffic and street light wiring as noted on the Drawings, the Contractor shall protect existing wiring from damage due to pulling new cable. Cable pulling compound shall be used to minimize cable pulling tensions and adverse effects on existing insulation, jackets and shields. Special caution shall be observed with existing loop lead-in cable because of its small size.

Cable shall be pulled into controller cabinets to allow approximately 4 feet of cable jacket to be stripped and coiled around the bottom of the cabinet before connections are made.

Cable feeding span wire mounted signal heads shall be securely attached to the span wire by means of preformed lashing spaced no more than 18 inches apart. The preformed lashing rods shall be of the proper size to hold the cable snug against the span wire with no intervening gaps between the cable and the span wire and shall give a neat appearance without displaying obtrusive pigtails. Drip loops shall be left at the point of entrance to signal heads and conduit entrance fittings to allow moisture to drip from the cable rather than run down the cable into entrances. Where the drip loop from the pole outlet to the span wire exceeds 18 inches, the cable shall be secured to the pole with large pre-formed lashing rods to give a neat appearance.

All electrical cable for traffic signal facilities passing through handholes, junction boxes, conduit bodies, vaults and manholes shall be properly identified. Each cable shall be identified as to its function by using 3 wraps of colored plastic tape.

The color representation shall be as follows:

Cable Function	Tape Color
Vehicular Signal Circuits	Red
Detector Circuits	Yellow
Pedestrian Signal Circuits	Green
Push Button Circuits	Brown
Interconnect	White
Telephone Circuit	Two White (White-White)
Service	Orange

Colored tape identification shall also apply to cables spliced in pole and pedestal bases and aerial splices. Each cable shall be identified with the appropriate colored tape within 6 inches of a splice.

Signal cable in handholes, junction boxes and conduit bodies shall be appropriately marked near the center of the enclosed section of cable.

Signal cable passing through Seattle City Light handholes, manholes and vaults shall be identified with stainless steel imprinted markers secured to the cable at each end of the marker by the appropriate colored tape. The markers shall be clearly visible and legible and shall be located at the center of the enclosed length of cable. In manholes and vaults, markers shall also be attached approximately 2 feet from each cable entry point. The cable marker shall indicate "SED SERVICE" for Traffic Signal Service cable, or "SED SIGNAL" for all other traffic signal cable usage.

Care shall be exercised in working near and within any City Light Vaults. Voltages present are as high as 26,000 volts, and the vault wiring will not be de-energized while the Contractor is working. City Light safety watch standards shall be adhered to while working in vaults. Seattle City Light shall be called at 625-3320 for safety watch 48 hours in advance of any entry into any City Light Vault. (There is no charge for a safety watch during regular work hours.)

**8-31.3(9)B SPLICES (New Section)**

Signal cable shall be spliced only in pole or pedestal bases and aerially within 2 feet of the poles as shown on the Drawings.

At those locations where the existing signal cables are being utilized, the traffic signal cables shall be spliced in pole or pedestal bases and each individual conductor shall be insulated and the entire splice shall be waterproof.

Each individual splice or termination of extra leads shall be insulated, taped and made waterproof. High strength bronze alloy split bolt fittings shall be used for splicing.

Loop wire shall not be spliced, except for splicing with the loop lead-in wire within the adjacent handhole or aerial terminal compartment.

Service cable or master cable shall not be spliced except as indicated on the Drawings.

#### 8-31.3(9)C TERMINATIONS (New Section)

Except at a splice, conductors shall be terminated on a terminal strip at the signal equipment which it is serving. Only terminal strips with screw-type pressure binding posts shall be used. Stranded conductors shall use compression-type pressure fittings at the terminal strip. Solid conductors shall attach directly to the screw post.

All terminals shall be marked with field wiring numbers printed on back or front mounted marking strips.

Connection of service wires to City Light wires will be by City Light.

All conductors at every termination and all terminal strips shall be permanently tagged with an identifying circuit number conforming to the Signal Wiring Diagram. Wire markers shall be self-adhesive vinyl cloth or vinyl film strips printed with the circuit numbers. Wire markers shall be applied within 6 inches of the termination.

#### 8-31.3(9)D PEDESTRIAN PUSH BUTTON CABLE (New Section)

The cable shield shall be grounded to the system ground at the controller end only. The cable shield between cabinet and splice shall be continuous throughout intermediate junction boxes and shall be insulated to prevent grounding in any junction box or in any conduit.

#### 8-31.3(9)E ELECTRICAL SERVICE CONNECTIONS (New Section)

The Contractor shall furnish and install equipment and wiring for 2 parallel 120 volts, 60 Hz AC electrical services. The electrical service cable shall be installed as indicated on the Drawings.

All electrical conductors within service enclosures shall be copper; except that conductors inside service enclosures shall be aluminum in serving exclusively an aerial distribution system which is totally aluminum. Electrical conductors as used herein are inclusive of bus bars, single conductor cables, conductors terminal lugs, grounding buses, etc. Those services which supply both aluminum aerial distribution feeders and other circuits shall employ copper buses, lugs, terminals, ground bars, etc.

The service neutral shall be connected to the ground in the controller cabinet. The service ground and neutral shall be kept isolated from the logic ground circuits in the controller cabinet.

The Engineer shall be notified when the Contractor is ready for the electrical service connection. The electrical service connection to the overhead secondary or underground vault service wires will be made by City Light.

#### 8-31.3(10) GROUNDING AND BONDING (New Section)

All metallic appurtenances containing electrical conductors, including cabinets, metallic conduit, metal poles, pedestals, and junction boxes, shall be made mechanically and electrically secure to form a continuous system which shall be effectively grounded. Where metallic conduit systems are employed, the conduit may serve as the equipment grounding conductor.

Where plastic conduit systems are employed, all metallic appurtenances shall be electrically bonded as required by Article 250-95 of the NEC.

The equipment grounding conductor shall in all cases be sized consistent with Table 250-95 of the NEC. All proportional adjustments in grounding conductor capacities shall be considered as accomplished by the installation of a ground rod at the junction box nearest each pole or pedestal in addition to the service ground rod. No "oversizing" of equipment grounding conductors will be required. However, a ground rod at the junction box nearest the pole or pedestal shall not be required if metallic conduit

other than that going to the light standard enters the junction box. Where parallel electrical circuits exist in an electrical conduit, the equipment grounding conductor shall be sized as determined by the rating of the largest overcurrent device serving any circuit contained in the conduit. Only one equipment grounding conductor is required in any conduit.

Equipment grounding conductors, if insulated, shall employ insulation rated at 60 degrees centigrade or higher and shall be chemically compatible to other insulations contained within the system.

Identification of the equipment grounding conductor shall conform to all NEC requirements.

Grounding of conduit and neutral at the service point shall be as required under the NEC. Service ground and neutral shall be kept isolated from the logic ground circuits in the controller cabinet.

At each multiple service point, a ground rod shall be furnished and installed.

A ground rod shall be driven in each new handhole adjacent to metal fixtures. A ground wire shall interconnect all ground rods in each handhole. A ground clamp shall be used to secure the ground wire to the ground rod. The neutral bus on the service switch shall be connected to the closest driven ground rod. Ground rods shall be 5/8-inch diameter by 10 feet long copper clad steel rods made by the molten welded process.

The ground clamp body shall be manufactured of forged cast or high-conductivity drawn copper alloy. Clamps shall provide high pressure contact directly between wire and rod by means of a set screw. The screw shall be of silicon bronze and shall have a square or hexagonal head.

Grounding of steel poles, posts, and pedestals shall be to ground rods in adjacent handholes.

#### 8-31.3(11) POLE LINE HARDWARE INSTALLATION (New Section)

Span wire shall be insulated above METRO trolley wires with plastic cable guard. The plastic cable guard shall extend a minimum of 4 feet past the nearest trolley wire. Plastic cable guard will be furnished by the City.

Span wire shall be secured to steel strain poles by means of pole bands, and to timber poles by means of single strand guy eye bolts. Pole bands and eye bolts shall be installed as detailed on the Drawings.

Span wire shall be secured to eye bolts or strain clamps at poles by the use of self-locking cable clamp type dead-ending devices. Span wire shall be secured to bull rings and anchors by the use of cable guy wrap and guy thimbles. Span wire shall be secured to strain insulators by the use of cable guy wraps.

Strain insulators shall be installed between all poles and on all down guys at a distance of 9 feet from the face of the pole.

Tether wire shall be mounted a minimum of 18 feet above the roadway.

On steel poles, no lag or through bolts shall be used. Bolts shall be installed by drilling and tapping.

#### 8-31.3(12) RELOCATING EQUIPMENT (New Section)

When existing equipment is to be relocated, the Contractor shall furnish and install all necessary new materials and equipment (including all hardware) required to install the salvaged equipment in the new installation. Any new hardware required to complete the installation shall be of the same quality and type as hardware required in these Specifications for all other new work.

All traffic signals, flashing beacons, and illuminated signs to be relocated shall be cleaned, relamped and refinished to the same condition as new equipment.

#### 8-31.4 MEASUREMENT (New Section)

Measurement for "Traffic Signal Controller (Description)" will be by each of the type specified.

Measurement for "Signal Head, (Type) (Description)" will be by each.

Measurement for "Pedestrian Pushbutton Assembly" will be by each.

Measurement for "Detector Loop, (Size)" will be by each complete installation.

Measurement for "Sign, Interior Illuminated (Size)" will be by each.

Measurement for "Sign Crosswalk, Illuminated" will be by each.

Measurement for "Interconnect Cable, (Type)," will be by linear foot.

Measurement for "Aerial Terminal Compartment" will be by each.

Measurement for "Signal Wiring, (Location)" will be by lump sum for each intersection.

Measurement for "Span Wire" will be by the linear foot.

Measurement for "Span Wire, Catenary," will be by linear foot of span.

Measurement for "Relocate (Item)," will be by each, linear foot or lump sum as directed for the particular item on the Bid Form.

#### 8-31.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 8-31 will be at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Traffic Signal Controller, (Description)," each.
- (2) "Signal Head, (Type) (Description)," each.
- (3) "Pedestrian Push Button Assembly," each.
- (4) "Detector Loop, (Size)," each.
- (5) "Sign, Interior Illuminated (Size)," each.
- (6) "Sign, Crosswalk, Illuminated," each.
- (7) "Interconnect Cable, (Type)," per linear foot.
- (8) "Aerial Terminal Compartment," each.
- (9) "Signal Wiring, (Location)," lump sum.
- (10) "Span Wire," per linear foot.
- (11) "Span Wire, Catenary," per linear foot.
- (12) "Relocate (Item)," each.
- (13) "Relocate (Item)," linear foot.
- (14) "Relocate (Item)," lump sum.

The unit contract price for "Traffic Signal Controller (Description)" shall include all costs for the work required to furnish and install the Controller, including but not limited to cabinets, all circuiting, equipment and internal wiring, manufacturer's testing and the pedestal for Type I cabinets.

The unit contract price for "Signal Head, (Type) (Description)" shall include all costs for the work required to furnish and install the Signal Head, including all mounting hardware for the mounting specified, installation, alignment, testing; and when specified, bimodal fiber optic arrow lens, installation of City-furnished interior illuminated traffic sign, louvers, and programming as may be required.

The unit contract price for "Pedestrian Push Button Assembly" shall include all costs for the work required to furnish and install the Pedestrian Push Button Assembly, including the button and housing, 1 or 2 directional signs as specified, and required mounting hardware. Pedestrian push button posts and foundations will be paid per Section 8-32.5.

The unit contract price for "Detector Loop (Size)" shall include all costs for the work required to saw cut the pavement and furnish and install the Loop Detector wire and conduit, including lead-in cable to the first handhole from the loop, rope, tar, splices, hardware, and restore the pavement surface as specified in Section 8-31.3(5)A herein.

The unit contract price for "Sign, Interior Illuminated (Size)," shall include all costs for the work required to furnish and install the Interior Illuminated Sign, including all mounting hardware and sign wiring.

The unit contract price for "Sign, Crosswalk, Illuminated," shall include all costs for the work required to furnish and install the Illuminated Crosswalk Signal, including all mounting hardware, photoelectric cell installed on a photoelectric control mounting bracket, service wiring, and sign wiring as indicated on the Drawings and in the Specifications.

The unit contract price for "Interconnect Cable (Type)" shall include all costs for the work required to furnish and install the cable in conduits or on poles, and shall include all hardware taps and splices for a complete, interconnected system as specified.

The unit contract price for "Aerial Terminal Compartment" shall include all costs for the work required to furnish and install the compartment, and shall include mounting hardware and sealing for a complete compartment as specified.

The lump sum payment for "Signal Wiring (Location)" shall include all costs for the work required to furnish and install all signal wiring at the intersection indicated, including signal lead wiring, push-button wiring, sign (attached to signal) wiring, service wiring, and loop lead-in wiring to the last handhole before the loop. Interconnect cable wiring will be included in payment for Interconnect Cable. Internal controller wiring will be included in payment for controller.

The unit contract price for "Span Wire" and "Span Wire, Catenary," shall include all costs for the work required to furnish and install the spanwire, including wire, clamps, insulators and all hardware for the span wire installation complete.

The unit contract price for "Relocate (Item)," shall include all costs for the work required to remove and reinstall the item, including hardware and rehabilitating signals and signs if required.

Existing materials required to be relocated and found to be unsatisfactory by the Engineer shall be replaced by new material and the cost thereof will be paid for as extra work per Section 1-09.4.

Measurement for "Pedestrian Pushbutton Assembly" will be by each.

Measurement for "Detector Loop, (Size)" will be by each complete installation.

Measurement for "Sign, Interior Illuminated (Size)" will be by each.

Measurement for "Sign Crosswalk, Illuminated" will be by each.

Measurement for "Interconnect Cable, (Type)," will be by linear foot.

Measurement for "Aerial Terminal Compartment" will be by each.

Measurement for "Signal Wiring, (Location)" will be by lump sum for each intersection.

Measurement for "Span Wire" will be by the linear foot.

Measurement for "Span Wire, Catenary," will be by linear foot of span.

Measurement for "Relocate (Item)," will be by each, linear foot or lump sum as directed for the particular item on the Bid Form.

#### 8-31.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 8-31 will be at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Traffic Signal Controller, (Description)," each.
- (2) "Signal Head, (Type) (Description)," each.
- (3) "Pedestrian Push Button Assembly," each.
- (4) "Detector Loop, (Size)," each.
- (5) "Sign, Interior Illuminated (Size)," each.
- (6) "Sign, Crosswalk, Illuminated," each.
- (7) "Interconnect Cable, (Type)," per linear foot.
- (8) "Aerial Terminal Compartment," each.
- (9) "Signal Wiring, (Location)," lump sum.
- (10) "Span Wire," per linear foot.
- (11) "Span Wire, Catenary," per linear foot.
- (12) "Relocate (Item)," each.
- (13) "Relocate (Item)," linear foot.
- (14) "Relocate (Item)," lump sum.

The unit contract price for "Traffic Signal Controller (Description)" shall include all costs for the work required to furnish and install the Controller, including but not limited to cabinets, all circuiting, equipment and internal wiring, manufacturer's testing and the pedestal for Type I cabinets.

The unit contract price for "Signal Head, (Type) (Description)" shall include all costs for the work required to furnish and install the Signal Head, including all mounting hardware for the mounting specified, installation, alignment, testing; and when specified, bimodal fiber optic arrow lens, installation of City-furnished interior illuminated traffic sign, louvers, and programming as may be required.

The unit contract price for "Pedestrian Push Button Assembly" shall include all costs for the work required to furnish and install the Pedestrian Push Button Assembly, including the button and housing, 1 or 2 directional signs as specified, and required mounting hardware. Pedestrian push button posts and foundations will be paid per Section 8-32.5.

The unit contract price for "Detector Loop (Size)" shall include all costs for the work required to saw cut the pavement and furnish and install the Loop Detector wire and conduit, including lead-in cable to the first handhole from the loop, rope, tar, splices, hardware, and restore the pavement surface as specified in Section 8-31.3(5)A herein.

The unit contract price for "Sign, Interior Illuminated (Size)," shall include all costs for the work required to furnish and install the Interior Illuminated Sign, including all mounting hardware and sign wiring.

The unit contract price for "Sign, Crosswalk, Illuminated," shall include all costs for the work required to furnish and install the Illuminated Crosswalk Signal, including all mounting hardware, photoelectric cell installed on a photoelectric control mounting bracket, service wiring, and sign wiring as indicated on the Drawings and in the Specifications.

The unit contract price for "Interconnect Cable (Type)" shall include all costs for the work required to furnish and install the cable in conduits or on poles, and shall include all hardware taps and splices for a complete, interconnected system as specified.

The unit contract price for "Aerial Terminal Compartment" shall include all costs for the work required to furnish and install the compartment, and shall include mounting hardware and sealing for a complete compartment as specified.

The lump sum payment for "Signal Wiring (Location)" shall include all costs for the work required to furnish and install all signal wiring at the intersection indicated, including signal lead wiring, push-button wiring, sign (attached to signal) wiring, service wiring, and loop lead-in wiring to the last handhole before the loop. Interconnect cable wiring will be included in payment for Interconnect Cable. Internal controller wiring will be included in payment for controller.

The unit contract price for "Span Wire" and "Span Wire, Catenary," shall include all costs for the work required to furnish and install the spanwire, including wire, clamps, insulators and all hardware for the span wire installation complete.

The unit contract price for "Relocate (Item)," shall include all costs for the work required to remove and reinstall the item, including hardware and rehabilitating signals and signs if required.

Existing materials required to be relocated and found to be unsatisfactory by the Engineer shall be replaced by new material and the cost thereof will be paid for as extra work per Section 1-09.4.



**SECTION 8-32 - POLES, PEDESTALS AND FOUNDATIONS (New Section)****8-32.1 DESCRIPTION (New Section)**

The work consists of furnishing and installing poles, luminaire extensions, pedestals, posts, mastarms, concrete foundations and back guy assemblies as indicated on the Drawings and specified herein.

**8-32.1(1) APPLICABLE CODES (New Section)**

See Section 8-30.1(2) for applicable codes.

**8-32.1(2) SHOP DRAWINGS (New Section)**

The Contractor shall submit shop drawings in accordance with Section 1-05.3 for the following material:

- (a) All metal poles
- (b) Ornamental nut covers
- (c) Mast arms
- (d) Luminaire extensions
- (e) Anchor bolts, nuts, washers
- (f) Bolt extenders
- (g) Pedestals

All strain poles or street light only poles which deviate from the Drawings shall include certification by a Licensed Professional Engineer that the metal poles meet all structural requirements of Section 9-33.

**8-32.1(3) GUARANTEE (New Section)**

All labor, materials, and equipment supplied under this Specification shall be guaranteed against defective workmanship and material for a period as indicated in Section 1-05.10. The Contractor shall be responsible for the return and replacement cost of any material or equipment found to be defective within the guarantee period, including labor, freight, shipping and delivery costs. All material returned to the supplier under the guarantee shall be repaired or replaced and returned to the City of Seattle within 30 days of receipt.

**8-32.2 MATERIALS (New Section)**

Materials shall meet the requirements of the following Sections of these specifications:

- Concrete for foundation . . . . . 5-06
- Poles, Pedestals, and Foundations . . . . . 9-33
- Back Guy Assemblies . . . . . 9-33

All poles will be subject to inspection at the point of manufacture and at the point of delivery. Inspection and acceptance at the point of manufacture shall not relieve the Contractor from obligation to furnish material in accordance with the Specifications.

**8-32.3 CONSTRUCTION REQUIREMENTS (New Section)****8-32.3(1) POLES (New Section)****8-32.3(1)A GENERAL (New Section)**

The Contractor shall lay out pole locations and grades as indicated on the Drawings. Poles shall be located to provide a minimum of 3 feet clearance from the face of the curb.

Poles shall be handled in loading, unloading and erecting in such a manner that they will not be damaged.

Field repair of galvanized surfaces shall be accomplished by coating with a heated zinc alloy solder to a minimum thickness of 2 mils per ASIM A 780.

The Contractor shall repair or replace all rejected poles at his own expense. Any parts of metal poles that are damaged due to Contractor's operations shall be repaired or replaced at his own expense.

**8-32.3(1)B METAL POLES AND PEDESTALS (New Section)**

Poles shall not be erected before concrete foundations have set 7 days. Poles shall not be loaded before concrete foundations have set 28 days.

Signal related poles shall not be grouted until after turn-on or cut-over.

Leveling nuts shall be used on all metal poles. Leveling nuts and washers shall be placed on anchor bolts to allow approximately 1 inch of dry pack mortar under the leveling nut. Poles shall be placed on the bolts and the leveling nuts and washers. The leveling and locking nuts and washers shall then be adjusted to plumb the pole.

The pole shall be raked before loading such that it will be plumb after all loads have been applied. Plumb shall be defined as the condition existing when 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 plus or minus 0.17 inches per foot of pole height above the ground will be permitted with the exception that in no case shall the pole lean toward the street. Locking nuts shall 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 shall be placed around the periphery of the anchor bolts and leveling nuts, then dry pack mortar shall 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. Dry pack mortar shall be sloped at approximately 60 degrees away from the base plate. Mortar shall consist of a 1:3 mixture of cement and fine sand with just enough water so that the mixture will stick together on being molded into a ball by the hand and will not exude free moisture when so pressed. There shall be a 3/4 inch drain tube in the mortar on the lowest side of the base to provide drainage from within the pole or pedestal.

Installation of pedestals shall meet the same requirements for installing pole, except raking will not be required.

All metal lighting poles shall be numbered for identification in accordance with numbering set forth on the Drawings by utilizing 3-inch Series "C" numbers. The light pole number shall be 3 feet above the concrete base oriented 45 degrees from the place of the bracket arm in the direction of approaching traffic. All numbers shall be clearly visible to approaching motorists. Paint for the numbering shall be black alkylid gloss enamel meeting Federal Specification TT-E-489. Numbers shall be applied over a compatible primer. An alternative application of a nonreflective lettering film with a pressure sensitive, self-adhering adhesive back may be used when approved by the Engineer.

**8-32.3(1)C WOOD POLES (New Section)**

Wood poles shall be set at the depth indicated in the following table:



## RECOMMENDED POLE SETTING DEPTH

Length of Pole (Feet)	Minimum Set Depth in Earth (Feet)	Set Depth in Rock (Feet)
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, the space around the pole shall be backfilled with selected earth or sand, free of rocks and other deleterious material, placed in layers approximately 4 inches thick. Each layer shall be moistened and thoroughly compacted. The poles shall be raked as necessary to be plumb as defined in Section 8-32.3(1)B after loading.

## 8-32.3(2) FOUNDATIONS (New Section)

## 8-32.3(2)A GENERAL (New Section)

Foundations shall be Class 5 (1 1/2) concrete and be of the size and configuration indicated on the Drawings. Foundations shall be constructed in undisturbed ground by placing concrete in auger-bored holes or rectangular holes. Concrete shall be placed against undisturbed earth. In unstable ground, metal forms may be used for the top 18 inches of foundation. Each foundation shall be poured in one continuous pouring operation. For purposes of this requirement, delays of more than 20 minutes are not acceptable as one continuous pour.

Anchor bolts shall be set securely in place and held in a vertical position with the specified bolt projection and at the specified bolt circle to match the exact hole pattern of the item to be installed. The top of the bolts shall all be at the same elevation. A steel template shall be used at the lower end and a wood or steel template shall be used at the upper end of the anchor bolt to maintain the correct bolt pattern and spacing. The lower template shall be bolted or welded to the anchor bolt and left in the foundation. Anchor bolts shall not be bent or cut after fabrication. Bending of anchor bolts shall be cause for rejection and removal of entire foundation.

Prior to placing concrete, all projecting anchor bolts shall be taped with a corrosion protection tape from a point 6 inches below the top of the foundation to the top of the bolt. Tape shall be per Material Standard 7367.3 and shall remain permanently in place. Nuts and washers shall be installed over the tape. Immediately after concrete is placed, the location of the anchor bolts shall be checked with a template conforming to the bolt pattern of the bases of the poles. Concrete shall be cleaned from anchor bolts and conduit after the concrete is placed. Concrete shall be float-finished, edged and brushed where necessary. Bending anchor bolts after concrete has set will not be allowed.

## 8-32.3(2)B CONTROLLER FOUNDATIONS (New Section)

Anchor bolts shall be the size specified by the controller manufacturer. A bead of waterproof sealant shall be installed under the lip of the controller cabinet prior to installing the cabinet to prevent moisture penetration.

Tops of the controller foundations shall be level with 6-inch minimum height above the adjacent surface.

A 3/4-inch diameter tubular drain hole shall be installed in all concrete foundations for signal controllers Type II and III.

## 8-32.3(2)C POLE, PEDESTAL AND PEDESTRIAN PUSH-BUTTON POST FOUNDATIONS (New Section)

Reinforcing steel shall be kept 2 inches clear on all sides of the foundation, and shall be set securely in place.

Where the foundation is in a paved area such as a sidewalk, the foundation shall be held 3-1/2 inches below and parallel to finish grade. Top of the foundation shall be given a float finish. The paving material shall then be placed over the top of the foundation to match the contour and finish of the adjacent surface.

Where the foundation is in an unpaved area, the top 6 inches of concrete shall be formed in a square form. The top of the square shall be 1 inch above the surrounding surface.

Each foundation shall be constructed with 2 conduit entries. If only 1 conduit entry is indicated on the Drawings, a second shall be installed in the foundation and stubbed out 18 inches from the foundation directed the opposite direction of the first, unless directed otherwise by the Engineer.

Conduits shall extend a minimum of 3 inches above final grade. The ground rod (where required) shall extend a maximum of 6 inches above final grade. Anchor bolts shall be installed with sufficient projection above the foundation to allow for a minimum of 3 threads above the upper nut. Where inadequate projection is provided, bolt extenders shall be utilized or complete removal and replacement of the foundation shall be required.

A 13-1/2 inch bolt circle shall be maintained on all Pedestal anchor bolts.

## 8-32.3(3) BACK GUY ASSEMBLIES (New Section)

Back guy assemblies for wood poles shall be constructed in accordance with details on the Standard Plans.

All thru bolts shall be properly trimmed and treated.

## 8-32.3(4) RELOCATING EQUIPMENT (New Section)

When equipment is to be relocated, the Contractor shall furnish and install all necessary materials and equipment (including all hardware) required to complete the new installation. Any new hardware required to complete the installation shall be of the same quality and type as hardware required in these specifications for other new work.

## 8-32.4 MEASUREMENT (New Section)

Measurement for poles, luminaire extensions, mast arms, pedestals, posts, foundations, back-guy assemblies, or a relocation of any of these items will be by each of the type and size specified in the Bid Form, as applicable. Davit poles and the attached davit arm will be measured per each as a combined unit.

## 8-32.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 8-32 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Pole, Steel Strain (Type)", each.
- (2) "Pole, Steel Strain Davit (Type) w/(Length) Arm", each.
- (3) "Pole, Steel Lighting (Length)", each.
- (4) "Pole, (Mat'l.) Lighting Davit (Length) w/(Length) Arm," each.
- (5) "Pole, Aluminum, (Length)," each.
- (6) "Pole, Wood, (Length)," each.
- (7) "Luminaire Extension," each.
- (8) "Mast Arm (Size)," each.
- (9) "Pedestal, Steel, (Length)," each.
- (10) "Pedestrian Push-Button Post," each.
- (11) "Foundation, (Use)," each.
- (12) "Back Guy Assembly," each.

(13) "Relocate (Item)," each.

The unit contract price for "Pole, Steel (Type)," and "Pole, Aluminum (Length)" shall include all costs for the work required to furnish and install the pole, including handhole, bracket arm flange and bolts, base plate, all necessary hardware, raking, plumbing, and grouting.

The unit contract price for "Pole, Steel Strain Davit (Type) with (Length) Arm" and "Pole, (Material) Lighting Davit (Length) with (Length) Arm" shall include all costs for the work required to furnish and install the pole, the extension arm, including handhole, steel pole extension tenon, steel pole luminaire tenon, welding, base plate, all necessary hardware, raking, plumbing, and grouting.

The unit contract price for "Pole, Wood (Length)," shall include all costs for the work required to furnish and install the wood pole, including excavation, backfill material, and compaction.

The unit contract price for "Mast Arm, (Length)" shall include all costs for the work required to furnish and install the mast arm with all necessary hardware, fittings and end cap.

The unit contract price for "Pedestal, Steel, (Length)," shall include all costs for the work required to furnish and install the Pedestal, and shall include installation, plumbing, raking and all hardware as detailed on the Drawings.

The unit contract price for "Pedestrian Push-Button Post," shall include all costs for the work required to furnish and install the post, including all drilling and tapping, plumbing, steel pipe, pipe cap, "meter collar", grout, pipe flange, and all required hardware.

The unit contract price for "Foundation, Traffic Signal Controller (Type)," and "Foundation, (Use)," shall include all costs for the work required to construct the foundation in place as specified and detailed on the Plans, including excavation, backfill, forming, concrete, reinforcing steel, anchor bolts, ground rods, washers, nuts, nut covers, grout and drainage hardware as specified.

The unit contract price for "Back Guy Assembly," shall include all costs for the work required to furnish and install the Back Guy Assembly, and shall include installation of all guy cable, hardware, insulators, pipe, fittings, and anchor as detailed on the Standard Plans.

The unit contract price for "Relocate (Item)" shall include all costs for the work required to remove and reinstall the item, including hardware and rehabilitation as required.

When installation of a new pole, pedestal, or post disturbs existing surface improvements that will remain, the cost of surface restoration will be included in the unit contract price of the pole, pedestal, or post as appropriate. No separate payment will be made.

Payment for the work to be performed shall be full compensation for all labor, material, equipment and incidentals necessary to complete the work as specified or shown on the Drawings.

## SECTION 8-33 - CONDUIT AND TRENCHING (New Section)

## 8-33.1 DESCRIPTION (New Section)

The work consists of conduit trenching, and furnishing and installing conduit, conduit, conduit junction boxes, and handholes as indicated on the Drawings and as specified in these Specifications.

## 8-33.1(1) APPLICABLE CODES (New Section)

Installation of conduit shall conform to appropriate articles of the National Electric Code (NEC), the Seattle Electrical Code and these Specifications.

## 8-33.1(2) SHOP DRAWINGS (New Section)

The Contractor shall submit Shop Drawings for the following in accordance with Section 1-05.3:

Conduit and Fittings  
Condulets Junction Box  
Stand-off Brackets  
Brackets used in the CSO structure  
Expansion Fittings  
Weatherhead  
Seals and Sealing Compounds  
Galvanizing Repair Material  
PVC Coatings to be field installed  
Handholes  
Flexible Conduit

## 8-33.2 MATERIAL (New Section)

Materials shall meet the requirements of the following sections of these specifications:

Conduits . . . . . 9-34  
Handholes . . . . . 9-34.4  
Paint . . . . . 9-08

## 8-33.3 CONSTRUCTION DETAILS (New Section)

## 8-33.3(1) GENERAL (New Section)

Conduit shall be installed as noted on the Drawings. When installing conduit under existing pavement or sidewalks, removal shall meet the requirements of Sections 2-02.3(3)A, 2-02.3(3)C, and Section 2-02.3(3)F respectively. Pavement and restoration shall conform with the requirements of Sections 5-07 and 8-14 respectively. Conduit and fittings within CSO structures and sewer pump station wet wells shall be considered to be in Class I environment. All construction shall be in compliance with Article 501 of N.E.C.

## 8-33.3(1)A TRENCHING (New Section)

Excavation required for the installation of conduit, foundations, and other materials shall be performed in such a manner as to cause the least possible injury to the streets, sidewalks, and other improvements. Trenches shall not be excavated wider than necessary for the proper installation of the electrical appliances and foundations. The material from the excavation shall be placed where the least interference to vehicular and pedestrian traffic and to surface drainage will occur.

Excavating shall not be performed until immediately before installation of conduit and other materials. Excavation after backfilling shall be kept well filled and maintained in a smooth and well drained condition until permanent repairs are made. Work shall be scheduled to permit placing of conduit prior to paving or landscaping operations.

The Contractor shall take any necessary steps to keep excavated native material from becoming saturated beyond the critical moisture limits. Native excavated material shall be protected from weather and

contamination by waterproof sheeting or other means approved by the Engineer. When otherwise suitable native backfill material from the trench excavation becomes unsuitable due to failure by the Contractor to protect the material from moisture or contamination, the Contractor shall backfill the trench with Mineral Aggregate Type 17 at his own expense. In general, backfill material from excavation shall be free of large or frozen lumps, wood or other extraneous material and of a quality acceptable to the Engineer.

If the trench is not backfilled the same day conduit is placed, one end of the conduit shall be left free until backfilling is started, or a rigid non-metallic conduit expansion joint shall be installed in the conduit run.

At the end of each day's work and all other times when construction operations are suspended, all equipment and other obstructions shall be removed from that portion of the roadway which may be required to be open for use by public traffic.

Special care shall be taken in backfilling tunnel sections used for conduit installations under existing pavement so that all voids are completely filled. Water saturated sand-pea gravel mixture Mineral Aggregate Type No. 5 may be used provided the space can be completely filled using vibrators.

Conduit shall be laid to provide a minimum of 24 inches of cover at street crossings, 36 inches cover under asphalt roadways, 48 inches of cover under the bottom of railroad ties (conduit under railroad tracks shall be rigid steel), and 18 inches of cover at all other locations, unless otherwise noted on the Drawings.

Bottom of trenches for all conduit shall be free of sharp irregularities which would cause damage to the PVC conduit coating and excessive bending of the conduit. The first 6 inches of backfill shall be free of rocks. The Engineer shall approve all conduit installations prior to backfilling the trench.

Trench backfilling shall be compacted to 95 percent of maximum density in accordance with Section 7-10.3(11) (COMPACTION OF BACKFILL). Optimum moisture content and maximum density will be determined in accordance with Section 2-03.3(14)D (COMPACTION CONTROL TESTS).

#### 8-33.3(2)A GENERAL (New Section)

Conduit shall be installed in the number, type, size and location indicated on the Drawings. Deviations from the locations indicated or relocations that may be required by field conditions shall be approved in writing by the Engineer prior to installation.

For conduit runs that deviate from the planned location and are to be buried in concrete structures such as floor slabs, retaining walls, abutments, or bridge superstructures, the Contractor shall be required to submit an "as-built plan" showing the new location of all the rough-in conduit to the Engineer prior to pouring the concrete. The as-built plan shall show the conduit run in red and be dimensioned to the nearest 1 inch.

Conduit runs parallel to curbs shall be placed adjacent to back of curb, or according to the details on the Drawings or the Appendix to the Project Manual, except where in conflict with existing facilities.

Changes of conduit direction shall be made with manufactured or fabricated elbows of radius not less than that noted in the NEC.

All conduit shall be thoroughly cleaned and a proper size mandrel pulled through it prior to installing wires or pull cord. Mandreling shall be done in the presence of the Engineer.

Existing conduit to be incorporated into a new system shall be cleaned with a mandrel and a cylindrical wire brush and blown out with compressed air.

Suitable marker stakes or tacks shall be set flush with the ground to locate the ends of conduits which may be buried so that they may be located in the future.

Conduit entrances into metal junction boxes (Except NEMA 1) shall be drilled and tapped a minimum of 3 full threads for the size conduit used. Bosses shall be provided where the wall thickness is not sufficient for the minimum number of threads.

Entry to electrical vaults or other structures shall be made such that the physical integrity of the vault or structure is not impaired. Any hole for entry to vaults or structures shall be of a diameter no greater than 1-1/2 times the diameter of the conduit entering the vault.

Annular spaces around conduit, ground wire, ducts, at wall penetrations of vault or other structural walls shall be filled with 1:3 cement to fine sand dry pack mortar using just enough epoxy grout mixed

with an equal quantity of water so that the mortar mixture will stick together on being molded into a ball by hand and will not exude free moisture. Prior to placing the dry pack mortar, the annular surfaces of the spaces to be filled shall be given a thin continuous film of undiluted epoxy. Threaded inserts shall be coated with an approved rust preventative compound which is soluble in petroleum solvent.

Conduit entering through the bottom of a handhole shall be located near the end walls to leave the major portion of the box clear. Conduit shall enter from the direction of the run, terminating 6 to 8 inches below the handhole lid and near the box wall.

At locations designated by the Engineer, fittings shall be installed to provide a conduit channel that will permit freedom for installing the electrical control wires. When conduit fittings are indicated on the Drawings, or where their installation is required by the Engineer, the Contractor shall also furnish all necessary covers and gaskets. Expansion/deflection fittings shall be installed at all structure expansion joints.

Conduits shall be attached to walls and other surfaces (except poles) using one hole malleable iron pipe clamps and clamp backs.

Rigid steel conduit may be jacked or bored when approved by the Engineer in writing.

New conduit that does not have wire installed shall have a pull cord installed.

For hazardous areas as defined by the NEC, conduit entrances into metal junction boxes shall be drilled and tapped a minimum of 5 full threads for the size conduit used. Bosses shall be provided where the wall thickness is not sufficient for the minimum number of threads.

#### 8-33.3(2)B RIGID STEEL CONDUIT AND PVC-COATED RIGID STEEL CONDUIT (New Section)

When rigid steel conduit (RSC) is cut, the ends shall be made square and true with conventional pipe cutting equipment. Conduit shall be threaded with a standard conduit cutting die. Burrs and sharp corners at the end of each conduit shall be removed with a tapered reamer. Threads shall be cleaned of all metal, lubricants and red lead. Conduit shall be joined by the use of rigid steel conduit couplings. Slip joints or field cut running threads will not be permitted for coupling conduit. When a standard coupling cannot be used, a threaded union coupling shall be used upon approval of the Engineer. Conduit threads shall be coated with a conduit thread compound designed to ease assembly and disassembly, and to improve electrical conductivity. The compound shall be Appleton Company Type TLC-3 or approved equal. Conduit shall be tightened securely to prevent the entrance of moisture, concrete or other foreign material, and to provide a good electrical connection throughout the entire length of the conduit run. The method of tightening shall not damage the conduit or coupling. Where the coating on the conduit or the coupling has been damaged, it shall be thoroughly painted with galvanizing repair paint Federal Spec. MIL-P-21035 per the manufacturer's recommendations.

All bushings shall be of the insulated throat type. The entire conduit system shall be properly bonded and grounded in accordance with N.E.C.

Installation of the PVC-coated system shall be made in conformance with the following:

- (a) Coupling and Joining: All connections shall be made with strap wrenches. The conduit shall be pulled up until it is tight enough to be rigid and provide good electrical continuity. Over-tightening that results in gouging of the PVC coating will not be permitted. After each connection is completed, any gouges, cuts or abrasions shall be coated with approved touch-up compound. Solvent weld the sleeves to the conduit at each connection by applying touch-up compound to the PVC coating before screwing on the sleeve. Cutting off plastic sleeves shall be cause for rejection of that length of conduit.
- (b) Cutting: The conduit shall be tightened securely in a vise or chuck. The cut shall be made with a roll cutter or hack saw. When using either a jaw vise or a chain vise, the use of vise adaptors will be required. If vise adaptors are unavailable, a jaw vise shall be used and the portion of the coated conduit to be gripped in the vise shall be wrapped with emery cloth with the coarse side toward the conduit. The use of a chain vise without adaptors will not be permitted.
- (c) Threading: When using a hand threader, a tool with an adjustable guide shall be used. If the threader to be used does not have an adjustable guide, ream the stationary guide 0.10 inch to accommodate the plastic coating. Whittling of the PVC coating will not be permitted. After threading, apply touch-up compound to indentations made by the vise. Raw field cut threads shall be protected by the methods set forth above. For machine threading, the use of a threader designed for coated conduit shall be used.

- (d) Bending: PVC-coated conduit may be bent with conventional bending equipment, however, the internal walls of the shoes shall be machined out approximately 0.050 inch. Bending shall be accomplished by segmented bending rather than a one-shot bend. For sharp bends, saddles, or offsets, a PVC-coated hickey shall be required. Any cuts, gouges, or abrasions shall be coated with touch-up compound. Coating the exterior of the conduit, prior to bending, with a slippery substance such as wire-pulling compound will be permitted.
- (e) Touch-up: During the installation of the coated conduit, the Contractor shall assure that no metal is left exposed. Metal exposed as the result of field cuts shall be coated with touch-up compound. If in an emergency an uncoated accessory must be used, it should also be coated with touch-up compound. Nonspray type touch-up compound shall be used.
- (f) One hole malleable iron pipe strap, pipe spacers (clamp backs), and mounting brackets shall be PVC coated.

#### 8-33.3(2)C PVC CONDUIT (New Section)

PVC conduit shall be assembled with solvent welded joints in accordance with the manufacturer's written instructions. Bends and fittings shall be factory-produced when available.

#### 8-33.3(3) CONDUIT RISERS (New Section)

Conduit to be mounted on the outside face of metal poles shall be mounted by use of 3/4 inch stainless or galvanized steel band straps. After steel bands have been drawn tight, the ends shall be cut and folded under to eliminate protruding edges. Bands shall be placed a maximum of 3 feet apart.

Conduit less than 2 inches in diameter mounted on wood poles shall be mounted by use of 2-hole malleable conduit clamps spaced per N.E.C. A minimum of 2 clamps shall be used per length of conduit.

Conduit sized 2 inches and larger, or more than 1 conduit installed on wood poles, shall be installed using stand-off type brackets. Stand-off brackets shall be installed per N.E.C. with a 10 foot maximum spacing. Attachment shall be near the top of each 10 feet length of conduit.

All conduit risers shall be grounded with a ground clamp installed 8 feet above finished grade. Where conduit risers are connected to a ground rod, a ground rod handhole shall be provided as part of the conduit riser bid item.

The conduit shall be wrapped with corrosion protection tape conforming to Material Standard 7367.3, 8 inches above and below finished grade.

#### 8-33.3(4) HANDHOLES (New Section)

Handholes shall be precast concrete, and reinforced as indicated on Standard Plans 550. Handholes shall have covers with a slide-lock device. Covers shall be 5/16 inch thick steel having a 3-way raised pattern, and shall be hot-dip galvanized in accordance with ASTM A123. Covers shall be identified with 3 inch high letters "IC" clearly visible on the top wherever traffic control cables occupy the handhole or "SI" where the handhole is used by street lighting only. The marking shall be accomplished by welding or shall be cast onto the cover.

HH TYPE	INSIDE DIMENSIONS (INCHES)		
	Length	Width	Depth
1	19	14	12
2	28	17	12
3	36	24	36
4	24 inch round		
GRHH	8 inch round	10-12	

Type 4 handholes shall use a Type 230 frame and cover in accordance with Section 9-05.15 except that the word "ELECTRIC" shall be cast on the cover in lieu of "SEWER."

When required by the Drawings, handhole extensions shall be provided and installed at no additional cost.

Handholes shown on the Drawings, unless dimensioned, are located schematically, and shall always be located outside the pedestrian travel way unless directed otherwise by the Engineer.

#### 8-33.3(5) JACKING OR BORING (New Section)

Rigid steel conduit may be jacked or bored when approved by the Engineer. Rigid non-metallic type conduit may be installed under existing pavement if a hole larger than the conduit is predrilled and the conduit installed by hand.

#### 8-33.4 MEASUREMENT (New Section)

Measurement for "Conduit, (Type), (Size)," will be by the linear foot measured on the ground along the alignment of the conduit between center line of poles or to the 90° bend of a conduit riser, or equipment or to the inside face of handholes or vaults.

Measurement for "Trenching, Conduit," will be by the linear foot.

Measurement for "Conduit Riser, (Size)" will be by each from and including the weatherhead to and including the 90° rigid steel bend underground.

Measurement for "Handhole (Type)" will be by each.

Measurement for "Relocate Handhole" will be by each.

No separate measurement will be made for jacked or augered conduit. No measurement will be made for removal or restoration of surface improvements where the conduit is jacked or augered, but such measurement will be made at jacking pits and access holes in accordance with Section 2-02 and 5-07.

#### 8-33.5 PAYMENT (New Section)

Compensation for the cost necessary to complete the work described in Section 8-33 will be made at the unit contract prices bid only for the pay items listed or referenced below:

- (1) "Conduit, (Material), (Size)," per linear foot.
- (2) "Trenching, Conduit," per linear foot.
- (3) "Conduit Riser, (Size)," each.
- (4) "Handhole (Type)," each.
- (5) "Relocate Handhole," each.

The unit contract price for "Conduit, (Type), (Size)" shall include all costs for the work required to furnish and install the conduit in the trench, and shall include all bends, fittings and hardware required.

Where conduit is jacked or augered, payment will be made for conduit trenching that would have been required had the conduit been placed in open cut.

The unit contract price for "Trenching, Conduit" shall include all costs for the work required to excavate, backfill with native material, and compact the trench section for the installation of conduit, including trenching for conduit riser. Backfill from sources other than the trench excavation required due to the unsuitability of native material will be paid for separately per Section 4-01.5, unless the native material is determined by the Engineer to be unsuitable due to the Contractor's not meeting the requirements for protection from weather and contamination.

The unit contract price for "Conduit Riser (Size)" shall include all costs for the work required to furnish and install the complete riser, including all conduit, fittings, clamps and hardware from and including the weatherhead to and including the 90° rigid steel bend underground.

The unit contract price for "Handhole (Type)" shall include all costs for the work required to furnish and install the handhole, including excavation, backfill and compaction.

The unit contract price for "Relocate Handhole" shall include all costs for the work required to remove and reinstall the handhole, including hardware and rehabilitation as required.



# DIVISION 9

## MATERIALS

Note: Delete all references to "F" and replace with "°F" in the following sections: 9-02.1(2), 9-02.1(3), 9-02.1(4), 9-02.1(8), 9-02.2(1), 9-04.1(2), 9-04.1(3), 9-04.2(2), 9-04.5, 9-04.10(2), 9-08.2, 9-08.4(8), 9-09.3(2)B, 9-09.3(2)D, 9-09.3(2)E, 9-09.3(2)F, 9-18.1(4), 9-18.1(6), 9-23.2, 9-26.1, 9-26.2(3).

## SECTION 9-00 DEFINITIONS AND TESTS

### 9-00.7 GALVANIZED HARDWARE, ASTM DESIGNATION A153

The first sentence of the first paragraph of this section is revised to read:

An acceptable alternate to hot dip galvanizing in accordance with ASTM A153 will be zinc coatings mechanically deposited in accordance with ASTM B695, providing (1) the minimum thickness of zinc coating is not less than that specified in ASTM A153, and (2) the process will not produce hydrogen embrittlement in the base metal.

## SECTION 9-01 - PORTLAND CEMENT

### 9-01.2 SPECIFICATIONS

Change all references to "Na<sub>2</sub>O" and "K<sub>2</sub>O" in Section 9-01.2 and its subsections to read "Na<sub>2</sub>O" and "K<sub>2</sub>O" respectively.

#### 9-01.2(3) LOW-ALKALI

Delete this section and replace with the following:

The percentage of alkalis in low-alkali cement shall not exceed 0.60 percent by weight calculated as Na<sub>2</sub>O plus 0.658 K<sub>2</sub>O. This limitation shall apply to all types of portland cement. Percentage of alkalis shall be determined in accordance with ASTM Designation C114.

## BITUMINOUS MATERIALS

9-02

## SECTION 9-02 - BITUMINOUS MATERIALS

### 9-02.1(3) RAPID CURING (RC) LIQUID ASPHALT

Section 9-02.1(3) is revised as follows:

Under the column labeled "RC-250", the volume percent of total distillate to 437 F is revised to 35.

Under the column labeled "RC-800", the volume percent of total distillate to 437 F is revised to 15.

### 9-02.1(5) REJUVENATING (RECYCLING) AGENTS (New Section)

The rejuvenating agent shall be a liquid emulsion of selected resin petroleum oil approved for use by the Seattle Materials Testing Laboratory. Rejuvenating agents shall meet the following specifications for the grade designated:

Test	ASTM Test Method	HOT MIX RECYCLING AGENTS <sup>1</sup>							
		RA 5		RA 25		RA 75		RA250	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Viscosity @ 140°F cst	D2170 or	200	800	1000	4000	5000	10,000	15,000	40,000
Flashpoint, °C, °F	D92	400	—	425	—	450	—	450	—
Saturates, Wt. %	D2007	—	30	—	30	—	30	—	30
Residue from RTFC Oven test at 325°F	D2872 <sup>2</sup>	—	—	—	—	—	—	—	—
Viscosity Ratio <sup>3</sup>	—	—	3	—	3	—	3	—	3
RTFC Oven Weight Change ± %	D2872 <sup>2</sup>	—	4	—	3	—	2	—	2
Specific Gravity	D70 or D1298	Report	Report	Report	Report	Report	Report	Report	Report

<sup>1</sup>The final acceptance of recycling agents meeting this specification is subject to the compliance of the reconstituted asphalt blends with the requirements in Section 27 for the class of asphalt mix required.

<sup>2</sup>The use of ASTM D1754 has not been studied in the context of this specification; however, it may be applicable. In cases of dispute, the reference method shall be ASTM D2872.

<sup>3</sup>Viscosity Ratio =  $\frac{\text{RTFC Viscosity at 140°F, cst.}}{\text{Original Viscosity at 140°F, cst.}}$

### 9-02.4 ANTI-STRIPPING ADDITIVE

Delete this section and replace with the following:

When directed by the Engineer, asphalt material shall be treated with an approved heat-stable anti-stripping additive. The anti-stripping additive shall be added to the asphalt at the point of shipment and shall be at the percentage designated by the Engineer, not to exceed 1 percent by weight of the asphalt. The anti-stripping additive shall be approved by the Materials Laboratory prior to use. Once designated for use on a specific project, the brand, grade or percentage of anti-stripping additive shall not be changed without the prior approval of the Engineer.



## 9-02.5 ASPHALT EMULSION (New Section)

The asphalt emulsion shall be cationic quick setting type (QCS-h) or latex modified cationic quick setting type (QCS-h-latex).

The emulsion shall be in accordance with the following requirements:

Test on emulsions:	QCS-h	QCS-h-latex
Furul Viscosity at 77° F. (Sec)	20-50	20-100
Residue by distillation	57% min.	58% min.
Sieve Test, retained on No. 20	0.10% max.	0.10% max.
pH	6.5 max.	6.5 max.
Settlement at 5 days	1% max.	3% max.
Particle Charge	Positive	Positive

Test on residue:

Penetration at 77° F. 100g., 5 sec.	40-110	40-90
Solubility in Trichloroethylene	97% min.	99% min.
Ductility at 77° F.	40 cm min.	44 cm min.

Emulsion shall pass all ASTM Specifications for Cationic Emulsified Mixing Grade Asphalts D 2397, and the ISSA TB 102 and 116 specifications for "Stripping" and "Quick Set Emulsified Asphalt Slurry Seal Systems." ISSA TB 114 "Wet Stripping Test for Cured Slurry Seal Mixes" shall also be applied to determine coating and compatibility with a given aggregate.

## 9-02.5A LATEX MODIFIED EMULSION (New Section)

In addition to the properties for QCS-h-latex above, the latex modified emulsion shall have added to it a bituminous binder. The binder shall be vinyl-acrylic copolymer latex meeting the following requirements:

Non-Volatile, %	54-56	
Viscosity, cps Brookfield, 60 RPM	300-1300	
pH		4-6
Particle size, microns	0.4 average	
Free vinyl acetate, %	Less than 0.6	
Odor		Very Slight
Specific gravity	1.8	
Lbs/Gal.		9.0

Proportion to Asphalt Emulsion: 0-10% by weight - depending on aggregate and job demands.

## SECTION 9-03 - AGGREGATES

## 9-03.0 GENERAL (New Section)

Mineral aggregates most commonly used for backfill purposes have been given an aggregate type number to identify each particular aggregate. Requirements for mineral aggregates identified by a type number are contained in the sections beginning with 9-03.9 through the Mineral Aggregate Chart listed in section 9-03.16.

Mineral aggregates shall be uniform in quality, essentially free from various types of wood waste or other objectionable or extraneous material, and obtained only from sources approved by the Engineer. Written requests for source approval shall be submitted to the Engineer not less than 10 days prior to the intended use of the mineral aggregate. Should the proposed source be one the Engineer is unfamiliar with, the Engineer reserves the right to take preliminary samples and make preliminary tests at the proposed source prior to approval. Continued approval of a source is contingent upon the mineral aggregates from that source continuing to meet contract requirements.

Unless otherwise specified, mineral aggregates shall meet the requirements for grading and quality when delivered to the project site. The exact point of acceptance will be determined in the field by the Engineer.

## 9-03.1(2)A DELETERIOUS SUBSTANCES

Delete this section and replace with the following:

The amount of deleterious substances in the washed aggregate shall not exceed the following values:

- (1) Particles of specific gravity less than 1.95 not greater than 1.0 percent by weight.
- (2) Organic matter, by colorimetric test, shall not be darker than the reference standard color ASTM Designation C40 unless other tests prove a darker color to be harmless.

## 9-03.1(2)B GRADING

Delete this section and replace with the following:

Fine aggregate shall be regularly graded from coarse to fine in two sizes and when separated by means of the U.S. Standard sieves shall meet the following grading requirements expressed as percentages by weight. Class 1 shall be used unless otherwise specified.

Acceptance of the grading and quality of the aggregates will be based on samples taken from the final mix. The exact point of acceptance will be determined in the field by the Engineer.

	Class 1		Class 2	
	Max.	Min.	Max.	Min.
% Passing No. 4	100	95	100	100
% Passing No. 6	98	82	100	93
% Passing No. 8	86	68	95	85
% Passing No. 16	65	47	80	63
% Passing No. 30	42	27	60	40
% Passing No. 50	20	9	30	15
% Passing No. 100	7	0	8	2
% Passing No. 200 (wet sieving)	2.5	0	2.5	0

In individual tests, variations under the minimum or over the maximum will be permitted as follows provided the average of 3 consecutive tests is within the above limits:

Sieve Number	Permissible Variation in Individual Tests
No. 30 and coarser	2.0 percent
No. 50 and finer	0.5 percent

## 9-03.1(2)C USE OF SUBSTANDARD GRADINGS

Delete the table in paragraph 2 and replace with the following:

Passing U.S. No. 8	95%
Passing U.S. No. 16	80%
Passing U.S. No. 30	60%
Passing U.S. No. 50	20%
Passing U.S. No. 200	2.5%

All percentages by weight.

## 9-03.1(3)C GRADING (New Section)

Supplement this section with the following:

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.

## 9-03.4(2) GRADING AND QUALITY

Delete paragraph 2 and the table under paragraph 2 and replace with the following:

Passing Sieve	Crushed Cover Stone %		Crushed Screening % Passing			
	Passing	5/8"-1/4"	5/8"-#10	1/2"-1/4"	3/8"-#10	1/4"-0"
3/4" Square	100	100	100	100	100	100
5/8" Square	95-100	95-100	95-100	95-100	100	100
1/2" Square	—	—	—	95-100	100	100
3/8" Square	—	—	—	—	90-100	100
1/4" Square	30-50	0-10	30-50	0-15	50-75	90-100
U.S. No. 10	—	0-3	0-10	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.	75	75	75	75	75	75
Sand Equivalent Min.	40	—	—	—	—	—
Static Stripping Test	Pass	Pass	Pass	Pass	Pass	Pass

## 9-03.6(2) GRADING (New Section)

Supplement this section with the following:

Acceptance of the grading and quality of the aggregates will be based on samples taken from the final mix.

## 9-03.8(2) TEST REQUIREMENTS

Delete this section and replace with the following:

Aggregate for asphalt concrete shall meet the following test requirements:

CLASS OF ASPHALT CONCRETE	B	D	E	F	G
Fracture, by weight (%)	Min. 90	95	50	50	95
Sand equivalent	Min. 45	45	45	35	45

When material is being produced and stockpiled for use on a specific contract or for a future contract, the fracture and sand equivalent requirements shall apply at the time of stockpiling. When material is used from a stockpile that has not been tested as provided above, the requirements for fracture and sand equivalents shall apply at the time of its introduction to the cold feed of the mixing plant.

The properties of the aggregate in a preliminary mix design for asphalt concrete shall be such that when it is combined within the limits set forth in Section 9-03.8(6) and mixed in the laboratory with the designated grade of asphalt, mixtures with the following test values can be produced:

CLASS OF ASPHALT CONCRETE	B	D	E	F	G
Stabilometer Value	Min. 35	—	35	35	35
Cohesimeter Value	Min. 100	—	100	50	100
% Air Voids	2-4.5	—	2-4.5	2-4.5	2-4.5
Modified Lottman Stripping Test	Pass	Pass	Pass	Pass	Pass

Mineral aggregates utilized in MC 250 and MC 800 asphalt concrete mixes shall meet the same requirements as the aggregates used in Asphalt Concrete Cl. B.

## 9-03.8(3)A GRADATION - FUTURE USE

Delete paragraph 1, and replace with the following:

Mineral aggregate for classes B, E and F asphalt concrete shall be produced or furnished in the following sizes as they apply to the class of asphalt concrete to be produced. Each size shall be stockpiled separately regardless of whether it is being produced for future work on other contracts or for immediate use. The aggregates produced shall meet the grading requirements set forth in the table below. Acceptance of the aggregate shall be based on gradation tests at the time of stockpiling.

## 9-03.9(1) BALLAST

Delete this section and replace with the following:

Roadway ballast shall be manufactured from ledge rock or talus obtained from sources approved by the Engineer. Roadway ballast shall meet the requirements of Section 9-03.16 for Mineral Aggregate Type 14.

That portion of roadway ballast retained on a 1/4 inch square sieve shall not contain more than 0.2 percent wood waste.

When approved by the Engineer, Mineral Aggregate, Type 1 or 2 may be utilized for roadway ballast in lieu of Mineral Aggregate, Type 14.

Ballast shall be a totally crushed material with no naturally occurring surfaces and shall apply to material retained on each sieve size 1/4 inch and above if that sieve retains more than 5 percent of the total sample.

## 9-03.9(2) SHOULDER BALLAST

Delete this section and replace with the following:

Shoulder ballast shall meet the requirements of Section 9-03.9(1) for ballast except the gradation shall meet the requirements of Section 9-03.16 for Mineral Aggregate, Type 13 or such other mineral aggregate manufactured from ledge rock or talus as may be specified by the Engineer or Contract Documents. The sand equivalent value and dust ratio requirements of Section 9-03.9(1) shall not apply.

## 9-03.9(3) CRUSHED SURFACING

Delete this section and replace with the following:

Except as otherwise specified below, crushed surfacing shall be manufactured from ledge rock or talus and shall meet the grading requirements of Section 9-03.16 for Mineral Aggregate Type 1, Type 2, and Type 3.

Crushed surfacing shall be a totally crushed material with no naturally occurring faces and shall apply to material retained on each sieve size No. 10 and above if that sieve retains more than 5 percent of the total sample.

The portion of crushed surfacing retained on a 1/4 inch square sieve shall not contain more than 0.15 percent wood waste.

Crushed surfacing may be manufactured from gravel if its use will meet the requirements set forth in Section 9-03.11 for Mineral Aggregate Type 1G and 2G.

#### 9-03.9(5) SAND FILLER (New Section)

Sand filler shall consist of naturally occurring sand grains, preferably angular, screened from natural deposits and meeting the requirements of Section 9-03.16 for Mineral Aggregate, Type 11.

#### 9-03.10 AGGREGATE FOR GRAVEL BASE

Delete this section and replace with the following:

Gravel base shall meet the requirements of Section 9-03.12(2) for Mineral Aggregate Type 17.

#### 9-03.11 CRUSHED GRAVEL (New Section)

Crushed gravel shall be manufactured by mechanically crushing clean, washed gravel, and shall meet the grading requirements of Section 9-03.16 for Mineral Aggregate Types 1G, 2G, and 21 through 24. The number of fractured surfaces and the minimum percent of crushed particles required to have the fractured surfaces specified are as follows:

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	1 or more	75%
23	1 or more	75%
24	2 or more	95%

Mineral Aggregate, Type 1G and Type 2G may be used as Top and Base Course in lieu of a Crushed Rock Type 1 and 2 only if:

- the Crushed Surfacing Mineral Aggregate Type 1G and 2G will be covered and confined completely with asphalt or cement concrete pavement; or
- confined within a trench; and
- costs shall be adjusted in accordance with Section 4-04.

Crushed gravel shall be substantially free from adherent coatings. The presence of a thin, firmly adhering film of weathered rock shall not be considered as coating unless it exists on more than 50 percent of the surface area of any size between successive laboratory sieves.

The portion of mineral aggregate retained on a 1/4 inch sieve shall not contain more than 0.1 percent wood waste by weight. The portion of material passing a U.S. No. 10 sieve shall not have wood waste that will result in more than 250 parts per million of organic matter by colorimetric tests when tested. The color shall be measured after the sample has been in the test solution one hour.

#### 9-03.12 GRAVEL BACKFILL

Delete this section and replace with the following:

Gravel backfill shall consist of crushed, partially crushed, or naturally occurring granular material depending on the type of mineral aggregate specified by the Engineer or the Contract Documents.

#### 9-03.12(1)A CLASS A (New Section)

Delete this section and replace with the following:

Gravel backfill for foundations, Class A, shall meet the requirements of Section 9-03.9 and 9-03.16 for Mineral Aggregate, Type 2 or Mineral Aggregate, Type 14, whichever is specified.

#### 9-03.12(1)B CLASS B (New Section)

Delete this section and replace with the following:

Gravel backfill for foundations, Class B shall conform to the requirements of Section 9-03.12(2) for Mineral Aggregate, Type 17.

#### 9-03.12(2) GRAVEL BACKFILL FOR WALLS

Delete this section and replace with the following:

Gravel backfill for walls shall consist of free draining sand and gravel from naturally occurring or screened sources; have such characteristics of size and shape that it will compact readily; and meet the requirements of Section 9-03.16 for Mineral Aggregate Type 17.

That portion of the material retained on a 1/4 inch square opening shall contain not more than 0.20 percent by weight of wood waste.

#### 9-03.12(3) GRAVEL BACKFILL FOR PIPE BEDDING

Delete this section and replace with the following:

Pipe bedding material shall meet the requirements of Section 9-03.16 for Mineral Aggregate Type 9 and Mineral Aggregate Type 22 as specified on the Drawings and the Standard Plans.

Pea gravel bedding, Mineral Aggregate, Type 9 shall consist of screened sand, gravel, or other inert materials, or combinations thereof, from sources approved by the Engineer. The aggregate shall have hard, strong, durable particles free from adherent coatings. The material shall be washed thoroughly to remove clay, loam, alkali, organic matter, or other deleterious substances. The amount of deleterious substances in the washed pea gravel shall not exceed values specified in Section 9-03.1(2)A.

Crushed gravel bedding, Mineral Aggregate, Type 22 shall be manufactured from screened crushed gravel. The finished product shall be clean, uniform in quality, and free from wood, bark, roots, and other deleterious materials. The crushed screenings shall be substantially free from adherent coatings. The presence of a thin, firmly adhering film of weathered rock shall not be considered as coating unless it exists on more than 50 percent of the surface area of any size between successive laboratory sieves. The portion of Mineral Aggregate, Type 22 retained on a 1/4 inch sieve shall not contain more than 0.1 percent deleterious materials by weight.

#### 9-03.12(4) GRAVEL BACKFILL FOR DRAINS

Delete this section and replace with the following:

Gravel backfill for drains shall meet the requirements of Section 9-03.1(3)A, 9-03.12(6), and 9-03.16 for Mineral Aggregate, Type 26 except the percent by weight passing the U.S. No. 200 sieve specified in Section 9-03.1(3)A shall not be greater than 2.0 percent.

#### 9-03.12(5) PIT RUN SAND AND GRAVELS (New Section)

Pit run sand and gravels shall consist of free draining granular materials obtained from naturally occurring deposits or manufactured from screened gravel.

Pit run sand shall meet the requirements of Section 9-03.16 for Mineral Aggregate Type 10.

Pit run sandy gravel shall meet the requirements of Section 9-03.16 for Mineral Aggregate Type 15.

#### 9-03.12(6) WASHED SAND AND GRAVELS (New Section)

Washed sand and gravels shall meet the gradation requirements of Section 9-03.16 for Mineral Aggregate, Types 4, 5, 6, 7, and 26, whichever is specified.

Washed sand and gravels shall consist of screened sand, gravel or other inert materials, or combinations thereof, from sources approved by the Engineer, having hard, durable particles free from

Crushed surfacing may be manufactured from gravel if its use will meet the requirements set forth in Section 9-03.11 for Mineral Aggregate Type 1G and 2G.

#### 9-03.9(5) SAND FILLER (New Section)

Sand filler shall consist of naturally occurring sand grains, preferably angular, screened from natural deposits and meeting the requirements of Section 9-03.16 for Mineral Aggregate, Type 11.

#### 9-03.10 AGGREGATE FOR GRAVEL BASE

Delete this section and replace with the following:

Gravel base shall meet the requirements of Section 9-03.12(2) for Mineral Aggregate Type 17.

#### 9-03.11 CRUSHED GRAVEL (New Section)

Crushed gravel shall be manufactured by mechanically crushing clean, washed gravel, and shall meet the grading requirements of Section 9-03.16 for Mineral Aggregate Types 1G, 2G, and 21 through 24. The number of fractured surfaces and the minimum percent of crushed particles required to have the fractured surfaces specified are as follows:

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	1 or more	75%
23	1 or more	75%
24	2 or more	95%

Mineral Aggregate, Type 1G and Type 2G may be used as Top and Base Course in lieu of a Crushed Rock Type 1 and 2 only if:

- the Crushed Surfacing Mineral Aggregate Type 1G and 2G will be covered and confined completely with asphalt or cement concrete pavement; or
- confined within a trench; and
- costs shall be adjusted in accordance with Section 4-04.

Crushed gravel shall be substantially free from adherent coatings. The presence of a thin, firmly adhering film of weathered rock shall not be considered as coating unless it exists on more than 50 percent of the surface area of any size between successive laboratory sieves.

The portion of mineral aggregate retained on a 1/4 inch sieve shall not contain more than 0.1 percent wood waste by weight. The portion of material passing a U.S. No. 10 sieve shall not have wood waste that will result in more than 250 parts per million of organic matter by colorimetric tests when tested. The color shall be measured after the sample has been in the test solution one hour.

#### 9-03.12 GRAVEL BACKFILL

Delete this section and replace with the following:

Gravel backfill shall consist of crushed, partially crushed, or naturally occurring granular material depending on the type of mineral aggregate specified by the Engineer or the Contract Documents.

#### 9-03.12(1)A CLASS A (New Section)

Delete this section and replace with the following:

Gravel backfill for foundations, Class A, shall meet the requirements of Section 9-03.9 and 9-03.16 for Mineral Aggregate, Type 2 or Mineral Aggregate, Type 14, whichever is specified.

#### 9-03.12(1)B CLASS B (New Section)

Delete this section and replace with the following:

Gravel backfill for foundations, Class B shall conform to the requirements of Section 9-03.12(2) for Mineral Aggregate, Type 17.

#### 9-03.12(2) GRAVEL BACKFILL FOR WALLS

Delete this section and replace with the following:

Gravel backfill for walls shall consist of free draining sand and gravel from naturally occurring or screened sources; have such characteristics of size and shape that it will compact readily; and meet the requirements of Section 9-03.16 for Mineral Aggregate Type 17.

That portion of the material retained on a 1/4 inch square opening shall contain not more than 0.20 percent by weight of wood waste.

#### 9-03.12(3) GRAVEL BACKFILL FOR PIPE BEDDING

Delete this section and replace with the following:

Pipe bedding material shall meet the requirements of Section 9-03.16 for Mineral Aggregate Type 9 and Mineral Aggregate Type 22 as specified on the Drawings and the Standard Plans.

Pea gravel bedding, Mineral Aggregate, Type 9 shall consist of screened sand, gravel, or other inert materials, or combinations thereof, from sources approved by the Engineer. The aggregate shall have hard, strong, durable particles free from adherent coatings. The material shall be washed thoroughly to remove clay, loam, alkali, organic matter, or other deleterious substances. The amount of deleterious substances in the washed pea gravel shall not exceed values specified in Section 9-03.1(2)A.

Crushed gravel bedding, Mineral Aggregate, Type 22 shall be manufactured from screened crushed gravel. The finished product shall be clean, uniform in quality, and free from wood, bark, roots, and other deleterious materials. The crushed screenings shall be substantially free from adherent coatings. The presence of a thin, firmly adhering film of weathered rock shall not be considered as coating unless it exists on more than 50 percent of the surface area of any size between successive laboratory sieves. The portion of Mineral Aggregate, Type 22 retained on a 1/4 inch sieve shall not contain more than 0.1 percent deleterious materials by weight.

#### 9-03.12(4) GRAVEL BACKFILL FOR DRAINS

Delete this section and replace with the following:

Gravel backfill for drains shall meet the requirements of Section 9-03.1(3)A, 9-03.12(6), and 9-03.16 for Mineral Aggregate, Type 26 except the percent by weight passing the U.S. No. 200 sieve specified in Section 9-03.1(3)A shall not be greater than 2.0 percent.

#### 9-03.12(5) PIT RUN SAND AND GRAVELS (New Section)

Pit run sand and gravels shall consist of free draining granular materials obtained from naturally occurring deposits or manufactured from screened gravel.

Pit run sand shall meet the requirements of Section 9-03.16 for Mineral Aggregate Type 10.

Pit run sandy gravel shall meet the requirements of Section 9-03.16 for Mineral Aggregate Type 15.

#### 9-03.12(6) WASHED SAND AND GRAVELS (New Section)

Washed sand and gravels shall meet the gradation requirements of Section 9-03.16 for Mineral Aggregate, Types 4, 5, 6, 7, and 26, whichever is specified.

Washed sand and gravels shall consist of screened sand, gravel or other inert materials, or combinations thereof, from sources approved by the Engineer, having hard, durable particles free from

adherent coatings. The materials shall be washed thoroughly to remove clay, loam, alkali, organic matter, or other deleterious substances. The amount of deleterious substances in the washed sand or gravel shall not exceed the values specified in Section 9-03.1(2)A for Mineral Aggregate, Types 6, 7, and 26 and Section 9-03.1(3)A for Mineral Aggregate, Types 4 and 5.

#### 9-03.14 GRAVEL BORROW

Delete this section and replace with the following:

Unless otherwise specified on the Drawings or in the Project Manual, gravel borrow shall meet the requirements of Section 9-03.12(2) and the grading requirements in Section 9-03.16 for Mineral Aggregate, Type 17.

If requested by the Contractor, the screen size may be increased if it is determined by the Engineer that larger size aggregate will be satisfactory for the specified backfilling or embankment construction.

#### 9-03.15 TEST METHODS FOR AGGREGATE

Supplement this section with the following:

TITLE	TEST METHOD
Mortar Strength	ASTM C109

Section 9-03.16 MINERAL AGGREGATE CHART														
Sieve Analysis-Percent Passing by Weight														
Aggregate No.	Use	Section	(Met. Sieving)	200	50	40	10	8	6	4	1/4	3/8	1/2	5/8
1/2" Minus	Crushed Rock	9-03.9(3)	0-10	.....	8-24	.....	.....	.....	.....	55-75	.....	.....	100	.....
5/8" Minus	Crushed Rock	9-03.9(11)	0-10	.....	8-24	.....	.....	.....	.....	55-75	.....	.....	100	.....
1-1/4" Minus	Base Course	9-03.9(3)	0-7.5	.....	3-18	.....	.....	.....	.....	30-50	.....	.....	50-80	.....
1-1/2" Minus	Base Course	9-03.9(11)	0-7.5	.....	3-18	.....	.....	.....	.....	30-50	.....	.....	50-80	.....
1/2" Minus	Crushed Rock	9-03.9(11)	0-7	.....	10-25	.....	.....	.....	.....	55-70	.....	.....	100	.....
1-1/2" Wash. Gravel	.....	.....	.....	.....	.....	.....	.....	.....	.....	0-20	.....	90-100	100	.....
1" Washed Gravel	.....	.....	.....	.....	.....	.....	.....	.....	.....	10-40	.....	80-100	100	.....
Washed Sand	.....	.....	.....	.....	.....	.....	.....	.....	.....	68-86 82-98	95-100	.....	.....	.....
Building Sand	.....	.....	.....	.....	.....	.....	.....	.....	.....	85-95 95-100	100	.....	.....	.....
3/8" Washed Gravel	Pipe Bedding	9-03.12(3)	0-3	.....	.....	.....	.....	.....	.....	95-100	.....	100	.....	.....
Pit Run Sand	Backfill	9-03.12(5)	0-10	.....	.....	.....	.....	.....	.....	90-100	100	.....	.....	.....
Sand Filler	.....	.....	.....	.....	.....	.....	.....	.....	.....	90-100	100	.....	.....	.....
2-1/2" Minus	Shoulder	9-03.9(2)	.....	.....	.....	.....	.....	.....	.....	0-5	.....	40-80	.....	.....
2-1/2" Minus	Ballast	.....	.....	.....	.....	.....	.....	.....	.....	30-50	.....	.....	65-100	100
Crushed Rock	Ballast	9-03.9(1)	0-9	.....	.....	.....	.....	.....	.....	50-85	.....	.....	.....	.....
Pit Run	Backfill	9-03.12(5)	0-10	.....	.....	.....	.....	.....	.....	20-40	.....	.....	.....	.....
Bank Run	Backfill	.....	.....	.....	.....	.....	.....	.....	.....	25-75	.....	.....	.....	.....
Bank Run	Select	9-03.12(2)	0-5	.....	.....	.....	.....	.....	.....	0-25	.....	45-70	85-100	.....
1-1/2" Cr. Gravel	Backfill	9-03.11	.....	.....	.....	.....	.....	.....	.....	0-25	.....	75-100	100	.....
5/8" Crushed Gravel	PVC and CMP	9-03.11	.....	.....	.....	.....	.....	.....	.....	70-100	.....	.....	.....	.....
1/2" Minus	Cover	9-03.11	2-12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1/2" Minus	Chip	9-03.11	0-3	.....	.....	.....	.....	.....	.....	25-55 50-90	98-100	100	.....	.....
3/4" Washed	Filler	9-03.12(4)	0-1	.....	.....	.....	.....	.....	.....	30-60	.....	.....	.....	.....



## 9-03.17 ROCK (New Section)

Rock for constructing new rock facings shall be large, broken pieces of igneous rock. Rock material shall be rectangular, selected pieces of rock sound and resistant to weathering. Rock shall be free of soft, weathered material and seams of soft rock susceptible to deterioration. When broken into pieces weighing 50 to 100 grams and tested for soundness with sodium sulfate in accordance with AASHTO T104, the loss through a 1 inch sieve after 6 cycles shall not exceed 35 percent by weight.

The density of rock material shall be a minimum of 160 pounds per cubic foot. The size categories for rock shall be as follows:

SIZE	APPROX. WEIGHT	MINIMUM DIMENSIONS	APPROX. VOLUME
One-man rock	160 to 400 lb	12 inches	1.75 cf
Two-man rock	500 to 800 lb	13 inches	4 cf
Three-man rock	900 to 1,200 lb	16 inches	6.6 cf
Four-man rock	1,300 to 1,600 lb	18 inches	9 cf

Rocks less than 1 cubic foot in volume or weighing less than 160 pounds shall not be used.

## SECTION 9-04 - JOINT AND CRACK SEALING MATERIALS

## 9-04.1(1) ASPHALT FILLER FOR CONTRACTION AND LONGITUDINAL JOINTS IN CONCRETE PAVEMENTS

Delete paragraph 1 and replace with the following:

Premolded joint filler for use in contraction and longitudinal joints shall be 3/8 inch in thickness and shall consist of a suitable asphalt mastic encased in asphalt-saturated paper or asphalt-saturated felt. It shall be sufficiently rigid for easy installation in summer months and not too brittle for handling in cool weather. It shall meet the following test requirements:

Premolded joint filler shall meet the requirements of ASTM Standard D994 or AASHTO Designation M33.

## 9-04.1(2) PREMOLDED JOINT FILLER FOR EXPANSION JOINTS

Delete this section and replace with the following:

Premolded joint filler for through joints shall be 3/4 inch thick and as wide as the depth of the pavement.

Premolded joint filler shall meet the requirements of ASTM Standard D1751 or AASHTO Designation M213.

## 9-04.2(2) POURED RUBBER JOINT SEALER

Delete this title and replace with the following:

## 9-04.2(2) POURED JOINT SEALER FOR PAVEMENT AREAS

Delete item (1) of paragraph 1 and replace with the following:

(1) Bond test methods shall be in accordance with WSDOT Test Method No. 412A.

## 9-04.2(3) POURED JOINT SEALER FOR WALKWAYS (New Section)

Poured joint sealer used to seal sawed joints in sidewalk, stairs, plazas, and other walkways shall be a polyurethane sealer conforming to the requirements of Federal Specification TT-8-00227E Type I (Self-leveling) Class A or Type II (Non-sag) Class A.

## 9-04.10 CRACK SEALING - RUBBERIZED ASPHALT

This section is supplemented with the following:

Rubberized asphalt for crack sealing asphalt concrete pavement shall conform to ASTM D-1190 and have a C.O.C. flash point (AASHTO T-48) of 400 minimum. During flash point testing, the rubberized asphalt shall be agitated carefully to prevent local over heating.

## SECTION 9-05 - DRAINAGE STRUCTURES, CULVERTS, AND CONDUITS

Delete the title of Section 9-05 and replace with the following:

## SECTION 9-05 - SANITARY SEWER AND STORM DRAIN STRUCTURES, CULVERTS, AND CONDUITS

## 9-05.1(1) CONCRETE DRAIN PIPE

Delete this section and replace with the following:

Concrete drain pipe shall meet requirements of ASTM Designation C14 Class 3 for pipe less than 12 inches in diameter; ASTM C76 Class IV for 12 and 15 inch diameter pipe; and ASTM C76 Class III for pipe 18 inches in diameter and larger, unless noted otherwise on the Drawings.

9-05.1(2) ZINC COATED (GALVANIZED) OR ALUMINUM COATED (ALUMINIZED)  
CORRUGATED IRON OR STEEL DRAIN PIPE

The last sentence is revised to read:

Welded seam aluminum coated (aluminized) corrugated iron or steel drain pipe with metallized coating applied inside and out following welding is acceptable.

## 9-05.1(2)A COUPLING BANDS

Delete paragraph 2 of this section and replace with the following:

Acceptable coupling bands for corrugated metal pipe shall 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, and be of the same material and corrugations as the pipe, and meet the requirements of Section 9-05.4(7).

## 9-05.1(3)A COUPLING BANDS

Delete paragraph 2 of this section and replace with the following:

Acceptable coupling bands for aluminum corrugated pipe shall 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, and be of the same material and corrugations as the pipe, and meet the requirements of Section 9-05.5(5).

## 9-05.1(4) ASBESTOS CEMENT DRAIN PIPE

This section is deleted.

## 9-05.1(5) POLYVINYL CHLORIDE (PVC) DRAIN PIPE

Delete this section and replace with the following:

Polyvinyl Chloride (PVC) drain pipe and fittings shall meet the requirements of ASTM D3034 SDR35 with restrained gasket joints.

## 9-05.2(1) PERFORATED ASBESTOS CEMENT UNDERDRAIN PIPE

This section is deleted.

9-05.2(4) ZINC COATED (GALVANIZED) OR ALUMINUM COATED (ALUMINIZED)  
CORRUGATED IRON OR STEEL UNDERDRAIN PIPE

The last sentence of the first paragraph is revised to read:

Welded seam aluminum coated (aluminized) corrugated iron or steel underdrain pipe with metallized coating applied inside and out following welding is acceptable.

## 9-05.3(1) PLAIN CONCRETE CULVERT PIPE

Delete this section and replace with the following:

Plain concrete pipe shall meet the requirements of ASTM C14 Class 2.

## 9-05.3(2) REINFORCED CONCRETE CULVERT PIPE

Delete this section and replace with the following:

Reinforcing concrete culvert pipe shall conform to the requirements of ASTM C76 Class III.

## 9-05.4 STEEL CULVERT PIPE AND PIPE ARCH

The last sentence is revised to read:

Welded seam aluminum coated (aluminized) corrugated steel pipe and pipe arch with metallized coating applied inside and out following welding is acceptable.

## 9-05.4(3) PROTECTIVE TREATMENT

The first paragraph is revised by deleting the following:

Treatment 3 - Coated inside and out with asbestos fibers embedded in the spelter coating and then covered on both sides with asphalt.

## 9-05.4(5) FIBER BONDING

This section is deleted.

## 9-05.5(5) COUPLING BANDS

Delete paragraph 3 of this section and replace with the following:

Aluminum angles shall be of the same material of the coupling bands.

## 9-05.7 CONCRETE STORM SEWER PIPE

Delete this title and replace with the following:

## 9-05.7 CONCRETE STORM DRAIN, SANITARY SEWER, AND COMBINED SEWER PIPE

## 9-05.7(1)A PLAIN CONCRETE STORM SEWER PIPE

Delete this title and section, and replace with the following:

9-05.7(1)A PLAIN CONCRETE STORM DRAIN, SANITARY SEWER, AND  
COMBINED SEWER PIPE

Plain concrete storm drain, sanitary sewer, and combined sewer pipe shall meet the requirements of ASTM C14 Class 3, unless otherwise called for on the Drawings. Permeability test shall be conducted as follows:

The pipe selected for test shall be placed either end down on a soft rubber pad, at the option of the Engineer, and filled with water. The pipe shall be kept full of water for a period of two minutes. At the end of that period the outer surface of the pipe shall be examined for leaks.

A leak is herein defined as a moist spot on which, when wiped dry with a cloth, moisture will quickly reappear.

The Engineer may select a maximum of 2 percent but in no case shall less than 5 pipes of each size be tested.

#### 9-05.7(2)A REINFORCED CONCRETE STORM SEWER PIPE

Delete this title and section and replace with the following:

#### 9-05.7(2)A REINFORCED CONCRETE STORM DRAIN, SANITARY SEWER AND COMBINED SEWER PIPE

Reinforced concrete pipe shall conform to ASTM Designation C76, and shall be of the class noted on the Drawings or in the Special Provisions.

Pipe ends of reinforced concrete pipe may be bell and spigot, modified bell and spigot, or tongue and groove unless otherwise specified in the Special Provisions.

Acceptance shall be based on load bearing tests, material tests and inspection of the product at all stages of construction. Acceptance by cylinders or cores instead of load bearing tests is permissible when agreed upon by the manufacturer and the Engineer prior to manufacture.

Both bells and spigots shall be reinforced in pipe 30 inches or more in diameter.

The identification of the minor axis of elliptical reinforcement shall be in accordance to Section 9-05.3(2)D.

#### 9-05.7(3) CONCRETE STORM SEWER PIPE JOINTS

Delete this title and section and replace with the following:

#### 9-05.7(3) CONCRETE STORM DRAIN, SANITARY SEWER, AND COMBINED SEWER PIPE JOINTS

All concrete pipe shall be joined with rubber gaskets. The joints and gasket material shall meet the requirements of ASTM C443. Gasket material shall be handled and stored in accordance to Section 9-04.4(5).

#### 9-05.7(4) TESTING CONCRETE STORM SEWER PIPE JOINTS

Delete this title and replace with the following:

#### 9-05.7(4) TESTING CONCRETE STORM DRAIN, SANITARY SEWER, AND COMBINED SEWER PIPE JOINTS

Amend this section to require testing for storm drain, sanitary sewer, and combined sewer pipe.

#### 9-05.9 ASBESTOS CEMENT STORM SEWER PIPE

This section is revised to read:

#### 9-05.9 STEEL SPIRAL RIB STORM SEWER PIPE

Steel spiral rib storm sewer pipe shall be manufactured of metallic coated (aluminized or galvanized) corrugates steel and inspected in conformance with Section 9-05.4. The size, coating, and metal shall be as shown in the plans or in the specifications.

The manufacturer of spiral rib storm sewer pipe shall furnish to the Engineer a certificate of compliance stating that the materials furnished comply in all respects with these specifications. The Engineer may require additional information or tests, to be performed by the Contractor, at no expense to the State.

Unless otherwise specified, spiral rib storm sewer pipe shall be furnished with pipe ends cut perpendicular to the longitudinal axis of the pipe. Pipe ends shall be cut evenly. Spiral rib pipe

shall be fabricated either by using a continuous helical lock seam with a seam gasket or a continuous helical welded seam paralleling the rib.

Helical ribs shall project outwardly from the smooth pipe wall and shall be fabricated from a single thickness of material. The ribs shall be essentially rectangular and shall be  $3/4$  inch plus 2 times the wall thickness ( $2t$ ) +  $1/8$  inch (measured outside to outside) and a minimum of 0.95 inch high (measured as the minimum vertical distance from the outside of pipe wall immediately adjacent to the lockseam or stiffener to top surface of rib). The maximum spacing of ribs shall be 11.75 inches center to center (measured normal to the direction of the ribs). The radius of bend of the metal at the corners of the ribs shall be a minimum of 0.10 inch and a maximum of 0.17 inch. If the sheet between adjacent ribs does not contain a lockseam, a stiffener shall be included midway between ribs, having a nominal radius of 0.25 inch and a minimum height of 0.20 inch toward the outside of the pipe. Pipe shall be fabricated with ends that can be effectively jointed with coupling bands.

When required spiral rib pipe shall be bituminous treated or paved. The bituminous treatment for spiral rib pipe shall conform to the requirements of Sections 9-05.4(3) and 9-09.4(4).

#### 9-05.9(1) CONTINUOUS LOCK SEAM PIPE

Pipes fabricated with continuous helical seam parallel to the rib may be used for full circle pipe. The lock seam shall be formed in the flat between ribs and shall meet the following quality requirements:

- The edges of the sheets within the cross-section of lock seam shall lap at least  $5/16$  inch for pipe greater than 10 inches in diameter with an occasional tolerance of minus 10 percent of lap width allowable.
- The lapped surfaces shall be in tight contact.
- There shall be no excessive angularity on the interior of the 180 degree fold of the metal at the lock seam which will cause visual cracks in the sheet. Roller indentations shall not cause cracks in the sheet or a loss of metal-to-metal contact within the seam.
- Tensile specimens cut from production pipe normal to and across the lock seam shall develop the strength as tabulated below:

Pipe Sheet Thickness Inches	Minimum Lock Seam Strength lb./in. of Width
0.064	425
0.079	650
0.109	875

#### 9-05.9(1)A BASIS FOR ACCEPTANCE

The basis for acceptance will be a qualification test, conducted by the Headquarters Materials Laboratory, for each manufacturer of gasketed helically corrugated lock seam steel pipe. Only those specific pipe sizes and gasket materials approved under the qualification test will be accepted.

Continuous lock seam, pipe shall be sampled and tested in accordance with AASHTO T-249.

#### 9-05.9(2) CONTINUOUS WELDED SEAM 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 shall be so controlled that the combined width of the weld and adjacent spelter coating burned by the welding does not exceed three times the thickness of the metal. If spelter is burned outside these limits, the weld and burned spelter shall be treated as required below. Testing for welded seam quality control shall conform to AASHTO T-421. Welded pipe fabricated from aluminized steel pipe shall 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 been burned by gas or arc welding, all surfaces of the welded connections shall be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked galvanizing removed, after which the areas shall be repaired by flame spray metallizing both inside and out.

## 9-05.9(3) COUPLING BANDS

Coupling bands shall be of the same materials as the pipe. Coupling bands and gaskets shall conform to Section 9-05.10(1).

## 9-05.10 STEEL STORM SEWER PIPE

This section is revised to read:

Steel storm sewer pipe shall conform to the requirements of Section 9-05.4 for steel culvert pipe and shall be either helically corrugated lock seam or helically corrugated continuous welded steel pipe. Helically corrugated lock seam steel pipe shall require protective Treatment 5. Welded seam aluminum coated (aluminized) steel pipe shall require metallized aluminum coating inside and out following welding.

## 9-05.11 ALUMINUM STORM SEWER PIPE

This section is supplemented with the following:

When gasketed helically corrugated lock seam aluminum pipe is called for, Treatment 5 is not required.

## 9-05.11(2) BASIS FOR ACCEPTANCE

This section is revised to read:

The basis for acceptance of aluminum storm sewer pipe will be the same as specified in Section 9-05.5(7), except when gasketed helically corrugated lock seam aluminum pipe is called for. A qualification test, conducted by the Headquarters Materials Laboratory, will be required for each manufacturer of gasketed helically corrugated lock seam aluminum pipe. Only those specific pipe sizes and gasket materials approved under the qualification test will be accepted.

## 9-05.14 ABS COMPOSITE SEWER PIPE

Delete this section.

## 9-05.15(1) MANHOLE RING AND COVER

Delete this section and replace with the following:

Ring and cover dimensions shall conform to the Standard Plans. Rings shall be manufactured from cast iron ASTM A 48 Class 30 or ductile iron ASTM A 536, Grade 80-55-06. Covers shall be manufactured from ductile iron ASTM A 536, Grade 80-55-06. Rings and covers shall be free of porosity, shrink cavities, cold shuts, and cracks. Rings and covers shall be free of surface defects which would impair serviceability. Repair of defects by welding or by the use of "smooth-on plasticized metals" or similar material will result in the casting being rejected. Manufacturer shall certify that the product conforms to the requirements of these Specifications. On orders of 25 or more units, the manufacturer shall also provide a test bar per ASTM A 48. In accordance with Section 1-06.1, where source of material is different from manufacturer, the Contractor shall also provide the name and location of the manufacturer.

A bituminous coating equivalent to American Tar Company #2219 Gilonite-Asphalt Paint shall be applied to all surfaces. The finished coating shall be continuous and smooth.

Castings shall 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 shall be beveled as shown on the Standard Plan. Upon request of the Engineer, the manufacturer shall furnish at the foundry standard ring and covers for use by inspectors in testing fit and seating.

All covers will be labeled with the following information:

- (a) Name or symbol of the manufacturer;
- (b) Owner's name (City of Seattle);

- (c) Material label "DUC" for Ductile Iron;
- (d) Identification of its use in 3-inch high lettering (Sewer, Water, Drain, Etc.);
- (e) Country or manufacture/origin.

Where lock-type castings are called for, the locking device shall permit the cover to be promptly released from the ring. All movable parts shall not bind and shall be made of non-corrosive metals and otherwise arranged to avoid possible binding. Upon request of the Engineer, the manufacturer shall make available at the foundry a testing device suitable for providing the capacity of the assembly to resist uplift pressure on the lid equal to 20 ft. head of water.

The manufacturer's identification and material type shall be adjacent to each other and shall be a minimum of 1/2 inch letters recessed flush with the adjacent surfaces.

## 9-05.15(2) METAL FRAME AND GRATE AND SOLID METAL COVER FOR CATCH BASINS OR INLETS

Delete this title and section and replace with the following:

## 9-05.15(2) METAL FRAME AND GRATE FOR CATCH BASINS OR INLETS

The frame and grate shall conform to the Standard Plans.

The frame may be made of cast iron, ASTM A 48 Class 40, or ductile iron, ASTM A 536, Grade 80, at the manufacturer's option. The grate shall be made of ductile iron only. Other applicable provisions of Section 9-05.15(1) shall apply.

Catch Basins, Type 242A and 242B and Inlets, Type 250A and 250B shall be furnished with a vaned type grate as indicated on the Drawings.

## 9-05.17 FILTER FABRIC (New Section)

The geotextile shall be of woven or nonwoven construction and consist of long chain polymeric fibers composed of polypropylene, polyethylene, polyester, polyvinylidene chloride, or polyamide. The fibers shall be oriented into a multi-directional stable network whereby they retain their positions relative with each other and allow the passage of water as specified. The fabric shall be free of any chemical treatment or coating which reduces the permeability and shall be inert to chemicals commonly found in soil. The geotextile shall conform to the physical property requirements listed below.

Physical Property	Test Method	Acceptable Typical Test Results
Tensile Strength, wet, lbs.	ASTM D-1682	90 (*minimum)
Elongation, wet, %	ASTM D-1682	20 (*minimum)
Coefficient of Water Permeability, cm/sec	Falling Head 20 cm to 10 cm	.02 (minimum)
Puncture Strength, lbs.	ASTM D751 <sup>1</sup>	40 (minimum)
Pore Size-EOS, U.S. Standard Sieve	Corps of Engineers GW-02215	70 - 100

\*Minimum is the minimum value in any principal direction for the typical fabric weight.

<sup>1</sup>Tension testing machine with ring clamp; steel ball replaced with a 5/16 inch diameter solid steel cylinder with hemispherical tip centered within the ring clamp.

The geotextile shall be furnished in a protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling.

## 9-05.18 ALUMINUM SPIRAL RIB STORM SEWER PIPE (New Section)

Aluminum spiral rib storm sewer pipe shall be manufactured of corrugated aluminum and inspected in conformance with Section 9-05.5. The size, coating, and metal shall be as shown in the plans or in the specifications.

The manufacturer of spiral rib storm sewer pipe shall furnish to the Engineer a certificate of compliance stating that the materials furnished comply with all respects with these specifications.

The Engineer may require additional information or tests, to be performed by the Contractor, at no expense to the State.

Unless otherwise specified, spiral rib storm sewer pipe shall be furnished with pipe ends cut perpendicular to the longitudinal axis of the pipe. Pipe ends shall be cut evenly. Spiral rib pipe shall be fabricated by using a continuous helical lock seam with a seam gasket.

Helical ribs shall project outwardly from the smooth pipe wall and shall be fabricated from a single thickness of material. The ribs shall be 3/4 inch wide by 3/4 inch deep with a nominal spacing of 7-1/2 inches center to center. Pipe shall be fabricated with ends that can be effectively jointed with coupling bands.

#### 9-05.18(1) CONTINUOUS LOCK SEAM PIPE (New Section)

Pipes fabricated with continuous helical seam parallel to the rib may be used for full circle pipe. The lock seam shall be formed in the flat between ribs and shall meet the following quality requirements:

- The edges of the sheets within the cross-section of lock seam shall lap at least 5/16 inch for pipe greater than 10 inches in diameter, with an occasional tolerance of minus 10 percent of lap width allowable.
- The lapped surfaces shall be in tight contact.
- There shall be no excessive angularity on the interior of the 180 degree fold of the metal at the lock seam which will cause visual cracks in the sheet. Roller indentations shall not cause cracks in the sheet or a loss of metal-to-metal contact within the seam.
- Tensile specimens cut from production pipe normal to and across the lock seam shall develop the strength as tabulated:

Pipe Sheet Thickness Inches	Minimum Lock Seam Strength lb./in. of width
0.060	170
0.075	245
0.105	425

#### 9-05.18(1)A BASIS FOR ACCEPTANCE (New Section)

The basis for acceptance will be a qualification test, conducted by the Headquarters Materials Laboratory, for each manufacturer of gasketed helically corrugated lock seam steel pipe. Only those specific pipe sizes and gasket materials approved under the qualification test will be accepted.

Continuous lock seam, pipe shall be sampled and tested in accordance with AASHTO T-249.

#### 9-05.18(3) COUPLING BANDS (New Section)

Coupling bands shall be of the same material as the pipe. Coupling bands and gaskets shall conform to Section 9-05.10(1).

### SECTION 9-06 - STRUCTURAL STEEL AND RELATED MATERIALS

#### 9-06.5(3) HIGH STRENGTH BOLTS

Delete paragraph 4 and replace with the following:

The Contractor shall furnish to the Engineer 4 copies of the manufacturer's inspection test report for each shipping lot of bolts furnished. Tests shall be made in accordance with the applicable ASTM requirements.

#### 9-06.15 SHEAR CONNECTORS

This section is revised to read:

Manufacture and inspection of studs for shear connectors shall conform to the requirements of Division II, Articles 10.3 and 10.19 of the current AASHTO Standard Specifications for Highway Bridges.

#### 9-06.19 BRIDGE DRAINS (New Section)

Bridge drains shall be made of cast steel conforming to the requirements of ASTM Designation A 27, Mild to Medium Strength Carbon-Steel Castings for General Application, grade 70-36, unless otherwise designated in the Drawings or in the Special Provisions.

Bridge drains shall be furnished with vaned grates as shown on the Standard Plan. Grating covers shall be fitted to the individual drain casting with which they are to be used and shall be ground to rest evenly and without rocking.

To each drain casting there shall be shop welded a piece of either standard galvanized steel or galvanized wrought iron pipe of the size, length and type as shown in the Drawings.

The length of steel pipe shall be galvanized in accordance with the provisions of ASTM Designation A 120, Black and Hot-Dipped Zinc-Coated Welded and Seamless Steel Pipe for Ordinary Uses. Galvanizing shall be done after cutting to length, grooving, threading or other fabrication.

After welding, the drain castings and grating covers shall be coated inside and outside with an asphaltum base, black dipping paint, approved by the Engineer. This coating shall extend over that portion of the galvanized steel pipe adjacent to the casting far enough to cover the welds.

#### 9-06.20 DOWNSPOUTS (New Section)

Downspouts shall be standard weight steel pipe, 4 inch or 6 inch diameter as shown in the Drawings.

The downspouts shall be full length pipe sections in all straight runs. If the Contractor elects, he may use other types of couplings and fittings in lieu of the grooved couplings and fittings shown in the Drawings, provided they are equal and are approved by the Engineer.

All downspouts shall be hot-dipped galvanized in accordance with ASTM Designation A 120 after cutting to length, grooving, threading, bending or any other fabrication. Any areas where the galvanizing has been disrupted shall be repaired with galvanizing repair paint Formula A-9-73.

All fastenings of the downspouts to the structure, couplings, and pipe supports shall be galvanized in accordance with ASTM Designation A 153.

The portion of downspouts and/or drain pipe constructed within concrete shall be fully encased in a sponge rubber compound 1/2 inch thick and meeting the requirements of ASTM Designation D 1752, Type No. 1, except the color requirement is waived.

#### 9-06.21 ELASTOMERIC BEARING PADS

The first sentence of the first paragraph of this section is revised to read:

Elastomeric bearing pads shall conform to the physical property requirements of the current AASHTO Standard Specifications for Highway Bridges, Division II, Section 25.



## 9-06.23 BOLTS AND BOLTED CONNECTIONS

This section is deleted.

## SECTION 9-07 - REINFORCING STEEL

## 9-07.1 DEFORMED STEEL BARS

Delete this section and replace with the following:

Unless otherwise specified in the Special Provisions or on the Drawings, reinforcing bars for the particular use specified shall be deformed steel bars of the size specified in the Contract Documents meeting the requirements of ASTM Designation A615, Grade 60.

Deformed steel bars are referred to in the Drawings and Specifications by numbers: for example, #3, #4, #5, etc.

Reinforcing bars shall be free from loose mill scale, dirt, grease or other defects affecting the strength or bond with concrete. Steel coated with rust may be used if the oxidations are not deep or loose coated. Size numbers shall be taken to represent the diameter of the bar in 1/8 inch units, except where standard wire gauge sizes are indicated on the Drawings.

## 9-07.2 PLAIN STEEL BARS

Delete this section and replace with the following:

Where plain steel bars are specified, they shall conform to the chemical and physical properties of ASTM A 615, Grade 60, unless specifically noted otherwise. Plain steel bars are indicated in the Drawings and Specifications by fractions of an inch: for example, 3/8" diameter, 1/2" diameter, 5/8" diameter, etc.

## 9-07.2(3) SPIRAL TIES

Delete this section.

## 9-07.4 WIRE MESH

Delete this section and replace with the following:

Wire mesh for concrete reinforcement shall conform to the requirements of the Standard Specifications for Welded Steel Wire Fabric for Concrete Reinforcement, ASTM Designation A 185 or the Standard Specifications for Welded Deformed Steel Wire Fabric for Concrete Reinforcement, ASTM Designation A 497. All wire mesh shall be of an approved kind and quality of manufacturer.

## 9-07.5 COLD DRAWN WIRE

Supplement this section with the following:

Cold drawn wire is noted in the Drawings and Specifications by the letter W followed by a number indicating the cross-sectional area of the wire in hundredths of a square inch: for example, W2, W4, W5, etc.

## 9-07.7 DEFORMED WIRE (New Section)

Deformed wire shall conform to the requirements of ASTM Designation A 496, Deformed Steel Wire for Concrete Reinforcement.

Deformed wire is noted in the Drawings and Specifications by the letter D, followed by a number indicating the cross-sectional area of the wire in hundredths of a square inch: for Example, D20, D31, etc.

## SECTION 9-08 - PAINTS

## 9-08.5 TEST METHODS

Delete this section and replace with the following:

As set forth in Section 9-08.2, all paints shall meet the special requirements set forth for each formula. The test methods used to check those special requirements shall be as specified by Federal Specification TT-P-141. When test methods are not covered by the above, applicable ASTM methods shall be followed.

## SECTION 9-09 - TIMBER AND LUMBER

## 9-09.2 GRADE REQUIREMENTS

The Tabulated Working Stresses Chart referred to in this section is supplemented with the following:

Guard Rail Posts

Lodgepole Pine 6" x 8" or 8" x 8"	1100	65	250	850	1,100,000	Select Structural WWPA or WCLIB
Lodgepole Pine 8" x 8" only	875	65	250	725	1,100,000	Grade No. 1, WWPA or WCLIB

## SECTION 9-08 - PAINTS

## 9-08.5 TEST METHODS

Delete this section and replace with the following:

As set forth in Section 9-08.2, all paints shall meet the special requirements set forth for each formula. The test methods used to check those special requirements shall be as specified by Federal Specification TT-P-141. When test methods are not covered by the above, applicable ASTM methods shall be followed.

## SECTION 9-09 - TIMBER AND LUMBER

## 9-09.2 GRADE REQUIREMENTS

The Tabulated Working Stresses Chart referred to in this section is supplemented with the following:

Guard Rail Posts

Lodgepole Pine 6" x 8" or 8" x 8"	1100	65	250	850	1,100,000	Select Structural WWPA or WCLIB
Lodgepole Pine 8" x 8" only	875	65	250	725	1,100,000	Grade No. 1, WWPA or WCLIB

## SECTION 9-10 - PILING

## 9-10.2(1) CONCRETE

The second paragraph of this section is revised to read:

The concrete for precast-prestressed piles shall conform to the requirements of Section 9-19.1. The concrete for prestressed piles shall have a minimum compressive strength of 6,000 psi at the age of 28 days. The minimum compressive strength of concrete at the transfer of prestress shall be 3,300 psi.

## SECTION 9-12 - MASONRY UNITS

Delete the title and content of Section 9-12 in its entirety and replace with the following:

## SECTION 9-12 - MANHOLES, CATCH BASINS &amp; INLETS (New Section)

## 9-12.1 REINFORCED CONCRETE (New Section)

Reinforced concrete shall consist of portland cement, mineral aggregates and water, in which steel has been embedded in such manner that the steel and concrete act together.

## 9-12.1(1) CEMENT (New Section)

Portland cement shall conform to the requirements of the Specifications for Portland Cement ASTM C 150, any type, unless otherwise limited in the Special Provisions; or it may be air-entraining portland cement conforming to ASTM C 175.

## 9-12.1(2) STEEL REINFORCEMENT (New Section)

Reinforcement shall 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 bars of Grade 60 steel conforming to ASTM A 615 or of bars of Grade 80 steel conforming to ASTM A 308.

## 9-12.1(3) AGGREGATES (New Section)

Aggregates shall conform to ASTM C 33, except that the requirement for gradation shall not apply to precast items.

## 9-12.1(4) MIXTURE (New Section)

The aggregates shall be so sized and graded, and proportioned and thoroughly mixed in proportions of cement and water as will produce a homogeneous concrete mixture of such quality that the manhole components will conform to the strength and watertightness requirements of these specifications. Admixtures or blends may be used with the written permission of the Engineer.

## 9-12.1(5) CURING (New Section)

Upon completion of casting, the precast components shall be placed in a location free from outside drafts, covered and cured in a moist atmosphere maintained by an injection of steam for such a time and under such a temperature as may be needed to enable the manhole components to meet the strength requirements.

Or, precast components may be water-cured by covering the manhole components with a water saturated material, or by a system of perforated pipes, mechanical sprinklers, porous hose, or by any other approved method that will keep the components continuously moist during the curing period. Cast-in-place components shall be moist cured for a period not less than 7 days, except that when high-early-strength cement is used the curing shall be not less than 3 days. Pigmented membrane curing compound or other approved method may be applied in lieu of moist curing.

All cast in place concrete placed under these specifications shall have a minimum compressive strength of 3,000 psi at 28 days. Strength determination shall be in accordance with ASTM C 39, unless otherwise approved by the Engineer. Precast components shall conform to the strength requirements of ASTM C 478.

## 9-12.2 STEPS (New Section)

Unless otherwise specified in the Special Provisions, manhole steps may be either of the following, at option of the contractor or option of the manufacturer of the manhole.

## 9-12.2(1) ALUMINUM STEPS (New Section)

Aluminum steps shall be forged of 6005-T5 alloy having a minimum tensile strength of 38,000 psi. The cross section shall be not less than 3/4 inch wide by 7/8 inch deep with two non-skid grooves not to exceed 1/8 inch deep and 1/8 inch wide. Pattern and dimensions shall conform to the Standard Plans.

## 9-12.2(2) GALVANIZED DEFORMED BAR STEPS (New Section)

Galvanized deformed bar steps shall be 1 inch diameter deformed bar conforming to ASTM A 615, Grade 40 or Grade 60, hot bent and galvanized after bending. For bending, the temperature shall be at least 1600° F. Galvanizing shall conform to ASTM A 123-84. Step dimensions and pattern shall conform to the Standard Plans.

## 9-12.3 LADDERS (New Section)

Except as otherwise provided in the Special Provisions, base sections of precast manholes more than 3 feet in height shall be provided with a ladder as detailed on the Standard Plans, made of steel galvanized after fabrication, or aluminum conforming to the requirements for steps given in Sections 9-12.2(1) and 9-12.2(2). Base sections 3 feet or less in height require no steps or ladder.

## 9-12.4 MORTAR (New Section)

## 9-12.4(1) MORTAR FOR JOINTING (New Section)

Mortar for jointing precast or masonry manhole, catch basin, or inlet units shall 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 manhole elements shall also be rubber gasketed as noted in Section 9-12.9(7).

## 9-12.4(2) MORTAR FOR PLASTER-COATING (New Section)

Mortar for plaster-coating masonry unit manholes shall be proportioned according to either of the two alternates tabulated below:

	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
Alt. 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.
Alt. 2	1	0	1/4	

## 9-12.5 CONCRETE MASONRY UNITS (New Section)

Concrete block shall conform to the Specifications for Concrete Masonry Units for Construction of Catch Basins and Manholes ASTM Designation C 139, except that nominal horizontal thickness shall be 6 inches measured radially, and blocks shall have semicircular mortar grooves approximately 1 inch radius at the ends.

## 9-12.6 CONCRETE BRICK (New Section)

Concrete brick shall conform to the Specifications for Concrete Building Brick ASTM C 55 Grade A.

## 9-12.7 CLAY BRICK (New Section)

Clay brick shall conform to ASTM C 32, Grade NA unless otherwise provided in the Special Provisions.

## 9-12.8 FRAMES AND COVERS (New Section)

Refer to Section 9-05.15.

## 9-12.9 PRECAST MANHOLE COMPONENTS (New Section)

Precast manhole components shall conform to ASTM C 478 except as modified herein.

## 9-12.9(1) BASE SECTIONS (New Section)

Base sections shall conform to the requirements for precast manhole sections in Section 9-12.9(2), except that the reinforced base slab shall be made an integral part of the unit, and openings for pipe shall be provided to meet job requirements as indicated on the Drawings. The base slab thickness shall be not less than that called out in the Standard Plans and shall be cast monolithically with the wall section, or otherwise constructed in such manner as to achieve a completely watertight structure.

Reinforcement of the base slab shall be in accordance to the Standard Plans. The steel shall be placed not less than 1-1/2 inches nor more than 4 inches from the top, and shall extend into the wall of the manhole section and be tied to the longitudinal steel when called for in the Standard Plan. The walls of the base section shall be reinforced in accordance with ASTM C 478. Openings to receive pipe shall be circular, tapered in toward the inside of the section, and shall be held to the minimum size possible to accommodate the pipe to be inserted and to effectively seal the joint. Resilient connectors conforming to ASTM C 923 may be used at the Contractor's option.

## 9-12.9(2) PRECAST MANHOLE SECTIONS (New Section)

Reinforcement for standard sections shall consist of a single cage of steel, placed at the approximate center of the wall of the section. The cage shall be welded at every circumferential wire, or lapped 40 diameters and tied. The welded splice shall develop a tensile strength of 50,000 psi of wire diameter.

Joints between sections shall be tongue and groove, and shall provide 1/2 inch nominal annular space and a minimum of 1-1/4 inches lap.

No more than two lift holes shall be cast into each section. Holes shall be so located as to not damage reinforcing or expose it to corrosion. At the manufacturer's option, steel loops may be provided for handling, in lieu of lift holes.

Unless otherwise provided in the Special Provisions, steps shall be installed in each section so that sections placed together in any combination will provide a continuous vertical ladder with rungs equally spaced at 12 inches. The lowest rung shall be not more than 16 inches above the shelf, and the uppermost rung shall be not more than 18 inches below the street surface.

Steps shall project uniformly from the inside wall of the manhole per the Standard Plans and shall be cast or firmly grouted in place so as to ensure complete watertightness. Where it is intended that manholes be installed without fixed steps, the Special Provisions shall so specify.

## 9-12.9(3) PRECAST CONES (New Section)

Standard precast cones shall provide reduction from 48 inches to 24 inches and 54 to 24 inches and shall be not less than 24 inches in height. Jointing to the riser sections shall be similar to jointing between riser sections, but the top surface shall be flat and at least 5 inches wide, radially, to receive adjustment block brick. Wall thickness shall be 4 inches minimum and reinforcing shall conform to the requirements specified for standard sections of the larger diameter. Steps shall be provided as specified for standard precast sections, and an additional step shall be provided in the 48 inch to 24 inch and the 54 inch to 24 inch concrete cones opposite the ladder steps and about midway in elevation, as shown on the Standard Plans. No more than two lift holes shall be cast into each cone, and they shall be located so they will not damage reinforcing or expose it to corrosion. At the manufacturer's option, steel loops may be provided for handling, in lieu of lift holes.



## 9-12.9(4) FLAT SLAB COVERS (New Section)

Standard flat slab covers shall be a minimum of 8 inches thick and shall conform to the outer dimension of the standard sections upon which they are to be placed. Details of opening location and reinforcing shall be as shown on the Standard Plans.

## 9-12.9(5) FLAT SLAB REDUCTION SECTIONS (New Section)

Reductions to 24 inches and 48 inches openings can be made by means of a flat slab reducing sections as shown on the Standard Plans. Standard flat slab covers shall be a minimum of 8 inches thick and shall conform to the outer dimension of the standard sections upon which they are to be placed. Details of opening location and reinforcing shall be as shown on the Standard Plans.

## 9-12.9(6) T-TOP PIPE MANHOLES (New Section)

T-Top pipe manholes shall conform to the Standard Plans and shall be provided with foundation and bedding, and otherwise installed in the same manner as the connecting pipe.

## 9-12.9(7) JOINTS (New Section)

Joints between precast manhole elements shall be rubber gasketed in a manner similar to pipe joints conforming to ASTM C 443. Shop drawings of the joint design shall be submitted to the Engineer for approval, prior to manufacture. Completed joints shall show no visible leakage and shall conform to the dimensional requirements of ASTM C 478.

## 9-12.10 SHOP FABRICATED CORRUGATED METAL MANHOLES (New Section)

Where corrugated metal manholes are specified, they shall be as shown on the Drawings and shall conform to the details as shown in the Drawings. The base material and gage, and coating if required, shall be as shown on the Drawings. All pipe connections to the manhole stubs shall be made with a standard band type as shown in the Drawings.

## 9-12.11 MONOLITHIC CONCRETE MANHOLES (New Section)

Monolithic Concrete Manholes shall conform to the Standard Plans.

## 9-12.12 TRAPS (New Section)

Where traps are required they shall be of the type specified and constructed in accordance with the Standard Plans.

## SECTION 9-14 - ROADSIDE SEEDING AND ROADSIDE PLANTING

Delete this title and replace with the following:

## SECTION 9-14 - EROSION CONTROL AND ROADSIDE PLANTING

## 9-14.1 SOIL

Planting Soil Type D shall be used unless otherwise specified on the Drawings or in the Project Manual.

## 9-14.1(1) TOPSOIL TYPE A

The topsoil shall be friable surface soil from the A horizon as determined by the United States Agriculture Soil Conservation Service Soil Survey. Topsoil shall be free from: materials toxic to plant growth; noxious weed seeds, rizones, roots; subsoil; stones and other debris. One hundred percent of the topsoil shall pass through a 1 inch screen. Maximum electrical conductivity shall be 2.0 milliohms and the maximum exchangeable sodium percentage shall be 10 percent.

Topsoil Type A shall consist of a sandy clay loam, sandy loam, loam, clay loam, silty clay loam, or silt loam soil. These soil textural classes shall be determined by the United States Department of Agriculture Classification System. These textural classes shall be restricted by the following maximum percentage compositions based on the material passing the Number 10 screen.

Separates	Maximum Percentage Allowable
Sand	50%
Clay	20%

The maximum allowable percentage of gravel retained on a 1/4 inch screen shall not exceed 20 percent by weight. Of the material passing the 1/4 inch screen, the maximum allowable percentage of gravel retained on a Number 10 screen shall not exceed 10 percent by weight. Total organic matter shall be 1 percent to 10 percent by volume. Organic matter shall be determined by the Walkley-Black sulphuric acid dichromate digestion process. The pH shall be 5.5 to 7.0.

## 9-14.1(2) TOPSOIL TYPE B

Topsoil Type B shall be native topsoil, as described in Section 8-01.3(2)B, taken from within the project limits either from the area where roadway excavation is to be performed or from strippings from borrow, pit, or quarry sites, or from other approved State sources.

## 9-14.1(3) TOPSOIL TYPE C

Topsoil Type C shall be native topsoil meeting the requirements of Topsoil Type B but obtained from a source provided by the Contractor outside of the State owned right of way.

## 9-14.1(4) PLANTING SOIL TYPE D (New Section)

Planting soil shall consist of two-thirds soil and one-third organic material thoroughly mixed together.

The ingredients to be used in mixing planting soil shall meet the following requirements:

- (a) Soil shall be sandy loam or loamy sand consisting largely of sand, but with enough silt and clay present to give it a small amount of stability. Individual sand grains can be seen and felt readily. On squeezing in the hand when dry, it shall fall apart when the pressure is released; on squeezing when moist, it shall form a cast that will not only hold its shape when the pressure is released, but shall withstand careful handling without breaking.

Soil shall meet the following:

Size	Sieve	Percent Passing
3/8	ASTM E-11	100
#10	ASTM E-11	85-100
#270	ASTM E-11	10-50
0.002 mm	CLAY	0-10

(b) Organic Matter: Organic matter shall be derived from sphagnum peat or approved substitutes such as fibrous sedge, wood or reed type peat or well-rotted cow manure with a minimum of litter (straw, sawdust or shavings). Substitutes shall contain less than 20 percent of ash by dry weight, shall have a moisture content of less than 50 percent of the wet weight and shall have been thoroughly aerated during the drying process. Mixed planting soil shall have a pH range of 5.0 to 6.5 with dolomitic limestone added as necessary to attain this range.

The mixture shall be fertilized with a slow release fertilizer with a 14-14-14 formulation, or with ureaform or ureaformaldehyde, calcium nitrate, superphosphate, and sulphate of potash magnesium at rates indicated from a soil test or as directed by the Engineer.

All materials shall be pre-mixed prior to bringing to the jobsite.

#### 9-14.1(5) PLANTING SOIL FOR TREE PITS (New Section)

Planting soil for tree pits shall consist of native soil excavated from the planting pit and thoroughly mixed with a commercial grade 14-14-14 formulation slow release fertilizer in an amount of 1 pound per inch of tree diameter.

#### 9-14.2 SEED

Grasses, legumes, or cover crop seed of the type hereinafter specified shall conform to the standards for "Certified" grade seed or better as outlined by the State of Washington Department of Agriculture "Rules for Seed Certification", latest edition. Seed shall be furnished in standard containers on which shall be shown the following information:

- Common name of seed
- Lot number
- Net weight
- Percentage of purity
- Percentage of germination (in case of legumes percentage of germination to include hard seed)
- Percentage of weak seed content and inert material clearly marked for each kind of seed in accordance with applicable State and Federal laws.

Upon request, the Contractor shall furnish to the Engineer duplicate copies of a statement signed by the vendor certifying that each lot of seed has been tested by a recognized seed testing laboratory within six months before the date of delivery on the project. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

Seed mix shall be as specified in the Project Manual.

#### 9-14.2(1) SEED MIX #1 (Highway Mix) (New Section)

The seed mixture and rate of application shall be as follows:

Kind and Variety of Seed in Mixture	Percent by Weight
Colonial Bentgrass (Highlands or Astoria)	10%
Red Fescue (Illahee Rainier or Pennlawn)	40%

Perennial Rye	40%
White Dutch Clover	10%

The rate of application shall be 2 pounds per 1000 square feet. The seed mixture shall be no less than 98% pure, and shall have a minimum germination rate of 90%.

#### 9-14.2(2) SEED MIX #2 (Lawn Seed Mix) (New Section)

The seed mixture and rate of application shall be as follows:

Kind and Variety of Seed in Mixture	Percent by Weight
Red Creeping Fescue	45%
Chewings Fescue	30%
Kentucky Bluegrass	15%
Highland Colonial Bentgrass	10%

The rate of application shall be 4 pounds per 1000 square feet. No noxious weeds will be permitted. The seed mixture shall be no less than 98% pure, and shall have a minimum germination rate of 90%.

#### 9-14.2(3) SEED MIX #3 (Playground Mix) (New Section)

The seed mixture and rate of application shall be as follows:

Kind and Variety of Seed in Mixture	Percent by Weight
Perennial Ryegrass	35%
Tall Alta Fescue	25%
Manhattan Perennial Rye	20%
Annual Rye	20%

The rate of application shall be 4 pounds per 1000 square feet. No noxious weeds will be permitted. The seed mixture shall be no less than 98% pure, and shall have a minimum germination rate of 90%.

#### 9-14.2(4) SEED MIX #4 (Play and Shade Mix) (New Section)

The seed mixture and rate of application shall be as follows:

Kind and Variety of Seed in Mixture	Percent by Weight
Perennial Ryegrass	35%
Manhattan Perennial Rye	25%
Red Creeping Fescue	20%
Annual Rye	20%

The rate of application shall be 4 pounds per 1000 square feet. No noxious weeds will be permitted. The seed mixture shall be no less than 98% pure, and shall have a minimum germination rate of 90%.

## 9-14.3 FERTILIZER

Delete this section and replace with the following:

Fertilizer shall be a standard commercial grade of organic or inorganic fertilizer of the kind and quality specified herein. It may be separate or in a mixture containing the percentage of total nitrogen, available phosphoric acid and water-soluble potash in the amounts specified. All fertilizers shall be furnished in standard unopened containers with weight, name of plant nutrients and manufacturer's guaranteed statement of analysis clearly marked, all in accordance with State and Federal laws.

Acceptable commercial fertilizer may be supplied in one of the following forms:

- (a) A dry free-flowing granular fertilizer suitable for application by agricultural fertilizer spreader.
- (b) A soluble fertilizer ground to a fineness that will permit complete suspension of insoluble particles in water, suitable for application by power sprayer.
- (c) A granular or pelleted fertilizer, suitable for application by blower equipment.
- (d) A non-volatile liquid fertilizer.

Fertilizer shall be standard commercial grade of formulation. 50 percent of the nitrogen shall be derived from 38 percent ureaformaldehyde and apply at the rate of 12 pounds per 1,000 square feet.

The Contractor shall provide a sample (2 pounds) of fertilizer to the Seattle Engineering Department Materials Laboratory.

## 9-14.4 MULCH

Amend this title to read:

## 9-14.4 MULCH AND AMENDMENTS

## 9-14.4(2) WOOD CELLULOSE FIBER

Supplement this section with the following:

Wood cellulose fiber shall be applied at the rate of 60 pounds per 1,000 square feet.

## 9-14.4(5) ASPHALT EMULSION

Delete this title and section and replace with the following:

## 9-14.4(5) PEAT

The peat shall be derived from sphagnum moss and conform to ASTM D 2607 unless otherwise specified. Peat shall be shredded and granulated to pass a 1/2-inch mesh screen and conditioned in storage piles for at least six months after excavation. The peat shall not contain substances harmful to plant life.

## 9-14.4(6) VERMICULITE/PERLITE/PUMICE

Vermiculite, perlite, or pumice shall be horticultural grade and free of any toxic materials.

## 9-14.4(7) TACKIFIER

Tackifier used as a tie-down for mulch shall conform to, and is specified as one of the following:

Type A: Organic tackifier shall be derived from natural organic plant sources containing no growth or germination inhibiting materials. It shall be applied in quantities sufficient to equal the retention properties of a CSS-1 asphalt emulsion being applied at the rate of 400 gallons per acre. Tackifier shall hydrate in water and readily blend with other slurry materials. Wood cellulose fiber shall be added to the tackifier as a tracer at the rate of 150 pounds per acre. The tackifier shall be sprayed on the mulch after it is in place on the slopes.

Type B: Asphalt emulsion tackifier, a CSS-1 emulsion conforming to the requirements of Section 9-02.1(6).

## 9-14.6 PLANT MATERIAL DESCRIPTION

Seedlings are plants grown from cuttings, seeds, or other approved propagation methods. These plant materials do not normally show form characteristic to species generally under three years of age and less than 24 inches in height. Measurement is by height in 3-inch increments or by age and number of times transplanted.

Whips are bareroot, broadleaf trees, generally unbranched and between 2 feet to 6 feet in height. Measurement is by 1-foot height increments.

Broadleaf trees are branched, over 6 feet in height and measured by caliper and/or height.

Coniferous trees are over 2 feet in height and measured in height and occasionally spread.

Shrubs and groundcovers begin to show form characteristic to their normal habit of growth and are measured by height and/or spread.

Container sizes may be specified in addition to other measurements, however, the other measurements shall govern.

## 9-14.7(1) QUALITY

Delete this section and replace with the following:

All plant material furnished by the Contractor shall conform to the applicable requirements described in the current issue of "American Standard for Nursery Stock," and in addition thereto shall meet the following requirements:

- (a) All plant material shall comply with State and Federal laws with respect to inspection for plant diseases and insect infestation. Inspection certificates required by law shall accompany each shipment of plant material and shall be filed with the Engineer. All plant material specified shall 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 shall be free from disease and insect infestation, disfiguring knots, sun-scalds, abrasions of the bark, broken tops, torn roots and any other objectionable features. Plants cut back from large sizes to meet specified sizes will not be accepted. All plants shall be nursery grown stock unless otherwise specified. Trees must be self-supporting, with straight trunks and with single straight leaders. Trees having damaged or missing leader, multiple leaders, or "Y" crotches will be rejected.
- (b) Plants shall not have cuts over 3/4 inch diameter which are not satisfactorily callusing over. Leader shall be intact on all plants.
- (c) Plants furnished in pots or other containers shall be acclimated to outside conditions and equal to field grown stock.
- (d) Collected plant material shall conform in quality, size, and grade to standards for nursery stock.
- (e) Any plant material that is to be replaced shall be of the same species, cultivar and of equal size to the surviving plant material.
- (f) Root balls of plant materials shall be solidly held together by a fibrous root system and shall be composed only of the soil in which the plant has been actually growing. The ball shall be securely wrapped with jute burlap or other packing material not injurious to the plant life. Root balls shall be free of weed or foreign plant growth.

Container grown plants must be plants transplanted into a container and grown in that container sufficiently long for new fibrous roots to have developed so that the root mass will retain its shape and hold together when removed from the container. Plant material which is rootbound, as determined by the Engineer, will be rejected.

Container sizes for plant material of a larger grade than provided for in the container grown specifications of the American Standard for Nursery Stock (A.S.N.S.) shall be determined by the volume of the root ball specified in the A.S.N.S. for the same size plant material.

All bare root plant materials shall have a heavy fibrous root system. All plants must be dormant at the time of planting.

Average height to spread proportions and branching shall be in accordance with the applicable sections, illustrations, and accompanying notes of the American Standard for Nursery Stock.

Plants, which have been determined by the Engineer to have suffered damage as the result of girdling of the roots, stem, or a major branch; have deformities of the stem or major branches; have a lack of symmetry; have dead or defoliated tops or branches; or have any defect, injury, or condition which renders the plant unsuitable for its intended use, will be rejected.

#### 9-14.7(2) HANDLING AND SHIPPING

Delete this section and replace with the following:

All plant material shall be dug with care by experienced workmen. The root system of all plant material shall not be permitted to dry out at any time.

Evergreen and deciduous plant materials shall be furnished balled and burlapped (B&B) unless otherwise specified. Broken or "Made" balls will not be accepted. Balled and burlapped plants shall be handled by the ball of earth and not the plant. Unless otherwise specified, plants may be supplied in suitable metal or other containers should the Contractor so desire. Container grown plants shall be well-developed to hold the earth intact after removal from the container without being root bound.

Handling and shipping shall be done in a manner that is not detrimental to the plants.

The nursery shall furnish a notice of shipment in triplicate at the time of shipment of each carload or other lot of plant material. The original copy shall be mailed to the Engineer, the duplicate to the consignee and the triplicate shall be accompany the shipment to be furnished to the Engineer at the jobsite. The notice shall contain the following information:

- (a) Name of shipper.
- (b) Date of shipment.
- (c) Name of commodity (including all names as specified in the contract.)
- (d) Consignee and delivery point.
- (e) State contract number.
- (f) Point from which shipped.
- (g) Quantity contained.
- (h) Certificate of grade (statement that material conforms to the specifications.)
- (i) Size (height, runner length, caliper, etc. as required.)
- (j) Statement of root pruning (date pruned and size of pruning.)
- (k) Signature of shipper by authorized representative.

To acclimate plant materials to Northwest conditions, all plant materials used on a project shall be grown continuously outdoors north of the 42nd Latitude (Oregon-California Border) from not later than August 1 of the year prior to the time of planting.

All container grown plants shall be handled by the container.

All balled and burlapped plants shall be handled by the ball.

Plant material shall be packed for shipment in accordance with prevailing practice for the type of plant being shipped, and shall be protected at all times against drying, sun, wind, heat, freezing, and similar detrimental conditions both during shipment and during related handling. Where necessary, plant material shall be temporarily heeled in. When transported in closed vehicles, plants shall receive adequate ventilation to prevent sweating. When transported in open vehicles, plants shall be protected by tarpaulins or other suitable cover material.

#### 9-14.7(3) TAGGING

Delete this section and replace with the following:

Plants delivered shall have legible labels attached to each individual plant delivered as a separate unit or to each box, bundle, bale or container containing one or more plants. Labels shall give the necessary detailed information as to horticultural name, size, age, caliper or other data required to identify as conforming to Specifications. When the label is attached to a bundle, box, container, etc., containing more than one plant, information on the label shall show the quantity together with the other required information. Exception: All trees, whether furnished singly or bundled, shall be individually tagged with names, size or caliper, etc., needed as shown above. Contractor may refer to State of Washington Department of Agriculture, Orders 1229 and 1230, Nursery Stock Standards, regarding labeling of plant material. Plant material with illegible or missing tags will be rejected by the Engineer. All plants that are patented or trademarked shall have an individual tag on each plant.

#### 9-14.7(4) INSPECTION

Delete this section and replace with the following:

The Contractor shall, as soon as practical, inform the Engineer as to the source of plant materials for the project. Approval of plant material for a project shall not be considered as final acceptance. The Contractor shall notify the Engineer not less than 48 hours in advance of delivery of plants from the nursery to insure adequate time for inspection before planting.

All trees will be inspected by the Engineering Department Arboriculturist or his representative at the project site prior to planting. The Contractor shall plant only that plant material approved by the Arboriculturist or his representative.

Root condition of plants furnished in containers shall be determined by removal of the plant from the container. Plants not meeting the requirements herein specified shall be immediately removed from the project and replaced by the Contractor at no additional cost to the City.

Plant material delivered, inspected and approved for planting shall be planted immediately. Plants not immediately planted by the Contractor may be temporarily stored upon written authorization from the Arboriculturist.

#### 9-14.7(6) TEMPORARY STORAGE

Supplement this section with the following:

Plant material delivered and accepted shall be planted immediately. Plants that cannot be planted within 1 day after arrival shall be "heeled-in" in accordance with accepted horticultural practice.

- (a) Bare root plants shall be placed in trenches with roots covered with moist earth or other suitable material. All bare root material supplied in bundles shall have the bundle broken and placed in the trenches separately.
- (b) Balled and burlapped plants shall have the root ball protected by moist earth, sawdust or other acceptable material.

#### 9-14.7(7) SOD

Delete this section and replace with the following:

All sod shall comply with the State and Federal laws, including guaranty, with respect to inspection, plant diseases and insect infestation. Sod shipments shall have a certificate of origin and/or certification of approved treatment when shipment originates in known infected areas.

Sod shall be mature, densely rooted grass composed of equal mix of Bluegrass and Colonial Bent Grass, and/or Creeping Red Fescue Grass, and a minimum of 60% Perennial Rye Grass blend. The sod shall be free of weeds and reasonably free of objectionable grasses.

**9-14.7(8) FILL MATERIAL (New Section)**

Fill material shall be a "Mineral Aggregate, Type 10" meeting the requirements of Section 4-03, or may be a native sandy loam, of medium texture without clay or rocks, obtained from selected roadway or trench excavated material.

The fill material shall be free of toxic amounts of acid or alkaline elements, brush, roots, sticks and other objectionable material. A 1 cubic foot sample of the fill material shall be submitted to the Engineer for testing and approval.

**9-14.7(9) STAKES, GUYS, AND WRAPPINGS**

Stakes shall be wood and shall be installed as shown in the plans.

The minimum size of wire used for guying shall be 14 gage, soft drawn. Commercial plant ties may be used in lieu of hose and wire guying upon approval of the Engineer.

Hose for guying shall be nylon, rubber, or reinforced plastic and shall have an inside diameter of at least 1/2 inch.

Tree wrap shall be a crinkled waterproof paper weighing not less than 4.0 pounds per 100 square feet and shall be made up of two sheets cemented together with asphalt.

**SECTION 9-15 - IRRIGATION SYSTEM****9-15.1(2) POLYVINYL CHLORIDE PIPE AND FITTINGS**

Delete this section and replace with the following:

PVC pipe upstream of the control valves shall be Schedule 40 and conform to all requirements of ASTM D 1785.

PVC pipe downstream of the control valves shall be pressure rated for 200 psi and conform to all requirements of ASTM D 2241, SDR 21.

Fittings shall be of the solvent weld type except where risers, valves, etc., require threaded transition fittings. Fittings shall conform to the requirements of ASTM D 2466.

PVC pipe and fittings shall be non-toxic, free from taste and odor, and self-extinguishing.

Pipe shall be homogenous throughout and be free of defects cracks, holes, foreign materials, wrinkles, dents and blisters.

PVC pipe shall be continuously and permanently marked with the following information: manufacturer's name, kind of pipe, National Sanitation Foundation (NSF) approval and schedule number.

**9-15.2 DRIP TUBING**

Delete this title and section and replace with the following:

**9-15.2 CONTROL TUBING (New Section)**

Control tubing shall be copper refrigerator tubing meeting the current requirements of ASTM Designation B 280 in the size specified on the Drawings. Tubing and fittings shall be capable of withstanding a 300 p.s.i. operating pressure, and shall be of the size indicated on the Drawings.

**9-15.3 AUTOMATIC CONTROLLERS**

The fourth sentence of the second paragraph is deleted.

Supplement this section with the following:

(f) Controller adjustments shall be such that the open cycle may be doubled or repeated not less than 3 times during the complete watering cycle.

(g) Controller shall have a power failure cutout.

(h) Controller shall be UL approved and marked accordingly.

**9-15.4 SPRINKLER HEADS**

Supplement this section with the following:

Sprinkler heads shall be of the style, pattern and coverage shown on the Drawings. All heads shall be constructed of heavy duty bronze, brass or stainless steel. Sprinklers shall be designed so that spray adjustments can be made by either an adjustment screw or interchangeable nozzles. Watering cores shall be precision machined for accurate performances and shall be easily removed without removing the housing from the pipe. All turn heads shall be designed with turf flanges having 2 gripping holes to facilitate removal of the head.

**9-15.5 VALVE BOXES AND PROTECTIVE SLEEVES**

The first sentence is revised to read:

All automatic control valves, flow control valves, and pressure reducing valves shall be provided with valve boxes.



**9-15.6 GATE VALVES**

Delete this section and replace with the following:

Gate valves when called for on the Drawings shall be heavy duty bronze conforming to the requirements of ASTM Designation B 62. Valves shall be of the same size as the pipes on which they are placed and shall have union or flange connections. Service rating (for non-shock cold water) shall be 300 p.s.i. Valves shall be of the double disk, taper seat type, with rising stem, union bonnet and handwheel. Manufacturer's name, type of valve and size shall be cast on the valve.

**9-15.7(2) AUTOMATIC CONTROL VALVES**

Delete this section and replace with the following:

Valves shall be of a "normally closed" design and shall be electric solenoid operated, having maximum rating of 6.5 watts utilizing 24 volts AC power. Solenoids shall be directly attached to the valve bonnets or body with all control parts and ports completely internal. Valves shall be of 150 p.s.i. brass or bronze, or iron body bronze-mounted combination. The opening and closing speed of the valve shall be a minimum of 5 seconds for closure with a constant rate of closing, and a minimum of 3 seconds for opening with a constant rate of opening and closing. A manual control bleed cock shall be included on the valve to operate the valve without the requirement of electric current. A manual shutoff stem with cross handle for wrench operation is required for manual adjustment from fully closed to wide open. Once the manual adjustment is set, the valve shall operate automatically in the adjusted position. Water flow shall be completely stopped when the control valve is closed either manually or automatically. Automatic control valves and automatic controllers need not be of the same manufacturer.

**9-15.9 DRAIN VALVES**

Delete this section and replace with the following:

The Contractor shall install 3/4 inch male automatic ball check drain valve at the low point in the system. The drain valve shall be drained to a pocket containing a minimum of 1/2 cubic yard of coarse gravel or crushed rock (3/8 inch to 3 inches size).

**9-15.11 CROSS-CONNECTION CONTROL DEVICES**

Delete this title, section and its subsections and replace with the following:

**9-15.11 BACKFLOW PREVENTION DEVICES (New Section)**

When called for in the Drawings and Special Provisions or as required by the Seattle Water Department, backflow prevention devices meeting the requirements as outlined below shall be furnished and installed. All backflow prevention device installations are subject to inspection by authorized county or municipal authorities.

**9-15.11(1) ATMOSPHERIC VACUUM BREAKERS (New Section)**

Atmospheric vacuum breakers shall be of a type included in the Washington State Department of Social and Health Services listing of "Acceptable Atmospheric (Non-Pressure) Type Vacuum Breaker," or other types with IAPMO approval. They shall be installed downstream of the last shutoff valve and a minimum of 6 inches above the highest outlet or overflow level of the irrigation system.

A vacuum breaker shall be attached to each hose bib.

**9-15.11(2) PRESSURE VACUUM BREAKERS (New Section)**

Pressure vacuum breakers shall be of a type included in the Washington State Department of Social and Health Services listing of "Acceptable Pressure Type Vacuum Breaker" or other types with IAPMO or USC approval. They shall be installed a minimum of 12 inches above the highest outlet or overflow level of the irrigation system and located so that adequate room is available for maintenance and testing.

**9-15.11(3) DOUBLE CHECK VALVE ASSEMBLIES (DCVA) (New Section)**

Double check valve assemblies shall be of a type included in the Washington State Department of Social and Health Services listing of "Approved Double Check Valve Assemblies." Inspection of the installation and the initial test of the unit, to insure proper operation, will be conducted by the Seattle Water Department. DCVA's shall be inspected and tested periodically during the life of the contract by backflow device testers certified by the Washington State Department of Social and Health Services. Units found to be defective shall be repaired or replaced.

Installations shall be according to procedures outlined in the current edition of "Accepted Procedure and Practice in Cross-Connection Control Manual," published by the Pacific Northwest Section, American Water Works Association.

**9-15.11(4) REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION DEVICES (RPBD) (New Section)**

Reduced pressure principle backflow prevention devices will be required if fertilizers or other chemicals are to be injected into the irrigation system. These units shall be of a type included in the Washington State Department of Social and Health Services listing of "Approved Reduced Pressure Backflow Devices." Inspection of the installation and the initial test of the unit, to insure proper operation, will be conducted by the Seattle Water Department. RPBD's shall be inspected and tested periodically during the life of the contract by backflow device testers certified by the Washington State Department of Social and Health Services. Units found to be defective shall be repaired or replaced.

Installation shall be according to procedures outlined in the current edition of "Accepted Procedure and Practice in Cross-Connection Control Manual," published by the Pacific Northwest Section, American Water Works Association.

**9-15.12 CHECK VALVES**

Delete this section and replace with the following:

Check valves shall be heavy duty bronze or steel. The valves shall function by means of a hinged disc suspended from the body and able to close of its own weight. Valves shall be of the size as the pipes on which they are placed, unless otherwise specified, and shall have union or flanged connections. Service rating (for non-shock cold water) shall be 300 p.s.i. Manufacturer's name, type of valve and size shall be cast on the valve.

**9-15.17 ELECTRICAL WIRE**

Delete this section and replace with the following:

Wire from controller to valves shall be #14 UF direct burial (UL approved), red or black for the hot side, white for neutral (solid copper). The auxiliary wires, where required, shall be any third color (except green). UF and UL designations shall be clearly marked on the insulation jacket of all wires.

**9-15.19 SLEEVE (New Section)**

PVC Schedule 40 shall be placed under all pavement in the locations shown on the Drawings. Sizes and installation shall be according to the Drawings and Standard Plans.

Conduit shall meet the requirements of Section 8-20.

**9-15.20 DETECTABLE MARKING TAPE**

Detectable marking tape shall 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 shall be color coded and shall be imprinted continuously over its entire length in permanent black ink to read "Caution - Buried Waterline Below".

## SECTION 9-16 - FENCE AND GUARD RAIL

## 9-16.1(1) GENERAL

Delete paragraph 2 of this section and replace with the following:

The base material for the manufacture of steel pipes used for posts, braces, top rails, and gate frames shall conform to the requirements of ASTM Designation A 120, except the weight tolerance on tubular posts shall be applied as provided below. The base material for the manufacture of steel H columns shall meet the requirements of ASTM Designation A 663.

## 9-16.3(1) RAIL ELEMENT

Delete the first sentence of paragraph 1 and replace with the following:

The W-beam rail element and terminal sections shall consist of 12 gauge steel formed into a beam not less than 12 inches wide and 3 inches deep. Guard rail Type 10 (three beam) and the transition sections shall consist of 10 gauge steel formed into a beam not less than 20 inches wide and 3 inches deep. Design F terminal sections shall consist of 10 gauge steel.

## 9-16.3(2) POST AND BLOCKS

Supplement this section with the following:

Timber posts shall be square, 8 inches by 8 inches S4S and shall conform to the grade specified in Section 9-09. The posts shall be shaped as shown on the Standard Plans before being treated.

## 9-16.6(3) POSTS

Delete paragraph 3 of this section and replace with the following:

The base material for the manufacture of steel pipes used for posts shall conform to the requirements of ASTM Designation A 120, except the weight tolerance on tubular posts shall be applied as provided below. The base material for the manufacture of steel H columns shall meet the requirements of ASTM Designation A 663.

## 9-16.8(1) RAIL AND HARDWARE

Delete the first sentence of paragraph 1 and replace with the following:

Steel for rail elements and terminal sections shall conform to ASTM Designation A 606.

## SECTION 9-18 PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB

## 9-18.1(1) AGGREGATES AND PROPORTIONING

Delete paragraph 2.

## 9-18.1(2) MIXING

Delete this section and replace with the following:

Mixing concrete shall be done in accordance with Section 6-02.3(4).

## 9-18.1(10) CURB LENGTHS

Delete this section and replace with the following:

Curb shall be made in pieces not less than 3 feet nor more than 6 feet in length, except in special cases where shorter lengths are specified. Circular curbing shall be made only for such radii as called for in the detail Drawings.

## SECTION 9-20 - PLASTIC TRAFFIC BUTTONS

Delete Section 9-20 in its entirety. Refer to Section 9-21 Plastic Traffic Buttons and Lane Markers.

## SECTION 9-21 - LANE MARKERS

Delete the title of Section 9-21 and replace with the following:

## SECTION 9-21 - PLASTIC TRAFFIC BUTTONS AND LANE MARKERS

## 9-21.1 LANE MARKERS TYPE 1

Delete this title and section, and replace with the following:

## 9-21.1 PLASTIC TRAFFIC BUTTONS AND LANE MARKERS TYPE 1 (New Section)

Plastic Traffic Buttons and Lane Markers Type 1 shall be essentially in the form of a single-based spherical segment, composed of thermosetting resins and pigments, and of uniform composition throughout. The color shall be yellow or white to correspond to the delineation line color.

## 9-21.1(1) PHYSICAL AND CHEMICAL PROPERTIES

Delete this section and replace with the following:

The exposed surface shall be free of chips, cracks, mold marks, and other irregularities which interfere with appearance or application. The bottom surface may have molded patterns but shall not show general convexity or concavity in excess of 1/8 inch.

The molding process shall be such that coarse aggregate particles on the curved surface are covered by not less than 1/16 inch of pigmented material.

The plastic traffic buttons and lane markers Type 1 shall meet the following requirements:

TRAFFIC BUTTON (Description)	LANE MARKER TYPE 1	PLASTIC TRAFFIC BUTTON, 8 INCH	PLASTIC TRAFFIC BUTTON, 10 INCH
Diameter	3-7/8" to 4-1/8"	7-3/4" to 8-1/4"	9-1/2" to 10"
Weight (pounds)	0.1294 min.	4.0 max.	9.0 max.
State Reflectance	80% min.	70% min.	70% min.
Flexural Strength (Pounds total load)		1500 min.	1500 min.
Impact Resistance (Inches)	15 min.		
Planeness of Base:			
Concavity (Inches)	0.02 max.	0.125 min.	0.125 max.
Convexity (Inches)	0.05 max.	0.125 min.	0.125 max.
Titanium Dioxide (% by weight)	21 min.		
Resin Content (% by weight)	20 min.		

## 9-21.1(2) TEST METHODS (New Section)

Test methods shall be as follows:

- Reflectance: Reflectance will be measured with a photovolt Reflectance Meter or its equivalent by comparing the buttons to a 75 percent brightness standard.
- Flexural Strength: Flexural strength will be measured by placing the button base down on two 3/4 inch round bar supports placed 4 inches apart (with each rod offset 2 inches from the diameter of the button) and loading vertically at the center of the curved section by means of a flat plate.
- Impact Resistance: Impact resistance will be measured by allowing a 1 pound steel ball to fall 15 inches (free fall) onto the lane marker, supported by but not bonded to a steel base plate.
- Titanium Dioxide Content: The titanium dioxide content will be determined by ashing representative portions of the lane marker, treating the ash with a boiling  $(\text{NH}_4)_2\text{SO}_4$   $\text{H}_2\text{SO}_4$  solution, filtering,

and measuring the absorbance of the filtrate at about 410 millimicrons. Calibration shall be with known samples using ASTM Designation D 921.

- (e) Resin Content: Resin content will be determined by ashing and igniting representative portions of the marker.

Additional information on the test methods is available from the Materials Laboratory of the Seattle Engineering Department.

## SECTION 9-22 - MONUMENT CASES

Delete the title and content of Section 9-22 in its entirety and replace with the following:

## SECTION 9-22 - MONUMENT FRAMES AND COVERS (New Section)

Monument castings shall be cast iron and as indicated on Standard Plan No. 020.

Castings shall conform to the requirements of ASTM Designation A 48, Class 30 and shall be free of porosity, shrink cavities, cold shuts or cracks, or any surface defects which would impair serviceability. Repair of defects by welding, or by the use of "smooth-on" or similar material, will not be permitted. The manufacturer shall certify that the product conforms to the requirements of these specifications.

A bituminous coating meeting the requirements of Section 9-05 shall be applied to all faces.

Monument castings shall be machine finished or ground on seating surfaces to assure non-rocking fit in any position, and interchangeability. There shall be made available at the foundry standard frames and standard covers for use by the Engineer in testing fit and seating.

## SECTION 9-23 - CONCRETE CURING MATERIALS AND ADMIXTURES

## 9-23.3 TRANSPARENT CURING COMPOUND (New Section)

The compound, at the time of application, shall be a liquid that is free from suspended matter and sufficiently low in viscosity to result in an even, uniform coating when applied by spraying.

The compound shall be sufficiently transparent and free from permanent color to result in no pronounced change in color from that of the natural concrete at the conclusion of the curing period. The compound shall contain a dye of color strength sufficient to render the film distinctly visible on the concrete for at least 4 hours after application.

The loss of moisture shall not exceed 2 grams per specimen when subjected to the Test for Moisture Retaining Effectiveness of Concrete Curing Compounds. Details of the test method are available from the Materials Laboratory of the Washington State Department of Transportation in Olympia, Washington.

## 9-23.4 VACANT

## 9-23.9 CONCRETE MIXES INCORPORATING FLY ASH (New Section)

Delete Section 9-23.9 in its entirety and replace with the following:

Concrete mixes incorporating fly ash may be utilized for all classes of concrete, unless otherwise noted in the Special Provisions. Mix proportions will be subject to approval by the Engineer and shall be in compliance with the following conditions:

- (a) Fly ash may be used to replace up to 20 percent of portland cement at the rate of 1 1/4 pounds fly ash for each pound of portland cement replaced.
- (b) Cement replacement may be used subject to confirmation and approval of the proposed mix by the Engineer for concrete Class B when used in load bearing portions of bridges, culverts and retaining walls and for all concrete Class A and Class AX and other classes of concrete specified in the Special Provisions which require a minimum compressive strength of 4,000 pounds per square inch, or greater, at 28 days, subject to the following mix design requirements:
  - (1) The Contractor shall design a mix that meets the specified strength requirements in conformance with ASTM C 94, Section 5.3, Alternate Number 2, Section 16 and Table 3. The concrete strength criteria shall be per ASTM C 94 Section 16.5.2 using the minimum compressive strength of concrete at 28 days as listed in Section 6-02.3(2) of the Standard Specifications. A coefficient of variation of 20 percent shall be assumed unless the supplier can justify a lower value. A minimum of 30 sets of cylinder breaks, each set from a different batch of the same proposed mix design, are required to establish a coefficient of variation. A set of cylinder breaks shall consist of the average of 2 cylinders.
  - (2) The mix shall be approved by the Engineer and verified by submission of ingredients and testing of specimens made from the mix prior to use in the project.
  - (3) Confirming mix tests shall be made with the proposed production aggregates, type and source of portland cement and fly ash, and specific brands and proportions of admixtures to be used in the project. The test mix shall be air entrained if required.
- (c) Cement replacement may be used without further confirmation testing of the proposed mix for concrete Class D, and Class DX and Concrete Class B for applications other than those listed in Item 2.
- (d) In making calculations relative to cement factor or allowable water content, the total cementitious material shall be considered to be the weight of portland cement plus the weight of fly ash substituted.
- (e) All concrete of the same class within a structure shall contain the same proportion of fly ash.

As an alternative to the use of fly ash and cement as separate components, a blended hydraulic cement may be used. Concrete made with blended hydraulic cement shall meet the requirements listed. In addition, the origin and percentage of fly ash shall be certified on the cement mill test. The blended hydraulic cement shall comply with ASTM C-595-83 Type IP(MS).

Fly ash shall conform to the requirements of ASTM C 618 Class F with optional chemical and physical requirements as set forth in Tables 1A and 2A and with a further limitation that the loss of ignition be a maximum of 1.5 percent.

All costs in connection with replacing portland cement with fly ash as specified shall be included in the unit contract price per cubic yard in place for the various classes of concrete involved. If the concrete is to be paid for other than by class of concrete, all costs involved with replacing portland cement with fly ash as specified shall be included in the unit contract price for the applicable item or items of work.

## 9-23.10 COLORING AGENT (New Section)

The coloring agent for matching the color of new concrete to the color of adjacent existing concrete shall be dry lamp black, added to the concrete during mixing in an amount not to exceed 1-1/2 pounds per cubic yard of concrete.

Use of liquid concrete coloring agent will be permitted when approved by the Engineer.



## SECTION 9-27 - CRIBBING

## 9-27.2 FIBER-BONDED METAL CRIBBING

This section is deleted.

## 9-27.3(1) WIRE

Delete paragraph 3 and replace with the following:

Stainless steel fasteners for use with Type 2 gabions shall be fabricated of 10 gauge 431 stainless steel. The fasteners shall be capable of sustaining a load of 600 pounds without opening when tested in tension. The hardness of the steel shall be such that the clips can be opened 1/4 inch without permanent deformation.

## SECTION 9-28 - SIGNING MATERIALS AND FABRICATION

Delete Section 9-28 in its entirety and replace with the following:

## 9-28.1 SIGNS (New Section)

## 9-28.1(1) GENERAL (New Section)

Signs to be mounted on wood utility poles (other than City Light) and signs installed overhead shall be High Density Overlay plywood. Other signs shall be either High Density Overlay plywood or sheet aluminum.

Parking and pedestrian control signs may be nonreflectORIZED. All other traffic signs shall be reflectORIZED.

STOP and YIELD sign backs and edges shall be painted with one coat of red enamel to match the red on the sign face.

Regulatory and warning signs shall have rounded corners with the exception of STOP signs. All other signs shall have square cut corners. Borders for signs having square cut corners shall have a corner radius approximately 1/8 of the lesser side dimension of the sign up to a maximum radius of 12 inches. For signs with rounded corners, the borders shall be concentric with the rounded corners.

## 9-28.1(2) PLYWOOD (New Section)

Plywood signs shall be constructed of High Density Overlay plywood, meeting the requirements of "Products Standard PS 1-83 for Softwood Plywood, Construction and Industrial" published by the Product Standards Section of the U.S. Department of Commerce. The plywood shall be free of contaminants which would adversely affect the application or life of the sheeting to be applied. Face veneers shall be Grade B or better.

Core and crossband veneers shall be solid. Core veneers shall be jointed, and core gaps shall not exceed 1/8 inch in width. The entire area of each contacting veneer surface shall be bonded with a waterproof adhesive that meets the requirements of the U.S. Department of Commerce for exterior type plywood.

The overlay shall be of the high density type. It shall have a minimum weight of 60 pounds per thousand square feet of surface and shall be at least 0.012 inches thick before pressing. The overlay shall have a sufficient resin content to bond itself to the plywood, with a minimum resin content of 45 percent based on the dry weight of the impregnated fiber.

## Thickness-Single Panel Plywood Signs:

Up to 18 inches inclusive in width . . . . .	3/8 inch
Over 18 inches to 36 inches inclusive in width . . . . .	5/8 inch
Over 36 inches in width . . . . .	3/4 inch
Overhead signs . . . . .	3/4 inch

Street designation signs and signs mounted on span wires or mast arms shall have the sign back and edges primed with 1 coat of white exterior enamel undercoat and finished with 1 coat of International Green (Forest Green) exterior enamel. All other plywood signs shall have just the edges primed with 1 coat of white exterior enamel undercoat and finished with 1 coat of white exterior enamel. The primer shall be as recommended by the supplier of the finish coat. The finish enamel shall meet the requirements of Federal Specification TT-E-489.

## 9-28.1(3) SHEET ALUMINUM (New Section)

Sheet aluminum signs shall be constructed of alloy 6061-T6.

After the sheeting has been fabricated, the sheeting shall be degreased and etched by immersion for a minimum of 5 minutes in a 6 ounce per gallon caustic etch solution at 120 degrees F, followed, in order, by a water rinse, de-oxidation, water rinse, hot water rinse, and drying. The etching process

shall produce a dull aluminum finish on both sides of the panel which will last the life of the sign. The treated panel surface shall be compatible with the sign face sheeting to be applied. Reflectorized aluminum signs shall be comprised of panels 4 feet or less in width. The Contractor shall use the widest panels possible. Parts necessary for assembly shall be constructed of aluminum. Sheet aluminum thickness shall be 0.080 inch.

Metal shall be handled by device or clean canvas gloves between cleaning and etching operations and the application of sign face sheeting.

#### 9-28.1(4) REFLECTIVE SIGN FACE SHEETING (New Section)

Reflective sheeting shall consist of spherical lens elements either embedded within a transparent plastic or adhered to a synthetic resin and encapsulated by a transparent plastic. The sheeting shall have a flat, smooth outer surface, be weather resistant, and have a pre-coated adhesive backing with a protective liner.

The sheeting shall have the following minimum brightness values expressed as average candle power per foot candle per square foot of material. Measurements shall be conducted in accordance with standard testing procedures for reflex reflectors in Federal Specification L-8-300.

With Embedded Lens Elements:

Div. Ang. Inc. Ang.	Silver White #1			Silver-White #2			Yellow		
	0.2°	0.5°	1.5°	0.2°	0.5°	1.5°	0.2°	0.5°	1.5°
-4° 40°	70.0 14.5	30.0 8.5	4.0 1.5	80.0 16.5	41.0 9.5	4.0 2.0	50.0 11.5	25.0 7.0	5.0 1.5
Div. Ang. Inc. Ang.	Red			Blue			Green		
	0.2°	0.5°	1.5°	0.2°	0.5°	1.5°	0.2°	0.5°	1.5°
-4° 40°	14.5 3.0	7.5 1.5	1.0 0.3	4.0 0.9	2.0 0.4	0.6 0.08	9.0 1.8	4.5 1.5	1.0 0.2
Div. Ang. Inc. Ang.	Orange			Brown					
	0.2°	0.5°	1.5°	0.2°	0.5°	1.5°			
-4° 40°	25.0 1.0	13.5 0.8	1.5 0.1	1.0 0.2	0.35 0.1	0.1 0.01			

With Encapsulated Lens Elements:

Div. Ang. Inc. Ang.	Silver White			Yellow		
	0.2°	0.5°	1.5°	0.2°	0.5°	1.5°
-4° 40°	250.0 120.0	95.0 54.0	4.0 2.0	170.0 80.0	62.0 35.0	3.0 1.5
Div. Ang. Inc. Ang.	Orange			Green		
	0.2°	0.5°	1.5°	0.2°	0.5°	1.5°
-4° 40°	70.0 33.0	25.0 14.0	1.1 0.5	30.0 14.0	12.0 6.8	0.5 0.2
Div. Ang. Inc. Ang.	Red					
	0.2°	0.5°	1.5°			
-4° 40°	35.0 16.0	13.0 7.4	0.7 0.3			

The brightness of the reflective sheeting, totally wet by rain, shall be not less than 90 percent of the above values. Wet performance measurements shall be conducted in conformance with the Standard Rainfall Test specified in Federal Specification L-8-300.

The diffuse day color of the reflective sheeting shall be visually evaluated by comparison with the applicable Highway Color Tolerance Chart. Color comparisons shall be made under north daylight or a scientific daylight having a color temperature of from 6500 degrees to 7500 degrees Kelvin. Color shall be illuminated at 90 degrees and viewed at 45 degrees.

The sheeting surface shall be smooth and facilitate cleaning and wet performance and exhibit 85 degree glossmeter rating of not less than 50 (ASTM D 523). The sheeting surface shall be readily processed and compatible with transparent and opaque process colors and show no loss of the color coat with normal handling, cutting, and application. The sheeting shall permit cutting and color processing at temperatures of 60-100 degrees F. and 20-80 percent relative humidity.

The sheeting surface shall be solvent resistant such that it may be cleaned with gasoline, VM&P Naptha, mineral spirits, turpentine, methanol, or xylol.

The embedded lens sheeting, when applied according to manufacturer's recommendations to cleaned and etched 0.020-inch x 2-inch x 8-inch aluminum, conditioned 24 hours, and tested at 72 degrees F. and 50 percent relative humidity, shall be sufficiently flexible to show no cracking when bent around a 3/4-inch diameter mandrel.

Conditioned for 48 hours, the tensile strength of the embedded lens sheeting shall be 5 to 20 pounds per inch width when tested in accordance with ASTM Designation D 828. Following liner removal, the sheeting shall not shrink more than 1/32-inch in 10 minutes nor more than 1/8-inch in 24 hours in any dimension per 9-inch square at 75 degrees F. and 50 percent relative humidity.

The encapsulated lens sheeting, with liner removed, conditioned for 24 hours at 72 degrees F. and 50 percent relative humidity, shall be sufficiently flexible to show no cracking when bent around a 1/8-inch diameter mandrel with adhesive side contacting the mandrel.

The protective liner attached to the adhesive shall be easily removable by peeling without soaking in water or other solvents.

The pre-coated adhesive backing shall be a tack free heat activated type or a pressure sensitive type, either of which shall adhere to the sheeting without the necessity of additional coats of adhesive.

The adhesive shall form a durable bond to smooth corrosion and weather-resistant surfaces and permit the reflective sheeting to adhere securely 48 hours after application at temperatures of 30 degrees F. to 200 degrees F. The adhesive bond shall be sufficient to render the applied sheeting vandal-resistant and prevent its shocking off when jabbed with a spatula at 10 degrees F. The sheeting shall resist peeling from the application surface when a 5-pounds per inch width force is applied as outlined in ASTM Designation D 903.

#### 9-28.1(5) NON-REFLECTIVE SIGN FACE SHEETING (New Section)

The non-reflective sheeting shall consist of a white plastic film having a smooth, flat outer surface. The sheeting shall be weather-resistant and have a protected pre-coated adhesive backing.

#### 9-28.1(6) SHEETING APPLICATION (New Section)

Plywood sign faces shall be cleaned with lacquer thinner, heptane, benzene, or solvent recommended by the sheeting manufacturer. The surface shall be sanded with light sandpaper or steel wool and wiped dry and clean with clean cloth. Aluminum sign faces shall be cleaned with a solvent recommended by the sheeting manufacturer.

Sign face sheeting shall be applied by a vacuum applicator recommended by the sheeting manufacturer, or by a continuous roll applicator.

Heat-activated adhesive backed sheeting shall be applied by the vacuum method. The adhesive on the back of the sheeting shall be activated by a minimum temperature of 185 degrees F. and with a minimum vacuum pressure of 25 inches of mercury. This operation shall be in effect for a minimum of 3 minutes on plywood and 5 minutes on metal. After aging for 48 hours at 75 degrees F., the adhesive shall form a bond equal to or greater than the strength of the sheeting.

Pressure sensitive adhesive backed sheeting shall be applied by a continuous roll applicator. The process shall be in conformance with the recommendation of the sheeting manufacturer.

Edges and splices of sign face sheeting shall be coated with an edge sealer recommended by the sheeting manufacturer.

#### 9-28.1(7) LETTERS, ARROWS, AND SYMBOLS (New Section)

Letters, arrows, and symbols shall be of the type, size, and color specified on the Drawings, Specifications, and the "Standard Highway Signs" by United States Department of Transportation.

Letters, arrows, and symbols shall be of material compatible with the sign surface material, as recommended by the sign surface manufacturer or approved by the Engineer.

## 9-28.2 POSTS (New Section)

## 9-28.2(1) WOOD SIGN POST (New Section)

Wood sign post shall be Standard Grade Western Cedar with 2 coats of white primer. The first coat shall be quick dry alkyd white primer, meeting the requirements of Federal Specification TT-P-636. The second coat shall be reinforcing white primer, semigloss oil base, meeting the requirements of Federal Specification TT-P-102, Class A. The top of each sign post shall be chamfered at approximately 45 degrees. STOP and YIELD sign posts shall be painted with alternating 6-inch red and white paint stripes of sash and trim type exterior enamel, as indicated on Standard Plan No. 625, Wood Traffic Sign Posts Detail.

## 9-28.2(2) PARKING METER POST (New Section)

Parking meter post shall be fabricated from standard black 2-inch inside diameter pipe or standard Schedule 40 galvanized pipe, 40 inches in length, and 5/16-inch x 5-inch x 5-inch steel base plate. Parking meter post shall be primed with rust inhibitive paint and painted with 2 coats of aluminum, yellow or green paint, according to the time limit usage designated by the Engineer.

A parking meter base canopy shall be provided with all parking meter posts. Where a parking meter post is used as a sign post with no parking meter, a parking meter wood final shall be provided. The wood final shall be finished with 1 coat exterior enamel undercoat and a final coat of aluminum exterior enamel.

## 9-28.2(3) STREET NAME SIGN POST (New Section)

Street name sign post shall be 2-1/2 inches x 10 feet 6 inches standard gauge galvanized pipe, with a 6 inch end section flattened to form a wedge.

## 9-28.3 SIGN COVERING (New Section)

Sign covering shall consist of 4 mil minimum thickness black polyethylene sheeting.

## SECTION 9-29 - ILLUMINATION, SIGNALS, ELECTRICAL

Delete the title and content of Section 9-29 in its entirety and replace with the following:

## SECTION 9-29 - PAVEMENT MARKING (New Section)

## 9-29.1 GENERAL (New Section)

Materials for pavement markings shall be paint or plastic material as note in the Bid Form.

## 9-29.2 PAINT (New Section)

Paint shall comply with specifications for no heat, instant dry pavement marking. White sharp sand shall comply with specifications for E-16 sand.

## 9-29.2(1) PHYSICAL PROPERTIES OF THE COATING (New Section)

## (a) Viscosity (in Krebs Units).

- (1) At 70 degree F. - 70-75 KU
- (2) At 50 degree F. - 86 KU max.
- (3) At 122 degree F. - 66 KU min.

## (b) Weight per gallon at 70° F.

White 12.00 pounds min.  
Yellow 12.10 pounds min.

## (c) Contract ratio at spread rate of 320 sq. ft. per gallon.

White .92 min.  
Yellow .92 min.

## (d) Daylight reflectance (at 10 mils wet film thickness).

White 86 min.  
Yellow 64 min.

## (e) Non-volatile content (total at 212 degree F.) - 65%-68%.

## (f) Pigment content of total weight - 53% max.

## (g) Dispersion, Hegman standard gauge - 2 min.

## (h) Flexibility - Pass 1/2 in. mandrel bend.

## (i) Dry to no-pick-up (beaded) - 15-35 sec.

## (j) Bleeding over asphalt - 90% min.

## (k) The material shall not show evidence of heavy caking or settling which requires mechanical means to return the produce to usable condition for a period of one year from the date of manufacture or date first shipped to the Owner.

## (l) Color

The paint shall match a standard color sample which may be obtained upon application to the Materials Engineer at the Materials Laboratory, Seattle Engineering Department (Phone: 625-2951).

## 9-29.2(2) TEST METHODS (New Section)

The properties enumerated in these specifications shall be determined in accordance with the following methods of test:

## (a) Viscosity - Federal test method standard 141A, Method #4281.

- (b) Weight per gallon - Federal test method standard 141A, Method #4184.1.
- (c) Contrast ratio - Federal test method standard 141A, Method #4121 procedure "B", method "B".
- (d) Daylight reflectance - Federal test method standard 141A, Method #6121 using standards as prescribed in Par. 1.3.2.
- (e) Non-volatile content - Federal test method standard 141A, Method #4021.1.
- (f) Pigment content - Federal test method standard 141A, Method #4021.1.
- (g) Dispersion - Federal test method standard 141A, Method #4411.1.
- (h) Flexibility - The paint shall show no cracking, flaking, or loss of adhesion when tested in the following manner:

Apply a wet film thickness of .005 inches with a film applicator to a 3 x 5 tin panel weighing 0.39 to 0.51 lbs. per square foot previously cleaned with benzene and lightly buffed with steel wool. Dry the paint film at 70 - 80 degrees F. in a horizontal position for 18 hours, then bake in an oven 3 hours at 212° ± 4 degree F. Cool to room temperature for at least 1/2 hour and bend over a 1/2 inch diameter rod and examine.

- (i) Dry to no-pick-up - The reflectorized line, when applied at a rate of 10 mils wet film thickness and 4 pounds of glass spheres per gallon of paint, shall dry to no-pick-up in 15-35 seconds. For test purposes, the line shall be applied using a striper with accurate thickness control capable of maintaining a uniform thickness with 4 pounds of glass spheres per gallon either dropped or blown onto the stripe. The line shall be dry to no-pick-up within specified time range when the pavement temperature is 55 degree F. or more and the relative humidity is 50 percent or less, providing that the pavement is dry. Dry to no-pick-up tests will be performed by having a standard size sedan or equivalent test vehicle, coast across the paint stripe (no turning or accelerating). A successful no-pick-up test will be considered one in which at least 3 out of 4 samples show no visible paint from the stripe being tracked onto the adjacent pavement when viewed standing 50 feet from the point where the test vehicle crosses the stripe. All paint samples shall have successfully completed all lab tests prior to the no-pick-up test being performed. All field testing shall be performed blind in that the persons conducting the field test shall have no knowledge of which sample is from which manufacturer. All testing shall be performed without the manufacturer's representatives present. Each manufacturer will be provided test results for their sample(s) upon request.

- (j) Bleeding over asphalt - ASTM standards.

D 969 using substrate as in Par. 3.2 except reflectance measurement over asphalt paper area is compared to reflectance measurement over taped area.

$$\frac{\text{Reflectance over asphalt paper area}}{\text{Reflectance over taped area}} \times 100 = \% \text{ Bleeding over asphalt}$$

#### 9-29.2(3) COMPOSITIONAL REQUIREMENTS (New Section)

- (a) Pigment Composition

Pigments shall be first quality point grade pigments. Medium chrome yellow for the yellow traffic paint shall meet the requirements of ASTM D 211-67, Type III. The Titanium Dioxide for the white traffic paint shall meet the requirements of ASTM D 476-73 Type II, III or IV. The inert or filler pigments must be of a type and quality generally recognized as first quality paint grade products and shall not contribute to settling of the paint on storage or be so hard as to cause excessive wear of the spray application equipment.

- (b) Vehicle or Resinous Binder Composition

The vehicle may be any combination of natural or synthetic resinous materials. Chlorinated rubber combined with other natural and/or synthetic resins and plasticizers is the preferred system. All resins used must be permanently capable of re-dissolving in the solvent combination used in the paint. Therefore, resins which dry by the process of oxidation and/or polymerization such as alkyl resins are specifically excluded as suitable resinous binders in this specification. The purpose of the above requirement is to minimize build-up of the paint on the sides of tanks, paint lines, and clogging of spray equipment from undissolvable skins.

#### 9-29.3 THERMOPLASTIC (New Section)

One of the following types of thermoplastic pavement marking material Types "A" or "B" shall be used at the Contractor's option and in compliance with the manufacturer's recommendations:

Type "A": Hot-laid, liquid thermoplastic material, containing reflective glass bead (with additional glass beads applied separately), 120 mil (3.0 millimeters) or greater thickness.

The approved thermoplastic material suppliers are as follows:

- (a) Lafrentz brand, 125 mil thickness, hot extruded thermoplastic manufactured by Lafrentz Road Services Ltd., Edmonton, Alberta, Canada T6E4N7, or
- (b) Catatherm ABITOL formulation, 125-mil thickness, hot extruded thermoplastic manufactured by Ferro Corporation, Cataphote Division, P.O. Box 2369, Jackson, Mississippi 39205, or
- (c) M.L.E. Code #R200/80 formulation, 125-mil thickness, hot extruded thermoplastic manufactured by M.L.E. Industries Ltd., Calgary, Alberta, Canada T2C1N6, or
- (d) Pave-Mark SD formulation, 125-mil thickness, hot extruded thermoplastic manufactured by Pave-Mark Corporation, Smyrna, Georgia 30081.

Type "B": Cold-laid, prefabricated glass bead reflective thermoplastic ribbon, 60 mil (1.5 millimeters) or greater thickness.

The approved thermoplastic material suppliers are as follows:

- (a) Prismo brand thermoplastic pavement marking material, 60 mil thickness (HT60), coated with pressure sensitive adhesive, manufactured by Prismo Universal Corporation, 300 Lanidex Plaza, Parsippany, N.J. 07054, or
- (b) Prismo brand thermoplastic pavement marking material, 90 mil thickness (HT90), coated with pressure sensitive adhesive, manufactured by Prismo Universal Corporation, 300 Lanidex Plaza, Parsippany, N.J. 07054.
- (c) 3M, Stamark brand pliant polymer pavement marking film, 60-mil thickness, coated with pressure-sensitive adhesive, manufactured by 3M Company, 3M Center, St. Paul, Minnesota 55101.

The glass beads shall comply with specifications for Type II waterproof overlay glass spheres.

The skid resistance of the material when installed on the roadway shall be not less than 40 BPN when tested with a British Portable Tester in accordance with ASTM E 303.

Primer, if required, shall be as recommended by the thermoplastic material manufacturer.

#### 9-29.4 PRESSURE SENSITIVE TAPE (New Section)

Pressure-sensitive tape shall be a 4 inch wide, pressure-sensitive, reflective-type tape of the form suitable for marking asphalt and concrete pavement surfaces. Biodegradable tape with paper backing is unacceptable.

The following pressure-sensitive tape has been approved as a temporary pavement marking tape:

1. 3-M Scotch name brand pavement marking tape, coated with pressure-sensitive adhesive, manufactured by 3-M Company, 3-M Center, St. Paul, Minnesota 55101.

Surface preparation and application shall be in conformance with all the manufacturer's specifications.

## SECTION 9-30 - WATER DISTRIBUTION MATERIALS

## GENERAL

Delete the Section "General" and replace with the following:

All materials for water distribution and transmission shall be new. Except that materials used for temporary water mains and temporary service connections shall be either new or previously used only on temporary potable water supplies, and shall be subject to Seattle Water Department inspection and approval prior to installation.

Prior to ordering any pipe to be used in a potable water supply, the Contractor shall submit the material source, in accordance with Section 1-06.1 and obtain the Engineer's approval.

## 9-30.1 PIPE

## 9-30.1A DUCTILE IRON PIPE

Delete this section and replace with the following:

- (a) Ductile iron pipe shall be centrifugally cast in 18-foot nominal lengths conforming to AWWA C151 and shall have a cement-mortar lining conforming to AWWA C104. Ductile iron pipe to be joined using restrained joints shall be Standard Thickness Class 52. All other ductile iron pipe shall be Standard Thickness Class 52 or the thickness class as shown on the Drawings and/or Special Provisions.
- (b) Non-restrained joints shall be rubber gasket, push-on type, or mechanical joint conforming to AWWA C111.
- (c) Tension joints shall be as specified in Section 9-30.2F.
- (d) Special pipe coatings shall be in accordance with Section 9-30.2J.
- (e) Pipe with threaded flanges shall not be used.

## 9-30.1B ASBESTOS-CEMENT PIPE

Delete this section.

## 9-30.1C CONCRETE CYLINDER PIPE

Delete paragraph 1 and replace with the following:

Concrete cylinder pipe shall be modified, pretensioned concrete cylinder pipe with steel cylinder core. The pipe shall conform to AWWA C303, and shall be designed for the minimum pressure as specified on the Drawings or Special Provisions. The pipe manufacturer shall provide design calculations, tabulated layout, and details of specials and fittings. Specials and fittings shall be subjected to the same hydrostatic test required for straight sections. Tension joints shall be provided where shown on the Drawings.

Identification marks shall include design pressure and other items outlined in Section 1.6 of AWWA C303.

Sizes, class, marking, specials, lengths, etc., shall be as indicated on the Drawings or the Special Provisions. All items listed in Section 1.5 of AWWA C303 shall be provided for the Engineer by the pipe supplier. Cement mortar lining roughness tolerance shall be not more than  $\pm 1/16$ -inch.

## 9-30.1D STEEL PIPE

Delete this section and replace with the following:

## 9-30.1D(1) STEEL PIPE LESS THAN 4 INCHES DIAMETER (New Section)

Steel pipe smaller than 4 inches in diameter shall conform to ASTM Designation A 120, Schedule 40 and shall (including couplings) be hot dip galvanized inside and out. The pipe shall be coupled by using malleable iron screw coupling in accordance with ANSI Specification B16.3.

## 9-30.1D(2) STEEL PIPE 4 INCH DIAMETER AND LARGER (New Section)

Steel pipe 4 inches in diameter and larger shall conform to AWWA C200. The type of protective coating and lining and other supplementary information required by AWWA C204 shall be included on the Drawings and/or in the Special Provisions.

## 9-30.1D(3) STEEL CASING PIPE (New Section)

Steel casing pipe shall conform to the above sections and shall have a diameter and wall thickness as shown on the Drawings and/or in the Special Provisions. The pipe shall be smooth and bare.

## 9-30.1E POLYVINYL CHLORIDE (PVC) PIPE (4 INCHES AND OVER)

Delete paragraph 1 and replace with the following:

PVC pressure pipe shall conform to the requirements of AWWA C900, Class 200 (DR 14). Standard lengths shall be 20 feet (nominal). PVC pipe shall have the same outside dimensions as ductile iron pipe. PVC pipe for distribution pipelines shall be pressure Class 150. The pipe shall bear the seal of the National Sanitation Foundation for potable water pipe. The Contractor shall furnish the Engineer an affidavit that all delivered materials comply with this specification. In addition to the affidavit, the manufacturer shall furnish a sample marked in accordance with AWWA C900. Pipe joints shall be made with a rubber ring and thickened bell. Solvent welded pipe joints will not be permitted. All pipe shall be listed by Underwriters' Laboratories, Inc.

All PVC pipe shall be considered flexible conduit. Joints shall conform to ASTM D 3139 using a restrained rubber gasket conforming to ASTM F 477.

## 9-30.2 FITTINGS

## 9-30.2A DUCTILE IRON PIPE

Delete this section and replace with the following:

Fittings for ductile iron pipe shall be ductile iron conforming to AWWA C110 and C111 or AWWA C153 and shall be cement-mortar lined conforming to AWWA C104.

Except where restrained joint systems are required, mechanical or push on joints may be used.

Where restrained joint pipe is required, threaded flanges by restrained joint adapters shall not be longer than three pipe diameters. Threaded flanges and pipe shall conform to AWWA C115. The exterior flange lip overlapping the pipe barrel shall be sealed with a bituministic mastic.

Sleeves less than 12 inch diameter shall be 12 inch minimum length and shall be mechanical joint.

Sleeves greater than 12 inch diameter shall be of the long body type and shall be 15 inches minimum length and shall be mechanical joint.

Hub-by-flange fitting length shall conform to AWWA C110 or AWWA C153. Threaded flanges and pipe thickness shall conform to AWWA C115. Hub-by-flange fittings shall be mortar lined per AWWA C105. The exterior flange lip overlapping the pipe barrel shall be sealed with a bituminous mastic. Threaded flanges will be allowed only on hub-by-flange fittings. Pipe with threaded flanges will not be allowed.

## 9-30.2B ASBESTOS CEMENT PIPE

Delete this section.



**9-30.2C CONCRETE CYLINDER PIPE**

Delete this section and replace with the following:

Fittings for Concrete Cylinder Pipe shall meet requirements of AWWA C303 and shall be in accordance with details in the Drawings or Special Provisions.

**9-30.2D STEEL PIPE**

Delete paragraph 1 and replace with the following:

Fittings for steel pipe 3-1/2 inches in diameter and smaller shall be malleable iron threaded type with a pressure rating of 150 psi. Dimensions shall conform to ANSI B 16.3. Threading shall conform to ANSI B 2.1. Material shall conform to ASTM A 47, Grade 32510. All fittings shall be banded and hot-dip galvanized inside and out.

Delete paragraph 3 and replace with the following:

Steel fittings for pipe 4 inches in diameter and larger shall be in accordance with AWWA C208. The class of the fittings shall be at least the same as that of the pipe. Coatings for the fittings shall be the same as specified for the pipe. Field couplings shall be compression type. When flanges are required, they shall conform to AWWA C207. All couplings shall be coated the same as the pipe.

**9-30.2F TENSION JOINTS**

Delete this title and section and replace with the following:

**9-30.2F RESTRAINED JOINTS (New Section)**

Restrained joints, where required on the Drawings, shall be TR Flex Restrained Joint Pipe as manufactured by U.S. Pipe Co., or approved equal.

Where restrained joint pipe is required, threaded flanges by restrained joint adapters shall not be longer than three pipe diameters. Threaded flanges and pipe shall conform to AWWA C115. The exterior flange lip overlapping the pipe barrel shall be sealed with a bituministic mastic.

**9-30.2G TRANSITION REDUCING AND FLEXIBLE COUPLINGS**

Delete this title and section, and replace with the following:

**9-30.2G TRANSITION REDUCING, FLEXIBLE COUPLINGS AND SLEEVES (New Section)**

Transition couplings, reducing couplings, transition reducing couplings, sleeves, and flexible couplings for water mains shall be compression type, Smith-Blair, Dressler or approved equal, constructed with gray or ductile iron sleeves and ductile or malleable iron followers. Bolts and nuts shall be ductile iron unless otherwise noted on the Drawings and/or in the Special Provisions. Couplings and sleeves shall be the long body pattern with a minimum length of 10 inches for pipe up to 12 inches diameter and 15 inches minimum length for pipe greater than 12 inches diameter. Factory finish shall be the standard of the manufacturer.

**9-30.2H RESTRAINED FLEXIBLE COUPLINGS**

Delete this title and section, and replace with the following:

**9-30.2H RESTRAINED FLEXIBLE COUPLINGS AND SLEEVES (New Section)**

Restrained flexible couplings or sleeves shall be in accordance with the Drawings and the Special Provisions.

**9-30.2I SPECIAL FITTINGS (New Section)**

Special fittings shall be in accordance with the Drawings and Special Provisions.

**9-30.2J SPECIAL PIPE COATINGS (New Section)**

Special pipe coatings shall be in accordance with the Special Provisions.

**9-30.2K TWO INCH BLOW OFF ASSEMBLY (New Section)**

2-inch blow off assembly shall be as indicated on the Drawings.

2-inch plastic service tube shall be polyethylene PE 3406, and shall conform to Section 9-30.6C(2). 2-inch gate valve and operator shall be Kennedy 427, Nibco-Scott 123, Stokum B-110, or approved equal. Plastic foam material shall conform to Section 9-30.2L. Ring and Cover shall conform to Section 9-30.3K(8). Meter Box shall conform with Section 9-30.6G.

**9-30.2L PLASTIC FOAM (New Section)**

Plastic foam used in water main construction for meter boxes, valve chambers, valve boxes, pipe protection and various pipeline uses shall meet the Federal Spec. PPP-C-1752B Type 1, Class 2.

**9-30.2M PORTLAND CEMENT CONCRETE (New Section)**

Portland Cement Concrete for pipe support saddles and cradles and for thrust blocking shall be Class 5(1-1/2).

**9-30.2N POLYETHYLENE ENCASEMENT (New Section)**

Polyethylene film for encasement of ductile iron pipe and fittings shall conform to AWWA C105. Minimum thickness shall be 8 mil.

**9-30.2O STEEL CASING PIPE (New Section)**

Steel casing pipe shall conform to Section 9-30.1D and shall have a diameter and wall thickness as specified on the Drawings. Pipe shall be smooth and bare.

**9-30.2P STEEL PIPE CASING SEALS AND SPACERS (New Section)**

Casing seals shall be used to seal the ends of the casing with the water main. These seals may be Multiflex Molded Type or Pull On Fabricated Type as manufactured by F.H. Maloney Company, or approved equal.

Crossing Insulators (Spacers) shall be used to isolate the steel casing pipe from the water main. The Insulators (Spacers) shall be Maloney Model 60 as manufactured by F.H. Maloney Company, or as manufactured by Cascade Manufacturing Company, or approved equal.

**9-30.3 VALVES****GENERAL - MANUFACTURE AND MARKING (New Section)**

The valves shall be a standard pattern of a manufacturer whose products are approved by the Seattle Water Department and shall have the name or mark of the manufacturer, year valve casting was made, size, and working pressure plainly cast in raised letters on the valve body.

**9-30.3A GATE VALVES**

Delete this section and replace with the following:

Gate valves, 3 inches through 12 inches sizes shall conform to AWWA C500 and shall be iron body, bronze-mounted, double disc with bronze wedging device, non-rising stem, and O-ring stuffing box.

Valves shall open to the left, counterclockwise when viewed from above, and shall be equipped with a standard AWWA 2-inch square operating nut.

Three certified copies of performance tests complying with AWWA C500 shall be submitted to the Engineer.

Unless otherwise indicated on the Drawings, valve ends may be mechanical or push on joint. Where restrained joints are called out, valve ends shall be flanged with appropriate flange by restrained joint adaptors per Section 9-30.2A.

The valves shall be as manufactured by Rensselaer, Stockham, Ludlow, Clow, M & H, American-Darling, Crane, RP & C, Mueller and Kennedy or approved equal in size 12 inches or less.

The Contractor has the option of furnishing butterfly valves specified in Section 9-30.3C in lieu of gate valves for 3 inches through 12 inches size valves, except for 6-inch size auxiliary valves for fire hydrants.

Gate valves 2-1/2 inches and smaller shall be bronze, non-rising stem, F.I.P.T. inlet and outlet threading conforming to ANSI B 2.1, with hand wheel type operator and shall be minimum 150 pounds water working pressure rated unless otherwise noted on the Drawings and/or in the Special Provisions. The 2-1/2 inches and smaller valves shall be manufactured by Kennedy, Nibco-Scott, Stokum or approved equal.

#### 9-30.3B GATE VALVES 16 INCHES AND LARGER

Delete this section.

#### 9-30.3C BUTTERFLY VALVES

Delete this section and replace with the following:

Butterfly valves shall conform to AWWA C504 and shall be Class 150B. The valve shall be short-body type. If flanged ends are required they shall be sized and drilled in conformance with ANSI B 16.1 Class 125. Valve shall be suitable for direct burial installation.

Unless otherwise indicated on the Drawings, valve ends may be mechanical or push on joint. Where restrained joints are called out, valve ends shall be flanged with flanged by restrained joint adaptors per Section 9-30.2A.

Valves shall be mounted on the water main or pipeline such that the operating nut is accessible from directly above.

Operator shall be manual, fully enclosed, and suitable for buried service. It shall open left (counterclockwise when viewed from above), and shall be equipped with a standard AWWA 2 inches square operating nut.

Operators for 16-inch and larger valves shall be equipped with external indicators, visible from above, which show the position of the valve disc.

The minimum number of turns from fully open to fully closed shall be as follows:

Diameter	Turns
4 inches to 8 inches	16 turns
10 inches to 12 inches	28 turns
14 inches to 18 inches	30 turns
20 inches to 24 inches	44 turns
30 inches	60 turns
36 inches	72 turns
42 inches	84 turns
48 inches	96 turns
54 inches and larger	200 turns

An affidavit of compliance stating that the valves furnished fully comply with AWWA C504 and the modifications contained herein shall be furnished to the Engineer by the manufacturer.

The valve bodies shall be cast iron mounted with approved noncorrosive metals. Wearing surfaces shall be bronze or other approved noncorrosive material and there shall be no moving bearing or contact surface of iron in contact with iron. Contact surfaces shall be machined and finished in the best workmanlike manner, and all wearing surfaces shall be easily renewable.

The butterfly valves shall be manufactured by Henry Pratt Company, Dresser Industries, Kennedy Valve Division of ITT Grinnell Valve Company, Inc., American Darling, or approved equal.

#### 9-30.3D VALVE BOXES

Delete this section and replace with the following:

Unless otherwise noted on the Drawings or in the Special Provisions, valve boxes shall be installed on all buried valves. The box and lid shall be cast iron, 2-piece slip type with cast iron extension as necessary, conforming to requirements and dimensions of the latest City of Seattle Water Department Standards.

The cover shall have the work "WATER" or the letters "WW" cast in it.

Valve boxes, lids and extensions of the following manufacture and pattern are approved for use.

Olympic Foundry (1984) Inc.- Lid Section # 1908-33  
Top Section # 1106-33  
Base Section # 1301-33

Rich - Top Section and Lid #045  
with Rich standard base and extension.

Each top and lid section shall be tested for accuracy of fit and shall be marked in sets for delivery.

Valve box extension pieces shall be provided for valves with ground cover in excess of the depth of the standard valve box.

#### 9-30.3D(1) VACANT

#### 9-30.3E VALVE MARKER POSTS

Delete this section.

#### 9-30.3H TAPPING SLEEVE AND VALVE ASSEMBLY

Delete this section and replace with the following:

Tapping sleeves for use on pipes, not having special coatings or protection, shall be Mechanical Joint Type, Ductile Iron, flanged joint outlet conforming to ANSI B 16.1, Class 125, Drilling. Sleeves shall have a tapping Gate valve retaining ring groove.

Tapping sleeves shall be of a size designed by the manufacturer to fit the pipe called for on the Drawings and/or in the Special Provisions. It is the Contractors responsibility to determine the

outside dimension of the pipe and secure proper sleeve fit. The outlet size shall be as shown on the Drawings.

Tapping sleeves for use where Drawings and/or Special Provisions requires special pipe coating or protection systems shall meet the above requirements and shall be coated with Coal-Tar Epoxy according to AWWA C210. Bolts shall be stainless steel.

Prior to ordering tapping sleeves, the Contractor shall submit manufacturer's data, installation instructions and maximum air test pressure information to the Engineer for approval.

Tapping gate valves shall be of the size shown on the Drawings and shall conform to the gate valve provisions of Section 9-30.3A.

In addition, the inlet end shall be flanged with retaining ring extended beyond the flange face.

The outlet end shall be mechanical joint unless otherwise noted on the Drawings and/or the Special Provisions.

The valve seat ring openings shall be larger than normal size to permit entry of full diameter tapping machine cutters.

#### 9-30.3I OPERATING NUT EXTENSIONS (New Section)

An operating nut extension conforming to the latest Department Standards Plans shall be furnished and installed by the Contractor on all valves where called for on the Drawings or where the finished grade is more than 30 inches above the valve operating nut.

#### 9-30.3J PLASTIC FOAM RINGS (New Section)

Valve boxes shall have a 2 inches thick plastic foam ring conforming to the dimensions of the latest Seattle Water Department Standards, installed between the base and the valve casting. The plastic foam shall conform to specifications in Section 9-30.2L.

#### 9-30.3K VALVE CHAMBERS AND VAULTS (New Section)

This section shall apply to the construction of standard valve chambers and special valve chambers, all in accordance with the Standard Plans.

Where shown on the Drawing or where directed by the Engineer, valves shall be enclosed in valve chambers set over the operating stem.

Valve chambers may be either precast, cast in place, solid concrete blocks, concrete brick or made of clay brick.

##### 9-30.3K(1) PRECAST VALVE CHAMBER (New Section)

Size, shape, and materials shall be as indicated in the Standard Plan, Drawings, or Special Provisions.

The chambers shall be furnished in precast concrete sections with sufficient strength to withstand H-20 traffic loading together with ladder and access frames and covers to provide the minimum clearance dimensions as shown.

The chambers shall be watertight after assembly. Gasket material shall be installed in the grooves of the keyway of each of the chamber sections as they are installed. There shall be no evidence of moisture seeping into the chambers through the walls, floor, roof, or joints.

##### 9-30.3K(2) CONCRETE BLOCKS FOR VALVE CHAMBERS (New Section)

Portland cement concrete blocks shall be solid, and shall conform to the requirements of ASTM Designation C 139. Overall thickness of block shall be 6 inches with optional lengths and widths. Curved manhole blocks shall be used for round valve chambers.

##### 9-30.3K(3) CONCRETE BRICK FOR VALVE CHAMBERS (New Section)

Concrete brick shall be solid and conform to ASTM Designation C 55, Grade A.

##### 9-30.3K(4) CLAY BRICK FOR VALVE CHAMBERS (New Section)

Clay brick shall conform to ASTM C 62, Grade SW.

##### 9-30.3K(5) MORTAR (New Section)

Portland cement mortar shall be 1 part portland cement to not less than 1-1/2 parts nor more than 3 parts of plaster sand, mixed with the least amount of water necessary to provide a workable mix. Dehydrated lime, in an amount not exceeding 50 percent of the portland cement by weight, may be added to the mix at the option of the Contractor.

##### 9-30.3K(6) PORTLAND CEMENT CONCRETE (New Section)

Concrete for chamber foundation shall be Class C.

##### 9-30.3K(7) CAST IN PLACE CONCRETE VALVE CHAMBER (New Section)

The design, size, shape, and materials for cast-in-place concrete valve chambers shall be in accordance with the Drawings and Special Provisions. The Contractor shall submit complete shop drawings of the chamber for approval by the Engineer per Section 1-05.3.

##### 9-30.3K(8) RING AND COVER AND VALVE BOX CASTINGS (New Section)

Castings for cast iron ring and cover and for cast iron parts of valve boxes shall conform to the requirements of ASTM Designation A-48 and shall conform to the Standard Plans.

The word "WATER" shall be cast in the cover in 3-inch letters as indicated on the Standard Plan.

Each ring and cover section shall be tested for accuracy of fit and shall be marked in sets for delivery.

##### 9-30.3K(9) MORTAR FOR PLASTER-COATING (New Section)

Mortar for plaster-coating masonry unit manholes shall be proportioned according to either of the two alternates tabulated below:

	Parts by volume portland cement	Parts by volume masonry cement	Parts by volume hydrated lime or lime putty
Alt. 1	1	1 (Type II)	0
Alt. 2	1	0	1/4

Plaster sand for either Alternate 1 or Alternate 2 above shall be measured in a damp, loose condition, and shall be not less than 2 1/4 and not more than 3 times the sum of volumes of cement and lime.

A bituminous coating shall be applied to all surfaces after plastering.

##### 9-30.3K(10) LADDERS (New Section)

Except as otherwise provided in the Special Provisions, base sections of precast manholes more than 3 feet in height shall be provided with a ladder as detailed on the Standard Plans, Drawings and/or Special Provisions. This ladder shall be made of steel, and shall be galvanized after fabrication. They shall be made of 1 inch deformed bar conforming to ASTM A 615, intermediate or standard grade, hot bent at least 1600 degree F. Galvanization shall conform to ASTM A 123. Base sections 3 feet or less in height require no steps or ladder.

## 9-30.3L VACANT

## 9-30.3M PAINTING IN THE FIELD (New Section)

The valve shall be carefully inspected for injury to the outer protective coatings. At all places where the coating has been ruptured or scraped off, the damaged area shall be thoroughly cleaned to expose the iron base installation, and the cleaned area shall then be recoated with zinc chromate primer and the entire valve shall be field painted with two or more coats of Royston Roskote 612XM, or equal.

## 9-30.3N WATER PRESSURE REGULATING VALVES (New Section)

Water Pressure Regulating Valves, 3-inch through 12-inch Sizes:

Valve shall be flanged both ends, Class 125 ASA drilling, with cast iron body. Valve shall be a diaphragm operated, single sea, globe valve. It shall be spring loaded and hydraulically operated. Seat ring shall be replaceable. The diaphragm shall be fully guided top and bottom. All necessary repairs shall be possible without removing valve from the line. Packing glands are not permitted. Disc shall be synthetic rubber and have a rectangular cross section. The stem shall be guided by a bearing in the valve cover and an integral bearing in the valve seat. There shall be no piston operating the main valve.

Valves shall be designed to maintain a constant downstream pressure regardless of varying inlet pressure. They will be used handling clean, cold water.

No control pilots or optional equipment is to be furnished. Valves shall be CIA Valve No. 90 or approved equal.

Water Pressure Regulating Valves, 2-inch Size:

Valves shall be Mueller No. H-9310 2-inch Water Pressure Reducing Valves or approved equal.

## 9-30.5 HYDRANTS

Delete this section and replace with the following:

Fire hydrants shall conform to AWWA C502 and shall be of standard manufacture and of a pattern approved by the Seattle Water Department. The name or mark of the manufacturer, size of the valve opening and year made shall be plainly cast in raised letters on the hydrant barrel to be visible after the hydrant is installed.

Approved Manufacturers

Hydrants of the following manufacture and pattern have been approved for use by the City of Seattle:

- (a) Pacific States
- (b) Clow Model 5110 (Iowa)
- (c) Mueller "Centurion" Model A-423
- (d) American-Darling Model B-62B
- (e) Kennedy "Guardian"

## 9-30.5A END CONNECTIONS

Delete this section and replace with the following:

The end connection shall be 6 inches, standard flange, Class 125 drilling conforming to ANSI B 16.1.

## 9-30.5B HYDRANT DIMENSIONS

Delete this section and replace with the following:

The dimensions and details of hydrant and nozzles shall be as follows:

Hydrant connection pipe size inside diameter: 6 inches.

Standpipe, minimum inside diameter: 7 inches.

Length of hydrant from bottom of hydrant connection to sidewalk ring (flange): 3-1/2 feet.

Valve opening, minimum diameter: 5 inches.

Size of auxiliary gate valve: 6 inches.

Hose nozzles, number and size: 2 - 2-1/2 inches.

Thread (National Board of Fire Underwriters): 7-1/2 per inch.

Total length of threaded male nipple: 1 inch.

Streamer nozzle, number and size:

Hydrants shall be furnished with one streamer nozzle with size and threads conforming to dimensions as identified on the latest City of Seattle Standard Plans for Fire Hydrants.

Drain Valve: Drain valve shall be automatic with outlet tapped or plumbed to 3/4-inch female iron pipe threads.

Sidewalk flange (ring) to center of pumper nozzle: 14 inches or more.

Face: Rumper port toward the street.

All nozzles shall be fitted with cast iron threaded caps with operating nut of the same design and proportions as the hydrant stem nut. Caps shall be threaded to fit the corresponding nozzles and shall be fitted with suitable neoprene gaskets for positive water tightness under test pressures.

## 9-30.5D SHACKLING LUGS

Delete this title and section, and replace with the following:

## 9-30.5D HYDRANT RESTRAINT

Shackling rods shall be 3/4 inch diameter with threaded ends, and shall meet ASTM A 36. "All-thread" rod is not acceptable. If a tie bolt restraint system is used, they shall be "COR-TEN Steel Star National Products Super Star Tie Bolt #SST7" or approved equal. If a mechanical joint-gland-with-lugs restraint system is used, it shall conform dimensionally as shown on the hydrant detail, and shall be ductile iron conforming to ASTM A 536 Class 80-55-06. Coating for shackling rods shall be in accordance with Section 9-30.15.

## 9-30.5F GUARD POSTS

Delete this section.

## 9-30.5G HYDRANT FACTORY HYDROSTATIC TEST (New Section)

All hydrants shall be tested by the manufacturer, as required in AWWA C502. The Contractors shall furnish to the Owner an affidavit of compliance from the manufacturer for all tests.

## 9-30.5H HYDRANT SHOP PAINTING (New Section)

All iron parts of the hydrant, shall be thoroughly cleaned and painted at the factory as follows: All inside surfaces and the outside surfaces below the ground line shall be coated with asphalt varnish, Federal Specification TT-V-51a or J.A.N.P-450, unless otherwise specified. They shall be covered with two coats, the first having dried thoroughly before the second is applied.

Following installation, the hydrant shall be painted as follows:

Prior to backfill the extension below ground portion shall be painted with Asphaltic Varnish, Royston Roskote number 612XM or approved equal.

After backfill the outside area of the hydrant, which is above the finished ground line when backfilling is completed, shall be thoroughly cleaned and then painted with one coat of hydrant green Enamel, Preservative Paint Co. No. 43-107, Farwest Paint Company number 40255 or approved equal.

#### 9-30.5I HYDRANT CONNECTION PIPE (New Section)

Pipe connections from the hydrant to the water main shall be 6-inch Ductile Iron Pipe, Class 52, in accordance with Section 9-30.1A.

#### 9-30.5J HYDRANT VERTICAL EXTENSIONS (New Section)

Hydrant barrel extensions shall have a 7-inch minimum inside diameter and shall be gray cast iron or Ductile Iron and shall conform to the AWWA Standards for such castings. The drillings of the connecting flanges on the extensions shall match the drillings of the flanges on the hydrant.

Hydrant vertical extensions shall also include the necessary hydrant operating stem extension, complete with safety stem couplings.

Extensions with threaded flanges shall be ductile iron and shall conform to AWWA C115. The exterior flange lip overlapping the barrel pipe shall be sealed with a bituministic mastic.

#### 9-30.5K HYDRANT BLEEDER (New Section)

When approved by SWD, the hydrant bleeder assembly, as shown on the hydrant detail, shall be constructed of 3/4-inch polyethylene or polybutylene tubing or 3/4-inch copper tubing Type K, conforming to Sections 9-30.6C(1), 9-30.6C(2), or 9-30.6C(3), as approved.

#### 9-30.6 SERVICE CONNECTION

Delete this title and replace with the following:

#### 9-30.6 SERVICE CONNECTIONS AND SERVICE PIPE OR TUBING (New Section)

These standards shall be used unless modified by the Drawings and/or the Special Provisions.

Service Piping standards shall also be used, as modified on the Drawings for 2 inches blow off assembly; hydrant bleeder assembly.

#### 9-30.6A SADDLES

Delete this section and replace with the following:

Saddles shall be ductile iron, or bronze, double straps with F.I.P. thread standard outlet tapping. Saddles shall be of a size designed by the manufacturer to fit the pipe called for on the Drawings and/or in the Special Provisions.

#### 9-30.6C(2) POLYETHYLENE PIPE

Delete this section and replace with the following:

Polyethylene pipe, (tubing) when approved by the Seattle Water Department, to be used for water service lines 2 inches in size and smaller, shall conform to the requirements of AWWA C901. The pipe shall bear the seal of the National Sanitation Foundation for potable water pipe. Pipe joints shall be made in accordance with the manufacturer's recommendations. Solvent welded pipe joints will not be permitted. Minimum working pressure rating shall be 160 psi.

#### 9-30.6C(3) POLYBUTYLENE PIPE

Delete this section and replace with the following:

Polybutylene pipe (tubing), when approved by the Seattle Water Department, to be used for water service lines 2 inches in size and smaller, shall conform to the requirements of AWWA C902. The pipe shall

bear the seal of the National Sanitation Foundation for potable water pipe. Pipe joints shall be made in accordance with the manufacturer's recommendations. Solvent welded pipe joints will not be permitted. Minimum working pressure rating shall be 160 psi.

#### 9-30.6F METER STOPS

Delete this title and section, and replace with the following:

#### 9-30.6F METER STOPS AND SETTERS

Meter stops and setters shall be in accordance with the Seattle Water Department Standard Plans.

#### 9-30.6G METER BOX AND LID (New Section)

Meter Box and Lid shall be in accordance with the latest Seattle Water Department Standards. The Meter Box casting shall conform to ASTM A-48 Class 30 for gray cast iron. The Lid casting shall conform to ASTM A-536 Grade 80-55-06 for ductile iron, or ASTM A-47 for malleable cast iron. Castings shall be brushed or dipped with a bituminous coating. Meter Box and Lid shall be Olympic Foundry (1984) Inc. #5111-17 Box and #5111-19 Lid or approved equals.

#### 9-30.6H VALVES (New Section)

Valves shall conform to Section 9-30.3.

#### 9-30.7 BEDDING, FOUNDATION MATERIAL AND GRAVEL

Supplement this section with the following:

When the mineral aggregate is specified by a "Type" designation, it shall conform to the requirements shown on the table in Section 9-03.

#### 9-30.7A BEDDING MATERIAL

Delete this section and its subsections.

#### 9-30.7B FOUNDATION MATERIAL

Delete this section and its subsections.

#### 9-30.7C BANK RUN GRAVEL FOR TRENCH BACKFILL

Delete this section.

#### 9-30.8 PLASTIC FILM WRAP

Delete this section and replace with the following:

Plastic film wrap (Polywrap) shall be 8-mil polyethylene conforming to AWWA C105.

#### 9-30.9 TRACER TAPE

Delete this section.

#### 9-30.10 LOCATING WIRE (New Section)

Locating wire for use with PVC pipe shall be 14 gauge solid copper with neoprene coating. Connections and splices shall be made with Penn Wilson split Bolt Wire Connectors, catalog No. 5-8-5, or approved equal.



## 9-30.11 ELECTROLYSIS PROTECTION (New Section)

## 9-30.11A ZINC REFERENCE ELECTRODES (New Section)

The electrode material shall be high purity zinc with a minimum content of 99.99% zinc (ASTM B418-73 Type II or equivalent). The zinc electrode shall have a minimum surface area of 50 sq. in. (323 sq. cm.). The active material shall be molded around mild steel core.

The reference electrode shall include a lead cable consisting of a single conductor No. 12 AWG stranded copper type THW with 600 volt yellow insulation or equivalent.

- (a) The cable shall be attached to the mild steel core with a copper electrical compression crimpet.
- (b) The cable attachment shall be thoroughly covered with 2 half lapped layers of electrical tape, or epoxy cap.

## 9-30.11B WATER METER BOX (New Section)

The water meter box and lid shall conform to Section 9-30.6G.

## 9-30.11B(1) TEST BOX (New Section)

- (a) The 4 5/16 inch (11 cm) deep test box shall provide a single piece enclosure 8 inches x 6 inches (20 cm x 15 cm) with a lid. The test box shall be Stahlin No. J806W or approved equal.
- (b) The lid shall be manufactured from fiberglass and shall contain a one-piece closed cell neoprene gasket. The lid shall be secured by hold down screws.
- (c) The test box shall comply with the NEMA Type 12 standard for an oil, dust and drip-free enclosure. A 6 inches (15.2 cm) length of 1 inch (2.5 cm) PVC conduit standard long radius 90 degree with PVC fittings shall be installed at one end of the test box.
- (d) The test box shall include a 1/4 inch (6 mm) thick phenolic back panel with a terminal block assembly (Buchanan No. P625 or equivalent) containing 16 terminals sized to accommodate No. 12 AWG wire. Each terminal shall be specifically identified by laminated phenolic name plates which indicate the origin of the attached wire.
- (e) Each wire shall include at least 18 inches slack to allow lifting of the phenolic board out of the box during testing. Each wire shall be specifically identified by marking tape.

Approximately 1.5 cu. ft. (0.04 cu. m) of crushed rock or pea gravel shall be provided to create a permeable bed 6 inches (15 cm) deep inside each water meter box.

## 9-30.12 VACANT

## 9-30.13 TURBINE METERS (METER, COLD WATER, MAGNETIC DRIVE TURBINE TYPE, 2" THROUGH 12" SIZES)

These requirements apply to Magnetic Drive Turbine Type Cold Water Meters 2-inch through 12-inch in size, manufactured for use on customer water services. Turbine Meters shall consist of a cast bronze case containing the measuring mechanism with a strainer housing attached.

Meters shall meet the requirements of AWWA C701-78, latest revision, Class II type, except as modified herein.

## 9-30.13(1) REGISTER AND REGISTER BOX

Registration shall be in cubic feet. Register box and cover shall be of a copper alloy.

## 9-30.13(2) MAIN CASE AND COVER

The main case and cover shall be constructed of a copper alloy containing not less than 75% copper.

## 9-30.13(3) MEASURING MECHANISM

The measuring mechanism shall be the inline, horizontal axis, high velocity turbine type, and so designed that it can be readily removed from the main case as a complete unit. The measuring mechanism shall be capable of operating within the accuracy limits specified under "Normal Flow Limits," without recalibration when transferred from one turbine meter case to another.

## 9-30.13(4) INTERMEDIATE GEAR TRAIN

If an intermediate gear train is utilized, it shall operate in a dry, hermetically sealed compartment, separated from the water passage by a bronze wall.

## 9-30.13(5) CAPACITY AND ACCURACY

The turbine meter shall register all rates of flow through it with an accuracy of  $100\% \pm 2\%$  at rates of flow within the limits specified under "Normal Flow Limits."

## 9-30.13(6) NORMAL FLOW LIMITS

Size	Normal Flow Limit
2-Inch	5 - 160 GPM
3-Inch	10 - 350 GPM
4-Inch	15 - 800 GPM
6-Inch	30 - 1800 GPM
8-Inch	50 - 3500 GPM
10-Inch	55 - 5500 GPM
12-Inch	70 - 7000 GPM

Note: Above flow limit shall be for continuous flows, all turbine meters shall have a 25% overspeed capacity for intermittent flows.

## 9-30.13(7) HEAD LOSS

Maximum loss of head shall not exceed 7 psi at the flow rates listed under "Normal Flow Limits."

## 9-30.13(8) CONNECTIONS

All main case connections shall be flanged. The flanges for 2-inch meters shall be of the two bolt oval type. Meters shall be furnished without companion flanges.

## 9-30.13(9) INTERCHANGEABLE PARTS

All parts of turbine meters of the same size, make and model shall be interchangeable.

## 9-30.13(10) STRAINER

Turbine meters shall be supplied with a strainer attached. Strainers shall be short pattern, 125 lb. ANSI, iron body, with heavy gauge 1/4-inch perforated, stainless steel screen having an effective straining area at least double that of the meter main case inlet.

## 9-30.13(11) REMOTE READING

Turbine meters shall be compatible with existing Seattle Water Department Demand Recording Hardware and/or switches. Manufacturer, type, and style of switch are to be submitted for approval by the Engineer. (Note: Rockwell Impulse Contractor and Hersey MHR Turbine are compatible with existing Seattle Water Department switches.)

## 9-30.13(12) GENERAL REQUIREMENTS

Only meters manufactured by a well established firm will be considered. Only those meters of a specific model and manufacture, samples of which have been submitted to the Seattle Water Department for inspection and approval, and carrying a one (1) year guarantee will be acceptable.

## 9-30.13(13) INSPECTION

All turbine meters purchased under this specification will be subject to inspection and testing by the Seattle Water Department upon receipt, and if any meter is found not to conform with these specifications, the lot or any portion thereof may be rejected.

## 9-30.13(14) GUARANTEE

All turbine meters shall be guaranteed for a period of one (1) year after installation. This guarantee shall be against defect in materials, workmanship, and construction.

## 9-30.13(15) TEST REPORT

All turbine meters purchased under this specification shall be accompanied by a notarized test report of the factory accuracy test.

## 9-30.14 BONDING CABLE (New Section)

Bonding cable shall be stranded No. 2 AWG insulated copper conductor. The cable shall have polyethylene insulation and polyvinyl chloride jacket similar and equal to Anaconda "Type CP" cable with "Densheath" jacket, or General Cable "Gencathene."

Bond straps and connections supplied by the pipe manufacturer shall be the approved equal to the above.

## 9-30.15 COATING FOR ALL BOLTS AND SHACKLE RODS (New Section)

All bolts and shackle rods, unless otherwise designated by the Engineer, shall be coated with 2 coats of asphaltic varnish Royston Roskote 612 XM, or approved equal.

On corrosion protected watermains, all shackle rods, concrete blocking anchor rods, and shackle clamps shall have a factory applied protective coating with fusion bonded epoxy in accordance with ASTM A 755. After threading and assembly, the threaded ends, nuts, and washers shall be coated with a liquid epoxy patch kit in accordance with ASTM A 755 and manufacturer's recommendation.

## SECTION 9-31 - ILLUMINATION AND ELECTRICAL MATERIALS (New Section)

## 9-31.1 LUMINAIRES (New Section)

Luminaires shall be "cobrahead" style and shall consist of a luminaire housing, lamp, ballast, and photoelectric cell. Luminaires shall be in accordance with Material Standard 5723.1, except as modified herein and in the Special Provisions.

Luminaires shall have attached to the housing, an ANSI approval decal (3 inches square) which will be readily visible from the ground, indicating lamp type by color code (i.e., blue for Mercury Vapor, gold for High Pressure Sodium, red for Metal Halide); and lamp voltage by numerical code, i.e.:

7 for 70 Watt  
10 for 100 Watt  
15 for 150 Watt  
20 for 200 Watt  
25 for 250 Watt  
31 for 310 Watt  
40 for 400 Watt

Legends shall be a minimum of 2 inches in height and weather resistant.

Luminaire light distribution patterns shall conform to the IES classification system for Type II medium cutoff for less than 200 watts and Type II short cutoff for 200 watts and more.

Glare control shall be accomplished by use of a flat lens. Minimum streetside utilization shall be 39 percent at 1.5 transverse mounting height. Distribution shall be free from striations and hotspots.

Photometric performance will be subject to testing by the Washington State Material Testing Laboratory to insure conformance with these specifications and the photometric data submitted. A sample luminaire shall be submitted for testing when designated by the Engineer.

## 9-31.1(1) HOUSING (New Section)

The luminaire housing shall be aluminum provided with slipfitter end mounting for 2-inch nominal diameter pipe. The housing shall have means for leveling which shall consist of 2 sets of clamps equipped with lock washers on all 4 bolts.

The housing, complete with ballast, shall be weather tight. Gaskets and filters shall be composed of material capable of withstanding temperatures involved and shall be securely held in place. Air entering the optical assembly shall pass through a filtering medium capable of removing particulate matter and harmful gases.

The housing shall be equipped with a NEMA type twist lock receptacle for photoelectric cell, which shall be adjustable to allow facing the photoelectric cell north.

Luminaires shall have their components secured to the luminaire frame with stainless steel mounting hardware (nuts, bolts, washers, hinges, etc.). The stainless steel shall be ANSI 300 series, chrome-nickel grade.

The housing exterior shall have an acrylic electrocast finish. The color shall be grey ASA 70.

The refractor shall be flat, clear, heat and impact-resistant glass. Refractors shall be mounted in the door frame assembly which shall be hinged to the luminaire and secured in the closed position by means of an automatic-type latch. "Bird Guards" shall be provided at the slipfitter to prevent the entry of small birds into the ballast area.

The reflector shall be securely mounted such that the normal operation of the door does not affect the photometrics.

The lamp socket shall be porcelain enclosed mogul with integral lamp grips to assure electrical contact under conditions of normal vibration. The socket shall be rated to exceed the lamp starting voltage. All components shall be pre-wired to a terminal board with clearly identified contacts.

## 9-31.1(2) LAMPS (New Section)

Clear lamps suitable for operation in any position shall be used (unless noted otherwise on the Drawings).

High pressure sodium lamps shall meet the following minimum ratings:

WATTAGE	MINIMUM LIFE (HOURS)	INITIAL LUMEN OUTPUT
70	24,000	5,800
100	24,000	9,500
150	24,000	16,000
200	24,000	22,000
250	24,000	30,000
310	24,000	37,000
400	24,000	50,000

## 9-31.1(3) BALLAST (New Section)

The ballast shall be designed to properly operate the type of lamp at the specified operating voltage. The ballast shall be designed to start lamps at temperatures as low as -20 degrees Fahrenheit. Ballasts shall be the regulator type, high power factor. Ballasts shall be capable of operation with plus or minus 10 percent input voltage variation. All ballasts shall be multi-tap to allow field adjustment of voltage.

Ballast core laminations shall be of high quality electrical grade steel welded together to minimize noise and assure trouble free operation over the life of the luminaire.

Ballast coils shall be precision wound on formed insulating bobbins and terminals shall be of a push on type connection.

Components to provide the high starting voltage required by the high pressure sodium lamp shall be mounted on a printed circuit board which shall be easily accessible without disturbing other components of the total ballast assembly.

The ballast shall be capable of starting and operating high pressure sodium lamps from a nominal 60 hz. power source within the limits specified by the lamp manufacturer. The ballast, including starting aid, must protect itself against normal lamp failure modes. The ballast shall be capable of operation with the lamp in an open or short circuit condition for 6 months without significant loss of ballast life.

For nominal line voltage and nominal lamp voltage, the ballast design center shall not vary more than 5 percent from rated lamp watts.

At any lamp voltage, from nominal through life, lamp wattage regulation spread at that lamp voltage shall not exceed 18 percent for  $\pm 10$  percent line voltage variation.

For 70 watt, 100 watt and 150 watt lamps, socket voltage shall be rated at 55 volts. For 200 watts and above, socket voltage shall be rated at 100 volts.

Each ballast shall have a name plate attached permanently to the case listing all electrical data.

Supply voltage shall be as indicated on the Drawings.

## 9-31.1(4) PHOTOELECTRIC CELLS (New Section)

Photoelectric controls shall be used with all luminaires and shall meet the requirements of Material Standard 5693.2. Photoelectric controls shall be NEMA-type twist plug-in device in accordance with TDJ-146 & 148 rated to operate at the voltage indicated on the Drawings. The unit shall consist of a light sensitive element connected to necessary control relays. The light sensitive element shall have a spectral response that is especially sensitive to north sky illumination.

The unit shall be so designed that a failure of any electronic component will energize the lighting circuit.

Minimum inrush current ratings shall be 100 amps for 120 volt and 55 amps for 240 volt service. Photoelectric cells shall be provided with an integral lightning arrester.

Photoelectric cells shall be rated to switch 1000 watts incandescent "on."

## 9-31.2 BRACKET ARMS (New Section)

Luminaire bracket arms shall be manufactured as indicated on the Standard Plans and in accordance with AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals", to support a luminaire of 50 pounds, a 1.2 square foot Effective Projected Area for an 80 mph wind and a coefficient of height of 1.10. Brackets shall include the bolts, nuts and washers (galvanized for wood and steel pole mounting and stainless steel for aluminum pole types). Bracket arms shall be the same style as depicted on the Drawings. Small differences in dimensions may be acceptable when structural calculations accompany the Shop Drawings.

Luminaire bracket arms shall accommodate a slipfitter luminaire attachment. The terminal end of the arm shall be a straight, tubular section with external dimensions of 2 inches NPS by 6-1/2 inches long.

Bracket arms mounted on metal poles shall be constructed of the same material as the poles. If the bracket arm and metal pole are of dissimilar metals, they shall be separated by an approved plastic dielectric pad of 5 mils minimum thickness. The longitudinal axis of the luminaire end of the luminaire support arm shall be not less than 1 degree nor more than 4 degrees above the horizontal with the luminaire installed.

All tubing used for aluminum arm members shall be seamless, Alloy 6063 - heat treated to T-6 after fabrication. Aluminum arms shall meet the requirements of EEI-TDJ 135 & 139. Steel luminaire arms shall meet the requirements of EEI-TDJ 137 & 139.

## 9-31.3 WIRE (New Section)

Street light wire in conduits shall be stranded copper single conductor, with 600 volt type THWN color-coded insulation, size as indicated on the Drawings, and per Material Standard 6122.3.

Wire used inside of poles and bracket arms (including wood pole mounted bracket arms) or bonded to signal spanwires shall be No. 10 stranded copper "Pole and Bracket" cable with an insulation thickness of 45 mils and a belt thickness of 95 mils. Where the proper combination of colored conductors is unavailable in "Pole and Bracket" cable, No. 12 20-10 cable per Material Standard 6404.4 may be substituted when approved on a submitted shop drawing.

Duplex wire shall consist of one black conductor and one white conductor for circuits with one "hot" conductor and one neutral conductor; and one black conductor and one red conductor for circuits with 2 hot conductors. Multiple conductors shall be color coded in accordance with the NEC. Neutral wire shall always be white. Ground wires shall be green and insulated. The first hot conductor shall be black, the second hot conductor shall be red, and the third hot conductor shall be blue. Triplex wire shall be used for overhead applications, and shall conform with Material Standard 6007.3 except shall be sized as indicated on the Drawings. Color coding will not be required for triplex wire.

Wire shall be continuously color coded. (Color coding not required for triplex wire).

Taping at terminations is not acceptable.

Plastic molding for covering wire attached to the side of wood poles shall be per Material Standard 5820.5.

## 9-31.4 MINERAL INSULATED (MI) CABLE (New Section)

Conductors shall be solid copper, 600 volt rated, of the size noted on the Drawings.

The Contractor may choose cable with 2 or more conductors. All the conductors serving a device shall be in the same sheath. This shall not prevent normal practices such as the power conductors to a switch being in one sheath and the load conductors being in a second sheath.

The sheath shall be copper, and unless noted otherwise on the Drawings or in the Special Provisions, shall be covered with a factory provided polyethylene jacket. The sheath shall be considered the grounding conductor.

The sheath shall be terminated at junction boxes or condulets as shown on the Drawings, using glands and nuts provided by the cable manufacturer. The glands shall be sized for the cable used and U.L. listed.

The conductors exposed beyond the end of the sheath shall be covered by insulation provided with the gland. The normal length of the insulation is 10 inches. Power circuits shall be color coded per the NEC.

The sheath shall be sealed against moisture at the glands with seal provided by the cable manufacturer. The seal shall be suitable for prolonged submersion in water.

#### 9-31.5 WIRE SPLICES (New Section)

This standard applies to wire connections other than MI cable made in above grade or below grade installations except where the wires are attached directly to the terminal board. All connectors shall be U.L. or equivalent, labeled approved for the intended use.

##### (a) Above Grade Installations: (Including connections in pole hand holes)

- (1) Copper to Copper Connector - The connector shall be a high strength bronze alloy of the split bolt type specified in Material Standard 6688.7.
- (2) Copper to Aluminum Connector - The connector shall be of the one or two bolt type labeled CO/AIR and include an approved spacer bar.
- (3) Aluminum to Aluminum Connector - The connector shall be of the 1 or 2 bolt type and meet the requirements of Material Standard 6693.5.
- (4) Split bolt connections shall be insulated with 3 layers of electricians tape.

##### (b) Below Grade Installations:

- (1) Below grade splices shall be made in a 2 piece rigid body transparent moisture proof spliced enclosure. The body shall be webbed to ensure centering of the splice and even distribution of the encapsulant. The body and encapsulant shall be composed of material that will not support fungi or mold. The encapsulant shall be a reenterable (gel like), transparent type. (Non-reenterable encapsulant may be approved if each splice is approved by the Engineer prior to installing encapsulant.)
- (2) Connectors shall be as described in "A" above or a copper mechanical crimp type may be used when approved by the Engineer and/or an approved Shop Drawing. Mechanical crimp splices shall be made with an approved crimping tool.

##### (c) Inside Cabinets and Panels:

Wire nuts may be used only inside cabinets and panels. Copper or silver plated terminals shall be used at terminals blocks.

#### 9-31.6 FUSES AND FUSE HOLDERS (New Section)

The in-line fuse holder shall consist of a fuse, a two-section fuseholder body and two insulating boots, all rated at 600 volts. The fuse shall be of the voltage and amperage specified. Fuses rated at 30 amps and less shall be 13/32 inches by 1-1/2 inches in a 30 amp rated boot. Fuses rated 30 to 60 amps shall be 13/32 inches by 2-1/4 inches in a 60 amp rated boot.

The fuseholder body shall be made of waterproof molded plastic, in two sections, the line-side section and the load-side section. Their purpose is to provide a visible means of disconnect for circuit repairs or maintenance. The fuse shall be held in the load-side section only. Each section shall be totally enclosed at the wire entrance end and the sections shall be joined by a threaded, gasketed joint. The fuseholder body shall be designed to confine any electric arc, should the fuseholder be closed on a live circuit.

Fuse holder terminals shall be compression type, sized for the actual wire utilized. Only one wire shall be installed in any terminal.

Where the fuse is in the base of a metal pole, it shall have a breakaway receptacle used as a mechanical weak link to physically interrupt the circuit under impact in addition to the requirements for the fuseholder body.

Insulating boots shall be used to waterproof the wire connections. The type of insulating boot shall be a single conductor boot for the load-side and a single conductor boot for the line-side.

The fuse shall be a current limiting type with a high speed opening and an interrupting rating of 100,000 rms symmetrical amperes. The fuse shall have a minimum time delay of 25 seconds at 200 percent load, but not great enough to result in a safety loss during overload or short-circuit conditions.

The fuse shall be designed so that the carrying capacity or opening time is little affected by ambient temperature and will operate with low watt loss to reduce heating.

Individual luminaires fuses shall be rated at 10 amps except for 400 watt luminaires at 120 volts which shall be rated at 15 amps.

#### 9-31.7 GROUND RODS AND CLAMPS (New Section)

Ground rods shall be fabricated from cold-finished carbon steel shafting in accordance with ASTM Designation A 108 as it applies to Grade 1018. Galvanized ground rods shall not be used.

The covering of the steel core shall be a sheath of electrolytic-grade copper having a minimum thickness of 0.010 inches. The rods shall have rolled threads at each end for joining together with couplings. Rods shall be 10 feet in length and 5/8 inch diameter. Rods shall conform to Material Standard 5642.1, except for length.

Couplings for sectional rods shall be made of high-strength, corrosion-resistant bronze, internally threaded to fit standard rods.

Driving studs shall be made of high-strength, hardened steel of SAE 1045 or equal quality.

Ground rod clamps shall meet the requirements of Material Standard 5640.3.

#### 9-31.8 ENCLOSURES (New Section)

Enclosures located outside shall be weather-proof type, NEMA Type 3R. All doors and covers shall be gasketed. All enclosure metal shall be formed of Code gauge galvanized steel or aluminum as noted on the Drawings, and shall be constructed to the dimensions shown on the Drawings. All doors shall be provided with a heavy duty hasp suitable for padlocking.

All joints shall be seam welded. Enclosures shall be fabricated to allow for anchor bolt mounting.

A permanent sign shall be attached to the exterior of the enclosure cover or door. The sign shall be engraved into a 2-inch x 6-inch stainless steel plate with a minimum thickness of 18 gauge. The lettering shall be in 3 lines:

DANGER  
HIGH VOLTAGE  
KEEP OUT

The letters shall be 1/2-inch high with a stroke width of 3/32-inch, and will be filled with a red paint.

The completed sign shall be coated with a clear polyurethane enamel with exterior catalyst and attached to the enclosure cover with a minimum of 6 stainless steel drive rivets.

Circuit breakers shall conform to Federal Specifications W-C-375B. All 100 ampere frame breakers shall be Class 12a for single pole breakers, and shall be Class 12b for multiple pole breakers; 225 ampere frame breakers shall be Class 12b.

Circuit breakers shall be of the rating shown on the Drawings or as called for in the Special Provisions. Circuit breakers shall be of the unenclosed molded case bolt-on type with end conductor terminals, suitable for surface mounting in the cabinet on a false back or bracket.

Circuit breakers shall be labeled to indicate the circuit controlled.

Overcurrent protection and relay equipment, as called for on the Drawings or in the Special Provisions, shall be installed according to the best common practice, with materials and installation meeting all applicable requirements of the National Electric Code (NEC) and the Seattle Electrical Code.

Contactors shall be "lighting" type specifically rated for tungsten, fluorescent and mercury lamp loads, electrically held.



## 9-31.9 SWITCHES AND RECEPTACLES (New Section)

All toggle switches shall be 20 amp, 120 volt, AC type, grounded, specification grade, conforming to Federal Specification W-S-896 and shall be UL listed. Switches shall be Hubbell 122-G single pole, or approved equal.

## Receptacles:

All duplex receptacles shall be 20 amp, 125 volt, AC, GFCI, Hospital Grade receptacles, to be UL listed "Hospital Grade" under UL No. 498. Receptacles shall be Hubbell GF-8300, or approved equal.

Cover plates for switches and receptacles shall be stainless steel.

Device boxes shall be standard surface mount hot-dip galvanized steel type at least 1-1/2 inches deep, single or ganged of size to accommodate devices shown. All boxes shall be equipped with cover plates.

## 9-31.10 FULL CORD (New Section)

Full cord shall be 1/4 inch polypropylene per Material Standard 7272.2.

## SECTION 9-32 - TRAFFIC SIGNALS SYSTEM (New Section)

## 9-32.1 CONTROLLER ASSEMBLY (New Section)

The controller assembly shall consist of the controller, associated equipment and specified auxiliary equipment all in the specified cabinet, as indicated in the Controller Assembly Table and other Exhibits as found in the appendix of the Special Provisions, and the Drawings.

## 9-32.1(1) GENERAL (New Section)

Controllers shall be pre-timed or actuated as indicated on the Controller Assembly Table.

The controller assembly for each location shall be capable of controlling traffic flow in conformance with the respective Initial Controller Timing Exhibit and the Phase Sequence Diagram or Signal Sequence Diagram, or both, for each intersection as specified in the Controller Assembly Table.

The controller shall be micro-processor based, modularly constructed and shall be completely enclosed in a sheet metal case, with a protective finish, which shall serve as a mounting frame. No active or passive electronic components, other than the power supply, shall be attached to a part of the case.

Controller inputs and outputs shall be made at the front panel through a NEMA type (MIL-C-26482) connector. The connector shall be metal or plastic.

All circuits and their associated components shall be grouped in plug-in printed circuit assemblies. Printed circuits shall conform to the "printed circuit assemblies" standard, NEMA Standard TSI-1983. Contacts shall be gold-plated. The circuit reference symbol for each component part shall be clearly marked thereon. Circuit boards shall be mechanically keyed to prevent insertion in the wrong plug. Circuit boards shall be plug connected and systematically arranged so that they may be readily removed without unsoldering or handling individual connections.

External logic circuits shall be installed as required to provide special functions (e.g., pre-emption, special phasing, etc.) and shall conform to the external logic specifications as detailed on the Drawings and/or the Controller Assembly Table. External logic shall use digital methods and solid state construction. Logic units shall be modularly constructed, enclosed in a sheet metal case and all inputs and outputs shall be through NEMA Type (MIL-C-26482) connector. The connector shall be metal or plastic.

Automatic changes via time clocks or interconnect from flashing to normal operation shall be made at the beginning of the major street green interval. Automatic changes from normal operation to flashing shall be made at the end of the major street red interval. The change from flashing to normal or normal to flashing by any manual switch may be made at any time, except changes from flashing to normal through the "EMERGENCY FLASH" switch shall be made at the beginning of the major street green interval.

The controllers shall power up in the major street yellow.

All necessary programming equipment shall be provided with each controller to change the timing of the controller.

All timing shall be set with push buttons from the front panel.

All timing shall be set in decimal numbers.

It shall be possible to change the timing without removing any part of the controller and without using any special tools and to change timing without placing the intersection into the flashing mode.

All timing functions except offsets shall be in seconds (decimal numbers) and not in percentages. It shall be possible to program any interval to zero timing to allow that interval to be skipped.

All illuminated displays and manual input timing shall be clearly visible in bright sunlight.

Any power volatile memories such as random access memory (RAM) which contain input timing not stored in non-volatile memory shall be battery-supported for non-volatility for a period of not less than 5 days. The battery shall be a rechargeable type with automatic charging circuitry or lithium type with a 10 year shelf life and an accumulating running time of one 1 year minimum.

Each controller model shall be provided with an internal or external unit to program all programmable read-only memories used in each type of controller, unless one unit is capable of programming all models provided.



To prevent the conflict monitor from tripping during relamping of a green or yellow in a single head per phase location, a 10 watt wire wound 1000 ohm resistor on the yellow and green outputs to neutral shall be wired into the cabinet for the appropriate circuits.

The following exhibits included herein shall apply to the controller:

Exhibit	Title
A	Controller Assembly Table
B	Police Panel
C	Auxiliary Panel
D	Computer Interface
E	Field Wiring Terminals
F	Phase Sequence Diagram, Signal Sequence Diagram, and Initial Controller Timing
G	Functional Test Procedure for Controller Assemblies

#### 9-32.1(2) PRE-TIMED CONTROLLER (New Section)

The following table defines the minimum timing patterns which shall be provided:

Timing Element	Minimum #	Minimum Range	Maximum Increment
Pre-empt	1	N.A.	N.A.
Signal Sequence	2	N.A.	N.A.
Intervals	24	N.A.	N.A.
Cycle	4	30-120 sec.	5 sec.
Split	3 per Cycle	.1 to 99.9 sec.	.1 sec.
Offset	3 per Cycle	0 to 119 sec.	1 sec.

It shall be possible to program the start-up interval, to select the interval in which the controller will change a timing pattern, and to select the interval and amount of maximum change that can occur during one cycle for the dwell interrupter function.

Each controller shall accept the following inputs:

- |   |                  |
|---|------------------|
| a) Chassis Ground                                   | p) Split 2       |
| b) 120 VAC+   | q) Split 3       |
| c) 120 VAC Neutral                                  | r) Signal Plan 2 |
| d) Stop Time  | s) Actuation     |
| e) Interval Advance                                 | t) Pre-empt      |
| f) Offset 1   |                  |
| g) Offset 2   |                  |
| h) Offset 3   |                  |
| i) Cycle 2  |                  |
| j) Cycle 3  |                  |
| k) Interval Advance Enable                          |                  |
| l) On Line (computer control)                       |                  |
| m) Line Advance (computer advance-change intervals) |                  |
| n) Logic Ground                                     |                  |
| o) Restart  |                  |

Terminals or support logic, or both, shall be provided to allow the controller to rest in any designated walk phase position until a push button actuation, contact closure or remote signal permits the controller to cycle with a momentary push button actuation. The controller shall complete one cycle and return to rest in the designated walk phase lowercase. This operation shall be suitable for school crosswalk locations.

#### 9-32.1(2)A SIGNAL CIRCUITS (New Section)

The controller unit shall provide a minimum of 30 load switch control-circuits, at NEMA logic level.

Signal circuits shown on the wiring diagram shall be complete in each controller including flash transfer relay, conflict monitor capacity and signal load switch units to provide 120 VAC, 10 Ampere signal circuits controlled by the output of the fixed time controller.

A minimum of 12 signal circuits shall be programmable to flash.

#### 9-32.1(2)B 120 VAC INTERCONNECTION INTERFACES (New Section)

Pre-timed controller assemblies shall be wired to operate on a standard 120 VAC 3-cycle, 3-offset interconnect system:

Circuit	Function
1	120 VAC Common
2	Cycle 2 Transfer (120 VAC)
3	Cycle 3 Transfer (120 VAC)
4	Offset 1 (5 percent/cycle ground at zero)
5	Offset 2 (5 percent/cycle ground at zero)
6	Offset 3 (5 percent/cycle ground at zero)

#### 9-32.1(2)C MASTER CONTROLLER OPTION (New Section)

It shall be possible to program the controller to function as a master controller. In this mode the controller shall output a logic ground synch signal providing a grounded output for five percent of cycle in effect for each cycle length selected. The controller shall be furnished as a master controller if specified.

#### 9-32.1(3) ACTUATED CONTROLLER (New Section)

##### 9-32.1(3)A NEMA STANDARDS (New Section)

The controller shall conform to NEMA Standard TS 1-1983 and shall provide all functions (except that volume density can be, but need not be provided) which are provided for in the standard. Controller modules which are modified and are not interchangeable with the same module in a NEMA standard controller shall be marked, in a permanent manner, as a non-NEMA standard module. All overlap functions shall be programmable.

## 9-32.1(3)B MANUAL INPUTS (New Section)

The following manual inputs shall be provided:

- |                   |                                   |
|-------------------|-----------------------------------|
| (a) Minimum Green | (g) Walk                          |
| (b) Passage       | (h) Don't Walk                    |
| (c) Yellow Orange | (i) Minimum Recall                |
| (d) Red Clearance | (j) Maximum Recall                |
| (e) Max I         | (k) Pedestrian Recall             |
| (f) Max II        | (l) Locking non-locking detection |

## 9-32.1(3)C VISUAL OUTPUTS (New Section)

The following visual outputs shall be available by observing switch positions or illuminated displays on the front panel:

- (a) Per Phase:
  - (1) Phase on
  - (2) Phase next
  - (3) Vehicle call
  - (4) Vehicle actuation
  - (5) Pedestrian actuation
  - (6) All interval time settings listed above in section "Manual Inputs"
- (b) Per Ring:
  - (1) Initial
  - (2) Passage
  - (3) Walk
  - (4) Pedestrian clearance
  - (5) Yellow
  - (6) Red clearance

## 9-32.1(3)D CONSTRUCTION STANDARDS - WIRING (New Section)

Inputs and outputs of the controller and accessories shall be brought out through the wiring harness and connector(s) and terminated on terminal strips in the cabinet.

## 9-32.1(3)E CONTROLLER PEDESTRIAN SEQUENCE (New Section)

The basic operation of the controller will be to rest in the GREEN/DON'T WALK position so that it may advance to the next phase immediately after the vehicle clearance intervals (yellow/all red).

The controller shall also have the ability to rest in the GREEN/WALK position in any phase.

When the controller is in the GREEN/DON'T WALK rest position, it shall be capable of returning directly to the GREEN/WALK position upon actuation of the major street push buttons providing no demand is registered on the other phases.

When yield is provided by a co-ordination, the variable yield shall determine when the control may return to the walk position even if no calls are present on the opposing phases.

## 9-32.1(4) ASSOCIATED EQUIPMENT (New Section)

Both pretimed and actuated controller assemblies shall be equipped with the following associated equipment:

## 9-32.1(4)A TERMINAL STRIP/WIRING IDENTIFICATION (New Section)

Only terminal strips with screw-type terminals shall be used to secure signal and service wires to the terminal strips.

Each conductor termination and each terminal strip shall be permanently tagged with an identifying circuit number as indicated on the Drawings. Wire markers shall be stretch slip over/type printed with the circuit numbers for each circuit available. Wire markers shall be applied within 6 inches of the termination. Wire marker requirements apply only to field wiring.

The bottom row of terminal strips shall be located a minimum distance of 6 inches and a maximum distance of 8 inches above the bottom of the cabinet.

## 9-32.1(4)B POLICE PANEL (New Section)

The police panel shall have two toggle switches, each with two positions. Switch No. 1 shall be on the left side and its upper position shall be labeled "EMERGENCY OFF." In this position, the signals shall be off and the controller shall run. The lower position shall be labeled "ON" and in this position, the signals shall be on and the controller shall operate normally. Switch No. 2 shall be on the right side and its upper position shall be labeled "EMERGENCY FLASH." In this position, the signals shall flash with the pedestrian signals dark, and the controller shall run. The lower position shall be labeled "AUTO" and in this position, the signals and controller shall operate normally. Switch No. 1 shall override Switch No. 2. The controller shall start up in major street green when being returned from flashing operation through Switch No. 2.

## 9-32.1(4)C AUXILIARY PANEL (New Section)

A panel shall be mounted inside the cabinet door and shall include the following items, as specified in Exhibit C (included in the Appendix to the Special Provisions).

Switches and lights shall be oriented and labeled. The door switch shall cause all display lights to be turned on when the door is open and off when the door is closed. Switches shall be toggle type except for "OFFSET CONTROL" switch.

- (a) A "NORMAL FLASH" switch which shall cause the signals to flash and shall allow the controller to run.
- (b) A "MANUAL CONTROL" switch which shall cause the controller to stop time in each non-guaranteed interval until manually advanced by actuation of the manual push button. Actuated type controllers shall time guaranteed intervals normally without halting when in the manual mode.
- (c) A "PRE-EMPT TEST" switch which shall cause a pre-empt signal to activate the pre-emption sequence. If more than one pre-empt sequence is available there shall be a switch for each sequence.
- (d) A "DETECTOR INHIBIT" switch which shall inhibit all detector inputs to the controller, except the manual call buttons on the map display board or auxiliary panel.
- (e) A "COORD/FREE" switch which shall, when in the FREE position, free the local controller from coordination input but leave the coordinator energized.
- (f) A "CONTROLLER POWER" switch which shall de-energize the controller.
- (g) A "SIGNAL LIGHTS" switch which shall turn the signal lights off and allow the controller to run.
- (h) A "STOP TIME" switch which shall stop time the controller in the interval it is in when the switch is activated.

## 9-32.1(3)B MANUAL INPUTS (New Section)

The following manual inputs shall be provided:

- |                   |                                   |
|-------------------|-----------------------------------|
| (a) Minimum Green | (g) Walk                          |
| (b) Passage       | (h) Don't Walk                    |
| (c) Yellow Orange | (i) Minimum Recall                |
| (d) Red Clearance | (j) Maximum Recall                |
| (e) Max I         | (k) Pedestrian Recall             |
| (f) Max II        | (l) Locking non-locking detection |

## 9-32.1(3)C VISUAL OUTPUTS (New Section)

The following visual outputs shall be available by observing switch positions or illuminated displays on the front panel:

- (a) Per Phase:
  - (1) Phase on
  - (2) Phase next
  - (3) Vehicle call
  - (4) Vehicle actuation
  - (5) Pedestrian actuation
  - (6) All interval time settings listed above in section "Manual Inputs"
- (b) Per Ring:
  - (1) Initial
  - (2) Passage
  - (3) Walk
  - (4) Pedestrian clearance
  - (5) Yellow
  - (6) Red clearance

## 9-32.1(3)D CONSTRUCTION STANDARDS - WIRING (New Section)

Inputs and outputs of the controller and accessories shall be brought out through the wiring harness and connector(s) and terminated on terminal strips in the cabinet.

## 9-32.1(3)E CONTROLLER PEDESTRIAN SEQUENCE (New Section)

The basic operation of the controller will be to rest in the GREEN/DON'T WALK position so that it may advance to the next phase immediately after the vehicle clearance intervals (yellow/all red).

The controller shall also have the ability to rest in the GREEN/WALK position in any phase.

When the controller is in the GREEN/DON'T WALK rest position, it shall be capable of returning directly to the GREEN/WALK position upon actuation of the major street push buttons providing no demand is registered on the other phases.

When yield is provided by a co-ordination, the variable yield shall determine when the control may return to the walk position even if no calls are present on the opposing phases.

## 9-32.1(4) ASSOCIATED EQUIPMENT (New Section)

Both pretimed and actuated controller assemblies shall be equipped with the following associated equipment:

## 9-32.1(4)A TERMINAL STRIP/WIRING IDENTIFICATION (New Section)

Only terminal strips with screw-type terminals shall be used to secure signal and service wires to the terminal strips.

Each conductor termination and each terminal strip shall be permanently tagged with an identifying circuit number as indicated on the Drawings. Wire markers shall be stretch slip over/type printed with the circuit numbers for each circuit available. Wire markers shall be applied within 6 inches of the termination. Wire marker requirements apply only to field wiring.

The bottom row of terminal strips shall be located a minimum distance of 6 inches and a maximum distance of 8 inches above the bottom of the cabinet.

## 9-32.1(4)B POLICE PANEL (New Section)

The police panel shall have two toggle switches, each with two positions. Switch No. 1 shall be on the left side and its upper position shall be labeled "EMERGENCY OFF." In this position, the signals shall be off and the controller shall run. The lower position shall be labeled "ON" and in this position, the signals shall be on and the controller shall operate normally. Switch No. 2 shall be on the right side and its upper position shall be labeled "EMERGENCY FLASH." In this position, the signals shall flash with the pedestrian signals dark, and the controller shall run. The lower position shall be labeled "AUTO" and in this position, the signals and controller shall operate normally. Switch No. 1 shall override Switch No. 2. The controller shall start up in major street green when being returned from flashing operation through Switch No. 2.

## 9-32.1(4)C AUXILIARY PANEL (New Section)

A panel shall be mounted inside the cabinet door and shall include the following items, as specified in Exhibit C (included in the Appendix to the Special Provisions).

Switches and lights shall be oriented and labeled. The door switch shall cause all display lights to be turned on when the door is open and off when the door is closed. Switches shall be toggle type except for "OFFSET CONTROL" switch.

- (a) A "NORMAL FLASH" switch which shall cause the signals to flash and shall allow the controller to run.
- (b) A "MANUAL CONTROL" switch which shall cause the controller to stop time in each non-guaranteed interval until manually advanced by actuation of the manual push button. Actuated type controllers shall time guaranteed intervals normally without halting when in the manual mode.
- (c) A "PRE-EMPT TEST" switch which shall cause a pre-empt signal to activate the pre-emption sequence. If more than one pre-empt sequence is available there shall be a switch for each sequence.
- (d) A "DETECTOR INHIBIT" switch which shall inhibit all detector inputs to the controller, except the manual call buttons on the map display board or auxiliary panel.
- (e) A "COORD/FREE" switch which shall, when in the FREE position, free the local controller from coordination input but leave the coordinator energized.
- (f) A "CONTROLLER POWER" switch which shall de-energize the controller.
- (g) A "SIGNAL LIGHTS" switch which shall turn the signal lights off and allow the controller to run.
- (h) A "STOP TIME" switch which shall stop time the controller in the interval it is in when the switch is activated.

## 9-32.1(4)D LOAD SWITCHES AND BASES (New Section)

Each cabinet shall be furnished with the number of load switch bases specified in the Controller Assembly Table. Each base shall be fully wired for control circuits, flash transfer relay, and conflict monitor.

Load switches shall be furnished in the quantities specified in the Controller Assembly Table. Load switches shall be solid state, plug in, triple, according to NEMA Standards, TS 1-Part 5. Indicator lights for each circuit shall be provided on each load switch.

## 9-32.1(4)E OTHER EQUIPMENT (New Section)

An internally mounted thermostat which will activate the fan at temperatures above 70 degrees Fahrenheit and the light at temperatures below 55 degrees Fahrenheit. The thermostat shall have a minimum cycle of 5 degrees Fahrenheit between turn-on and turn-off of either the fan or the light.

An internally mounted electric exhaust fan mounted near the top of the cabinet with ball or roller bearings and a capacity of 100 cubic feet per minute as installed. The fan exhaust shall be vented to the outside and be weathertight. The fan shall be thermostatically controlled. The fan circuit shall be fused.

Weatherproof vents with a glass fiber air filter, (1" x 10" x 20" for Type II and III cabinets) or of sufficient size to allow the fan to pump 100 CFM.

An incandescent light socket door switch controlled and thermostatically controlled (thermostat switch in parallel with door switch) with 67 watt light bulb. The light shall be located near the bottom of the cabinet.

A radio interference suppressor shall be rated at 30 amps or more.

A 30 amp circuit breaker for the controller, accessories and signal lights and a 15 amp circuit breaker for illuminated signs and convenience outlet. Wherever 5 or more vehicle phases are provided, the primary circuit breaker shall be 45 amps.

A 15 amp NEMA standard convenience outlet with a ground contact and a ground fault interrupter.

Electrical interface shall be provided in the control cabinet wiring to provide the electrical logic and voltage levels required by the interconnect interface and the computer interface (See Exhibit D in the Appendix to the Special Provisions).

**Computer Interface:** A computer interface panel will be required in each controller assembly and a connecting harness. Space shall be provided adjacent to the computer interface panel for a communications amplifier (Eagle Signal Model DGS 352 - Approx. 8" x 8" x 11") which shall be installed and connected when required in all cabinets. The on-line command of the computer shall have circuitry that will remove control of the back-up system. Absence of the on-line command will automatically allow control to return to the back-up system. The computer on line command shall inhibit any control of the back-up system. The communications unit for interfacing the controller assembly with the computer located in the Municipal Building shall be an Eagle Signal Company Model DGS 352 either pre-timed or actuated as required whenever specified in the Controller Assembly Table.

**Interconnection Cable Interface:** An interface panel shall be provided to convert the 120 volt A.C. direct wire interconnect incoming commands to NEMA logic for the controller coordinator.

The flasher and flash relay shall be in accordance with the current NEMA Standard for flashers. The flasher shall have two circuits rated at 10 amps each.

The flash transfer relay shall be electromechanical, enclosed in a dust cover and plug mounted. The relay shall be rated at 120 VAC coil and 120 VAC 15 amp contacts. The relay shall apply power to the flash sequence and allow the controller to run when in the energized state.

A manual push button with a 4 foot flexible cord shall be installed on the inside of the door with a box or hook to keep the cord from dangling more than 6 inches.

## 9-32.1(5) AUXILIARY EQUIPMENT (New Section)

Controller assemblies shall be furnished with the following auxiliary equipment as specified in the Controller Assembly Table.

## 9-32.1(5)A INDUCTIVE LOOP DETECTOR AMPLIFIER (New Section)

Loop vehicle detector amplifier units shall be configured in 2 channel and/or 4 channel digital, sequential, "scanning" type, adaptable for either shelf or rack mounting which will provide the minimum number of amplifier units, as indicated in Exhibit A as found in the Appendix to the Special Provisions. The unit shall employ a single mating connector with adequate number of pins to accommodate input and output for the specified channels, AC power input and equipment ground.

Amplifier units shall be self-tuning. Tuning controls of any kind shall not be acceptable. Tuning shall employ a digital system which is completely automatic and is accomplished within 2 minutes after turn-on. Operation of the detector shall automatically compensate for changes in loop parameters caused by moisture and temperature variations.

Amplifier unit dimensions shall not exceed 2 1/4 inches wide, 6 inches high, and 9 inches deep, including connector.

All controls, cable connectors, and indicators shall be located on the front panel. Each channel shall have an associated "write-on" I.D. pad to indicate traffic phase or other relevant information.

An indicator (incandescent or LED) shall be provided for each channel to indicate output state.

Amplifier units shall operate on the "scanning" principle - only 1 channel exciting a loop/lead-in system at any one point in time - and shall provide for channel-to-channel automatic digital processing of loop inductance data over two-channels and/or four-channels as specified.

"Cross-talk" between channels of the same amplifier unit shall be eliminated within the unit by sequential scanning of the channels.

"Cross-talk" between amplifier units shall be minimized by a front panel mounted control switch.

Sensitivity, pulse or presence mode and "OFF" position for each channel shall be selectable by a multi-position switch. A wide range of sensitivity levels shall be provided to allow detection of small vehicles (motorcycles) at the higher levels and elimination of vehicle detection on adjoining lanes at lower levels.

In the pulse mode, each new vehicle shall provide an output pulse of 100 + 25 milliseconds. A vehicle stopped over the loop shall generate a pulse upon entering the loop and shall be "tuned-out" within 2 seconds at which time the detector channel shall return to full performance, so that additional vehicles shall register calls over the loop or other loops connected to the same channel.

In the presence mode, the minimum hold time for detectable vehicles shall be 4 minutes, and no more than 120 minutes. In the presence mode the detector channel shall recover to normal sensitivity within 1 second after termination of vehicle presence in the zone of detection regardless of the duration of the presence.

Each of the channels of the amplifier unit shall automatically self-tune to any standard loop or combination of loops, from 0 to 2000 microhenry, within 10 seconds after application or interruption of power.

Each channel of the amplifier unit shall provide continued operation on a loop, or loops, which are shorted or leaking to ground.

A broken loop or lead-in cable on any channel shall cause that channel to place a continuous call (fail call).

Each channel shall provide unlimited detection of continuous traffic without loss of detection in long, peak-hour traffic queues. Vehicle movement over loop shall restart presence hold time.

The output circuit for each channel shall be compatible for interfacing with solid-state digital equipment.

Lightning protection shall be installed inside the loop detector.

(a) The protection shall enable the detector to withstand the connection of a 2 microfarad capacitor charge to  $\pm 1000$  volts directly across the detector input inductance pins with no loop load present.

(b) The protection shall enable the detector to withstand the connection of a 2 microfarad capacitor charge to  $\pm 1000$  volts directly across either the detector input inductance pins or from either

side of the detector input inductance pins to earth ground. The detector chassis shall be grounded and the detector input inductance pins shall have a dummy resistive load attached equal to 5 ohms.

- (c) Varistors between the power line leads shall be included to limit power line peak transient voltage to not more than 280 Volts DC.

#### 9-32.1(5)B COORDINATING UNIT (New Section)

The coordinating units shall provide the following minimum functions:

- (a) 4 Cycles
- (b) 3 Split/Cycle
- (c) 3 Offsets per cycle
- (d) 3 Force-off circuits
- (e) 3 Permissive periods
- (f) 3 Hold circuits
- (g) Free mode
- (h) Flash operation
- (i) Pedestrian Lock-out

The unit shall be a digital, solid state device constructed as an integral part of the controller. All timing shall be done through the front panel by push button keyboard. Input shall be directly from the 120 VAC interconnecting cable; output shall be NEMA Logic.

#### 9-32.1(5)C TIME BASE COORDINATOR (New Section)

The term "Time Base Coordinator" shall describe a unit that is capable of providing mastering functions for any standard traffic signal controller on a "Stand Alone" basis without any external input. The unit shall be capable of maintaining all timing functions such as time of day, cycle, offset and synchronization through a power failure of up to 40 hours and resuming operation with all outputs including synchronization identical to any other units in a system which have not had a power interruption.

The unit shall be programmable on a weekly basis with the capability of programming on a yearly basis events such as daylight savings time changes, holidays and special events. The unit shall be micro-computer based, modular in design using circuits consistent with the latest solid state digital technology.

All programming shall be done on a front panel keyboard or by downloading.

The unit shall have an illuminated display on the front panel which will show all output functions currently in effect and also all programming that is placed in memory.

Time Base Coordinators shall be housed in one of the following ways:

- (a) A single fully enclosed metal housing with easy accessibility for internal maintenance.
- (b) A separate module of the controller front panel.

The unit shall provide negative true outputs (nominal 0 volts) for each programmed function. Each output shall be an NPN open collector capable of sinking 100 MA and shall be capable of interfacing directly with solid-state control equipment using true logic inputs per NEMA standards TS-1-1976 TS-1-3.02C. The units shall provide 120 VAC output via sensitive mechanical relays (mini relays) for all functions for operating electro-mechanical controls, interconnecting cable systems or sign feature.

For traffic-actuated controls, the unit shall provide a hold-force off program for 4 phases of an actuated control with the following minimum functions:

- (a) Phase 1 hold

- (b) 3 force-off circuits (output adjustable in length)

- (c) Programmable free operation

- (d) 2 unassigned outputs

- (e) 4 cycle lengths

- (f) 3 Splits

- (g) 3 offsets per cycle

For pretimed controls, the unit shall provide a dial-reset program with the following minimum functions.

- (a) 4 cycle length

- (b) 3 Splits

- (c) 3 offsets per cycle

- (d) 2 unassigned outputs

The zero point for each cycle shall be set by a push button on the front of the case or shall be based on an automatic reset of all cycles which occurs at midnight every 24 hours.

The unit shall execute up to 99 programs over a 7-day period with a 1 minute resolution between programs. Additional programming shall be available to provide daylight savings time resetting and to provide omitting of normal programming for 10 holidays on a yearly basis.

Each unit shall have a standby battery that will retain in memory all timing functions and all "zero" points for at least 40 consecutive hours with an accuracy of .015 percent over that period. During normal operation the battery shall be maintained by a trickle charge. The battery shall be a sealed lead acid type.

Each unit shall have the capability, when fully programmed, of programming (downloading) another unit by means of a connecting cable.

#### 9-32.1(5)D TIME CLOCKS (New Section)

Time clocks shall be solid state design with all programming through a push button keyboard. The clock shall be capable of driving all functions specified for a controller or a co-ordinator based on NEMA logic.

The clock shall provide a minimum of 8 output functions with an additional output for a synchronizing pulse for each cycle in effect. Timing functions shall be in seconds and decimals, not in percentages.

The clock shall provide a minimum of 100 on-off functions for a weekly program. The weekly program shall have the capability of omitting any day.

An illuminated display shall be provided to indicate time setting and program outputs.

The clock shall provide 4 discrete timing cycles from 30 to 256 seconds. The resynchronizing circuit shall provide a 5 percent synch pulse for any selected cycle. The start of each cycle (i.e. zero) shall be individually set and shall be retained through programmed cycle changes or battery back up operation as though that cycle had remained in continuous operation.

Battery back up power shall be provided to allow operation of the timing, memory, program, and resynch operations. The transfer to battery power and return to AC power shall be automatic and without interruption. The recharging of the battery shall be automatic. Battery operation shall not accumulate an error greater than .005 percent over 100 hours. The battery shall be a sealed lead acid type.

Timing shall be crystal controlled and synchronized to the 60 Hz AC line frequency. Timing error shall not exceed plus or minus 1 second per month on 60 cycle AC power.

The unit shall be enclosed in a metal cabinet suitable for shelf mounting or may be an integral part of the controller. Displays and connections shall be on the front panel.



## 9-32.1(5)E CONFLICT MONITOR (New Section)

The conflict monitor shall meet NEMA Standards and shall monitor all 120 volt AC outputs of greens, yellows and walks, for conflicting indications as well as the absence of red indications. It shall also monitor controller power. Conflict monitors shall provide indicators for each channel.

Conflicting indications or removal of the conflict monitor shall stop time the controller and cause the signals to flash all phases red and turn all pedestrian signals dark.

Conflict monitors shall be capable of monitoring the number of circuits specified in Exhibit A.

The monitor shall only detect conflicts after a minimum duration of approximately 0.3 seconds and not more than 0.4 seconds before transferring the timer to flashing operation.

The design of the sensing unit of the monitor shall be completely solid state with NEMA program board to program overlaps and NEMA plugs and harness.

The sensing unit shall detect both positive and negative alternations of the sine wave or full wave voltage conflicts.

The sensing unit shall detect a minimum of 25 volts.

An indicating light and reset button shall be provided on each channel.

Conflict monitors shall be modularly constructed, and shall be completely enclosed in a sheet metal case.

Conflict monitors shall be constructed as a separate unit, not integral to the controller. It shall have its own integral power supply and a separate connector for all inputs and outputs.

## 9-32.1(5)F MAP DISPLAY BOARD (New Section)

The map display board shall include a momentary contact switch to simulate detectors and push button for each phase.

The detector call buttons and colored signal indicator lights, with phases indicated and labeled, shall be mounted in the appropriate positions on the map display board of the intersection. North shall be at top of display panel.

The map display board shall graphically represent the intersection and shall be no smaller than 14 inches square and shall be mounted on the cabinet door.

White indicator lights shall show pedestrian and vehicular detector actuations and any special functions (e.g., pre-empt, etc.) for each phase. Indications shall be visible in bright sunlight.

## 9-32.1(5)G CONTROLLER ASSEMBLY CABINET (New Section)

The controller shall be housed in a cabinet type as shown in the Controller Assembly Table. If the cabinet size specified does not, in the estimation of the Contractor, provide adequate space, a larger size cabinet may be substituted, but only with the approval of the Engineer. The Engineer shall be given written justification and a proposed cabinet layout with the manufacturer request to use larger cabinets. Each cabinet and the arrangement of components therein shall be to accommodate the largest load switch allowed according to NEMA Standard, TSI-Part 5.

Cabinets shall be weatherproof meeting NEMA 3R specifications and constructed of aluminum. The maximum overall height of the complete assembly shall be 66 inches. There shall be a police door in the main cabinet door. Door hinge pins shall be stainless steel. Doors shall be sealed with gaskets. The main door shall be fitted with a door stop having at least two positions with an extreme position of not less than 120 degrees and an intermediate position of 90 degrees. The door shall be provided with an opening mechanism which will accept a 3/8 inch allen wrench for opening instead of a permanent door handle.

The main cabinet door shall have a Best Lock or equal with a construction core and the police panel door shall have a standard police lock. A Best Padlock (2B series) or equal with a construction core and an 1 1/4 inch shackle shall also be provided. The City will exchange the construction core for a Seattle "A" master core at the time of turn on. One key for the construction core and one key for the police lock shall be furnished with each assembly. A sliding keyhole cover shall be provided to prevent ice and snow build-up in the key hole.

Controller cabinets shall be painted with 2 coats meeting or exceeding Federal Specification TT-C-542D "Poly Urethane Coating, Moisture Curing" Type I, Class II 29. Exterior color shall be Federal Specification ASA 61 Gray. Interior shall be flat black.

Cabinets shall be clearly labeled on the inside of the door with a minimum of 3/8 inch lettering, indicating the intersection location including the main and minor cross streets.

The cabinets shall be of the following sizes:

Dimension	Type I	Type II	Type III
Width	18 to 24"	28 to 34"	36 to 46"
Depth	12 to 18"	16 to 20"	20 to 28"
Height	26 to 40"	38 to 52"	50 to 58"

Type I cabinet shall be pedestal mounted and Type II and III cabinets shall be base mounted. The bottom of Type I cabinets shall be of sufficient thickness and reinforced to provide a rigid assembly.

Cabinets shall be of sufficient size to house all required equipment and provide adequate space for maintenance and cooling. Shelves shall be provided for all equipment.

Type I cabinets shall be furnished with 4 inch pipe pedestal (4-1/2 inches O.D.). Type II & III cabinets shall fit concrete foundations as detailed on the Standard Plans.

Internal and external attachments to the cabinet shall be constructed such that no exposed screw heads or protruding screw threads are accessible from the outside of the cabinet.

Electrical interface shall be provided in the control cabinet wiring to provide the electrical logic and voltage levels required by the interconnect interface and the computer interface (Exhibit D in the Appendix to the Special Provisions).

## 9-32.2 TRAINING (New Section)

## 9-32.2(1) GENERAL (New Section)

Within 30 days after approval of controller assembly shop drawings, the Contractor shall submit a proposed plan and a course outline for the training of City engineering and maintenance personnel (3 days each) in the operation and maintenance of the complete intersection controller assembly.

The course shall be conducted for a minimum period of 6 hours each working day until the conclusion of the course, unless otherwise approved by the Engineer. A factory trained instructor for each element of the course shall be assigned to it full time and shall not perform other duties which would interrupt instruction during this period. A classroom will be provided by the Owner for the course.

As an alternate to the above training course, the Contractor may, with advance approval of the Engineer, furnish a video cassette tape which meets the following requirements:

- (a) VHS format
- (b) Standard speed T-120
- (c) 2 hours of operation instructions
- (d) 4 hours of maintenance and repair
- (e) Indexed by footage to identify course elements
- (f) Tape shall become the property of the owner

This may be a copy of an approved tape previously supplied to other agencies. The tape shall include the latest revisions to this equipment.

## 9-32.2(2) COURSE CONTENT AND MANUALS (New Section)

The course shall include, but not necessarily be limited to:

- (a) Operation of the local controllers and coordination units.
- (b) Operation of the local master units.
- (c) Routine maintenance and repair of local controllers and auxiliary equipment including diagnostic and trouble shooting procedures.
- (d) Routine maintenance and repair of communications system including diagnostic and trouble shooting procedures.
- (e) Routine maintenance of system master units including diagnostic and trouble shooting procedures.

The Contractor shall provide 8 sets of instructional material including trainee's workbooks, instructor's guides, training aids, equipment and systems technical manuals wiring diagrams, block diagrams, and all other necessary documentation and material sufficient to perform routine maintenance and trouble shooting.

## 9-32.3 SIGNAL HEADS, VEHICLE (New Section)

## 9-32.3(1) GENERAL (New Section)

Signal heads shall be in accordance with the "Institute of Transportation Engineers" publication, latest edition of "ADJUSTABLE FACE VEHICLE TRAFFIC CONTROL SIGNAL HEAD STANDARD" and the following additional requirements.

The equipment shall be designed for operation under temperature and humidity conditions encountered in the Pacific Northwestern United States.

Materials and workmanship shall conform to the best commercial standards of the industry.

The City reserves the right to return any signal head or heads, within 1 year from the date of receipt, which fail to comply with these specifications. The Contractor shall fully reimburse the City for all such heads.

A terminal block of an approved type shall be mounted inside at the back of each signal head. All sockets shall be so wired that a white wire will be connected to the shell of the socket and a wire, the color of the lens, to the end terminal of the socket. These wires shall in turn be connected to the terminal block mounted in the housing. The terminal block shall have sufficient studs to terminate 6 field wires and lamp wires independently to the block with separate screws. The terminals to which field wires are attached shall be permanently identified to facilitate field work.

All signal heads shall be installed as indicated on the Drawings and as designated by the Engineer.

The housing, door, visor exterior and mounting hardware/framework shall be dark green in color. The visor interior and both sides of the back plate shall be optical black or flat black in color. The paint shall be of the best quality synthetic resin enamel.

Adjustable signal heads shall consist of separate signal sections, expandable type, for vertical or horizontal mounting, rigidly and securely fastened together into one weather-tight signal assembly. The signal sections shall be 8 inches or 12 inches as indicated on the Drawings.

Each section shall consist of a housing, door assembly and optical unit and backplate and shall be so constructed as to provide complete inter-changeability of parts.

Weather-resistant mildew-proof gasketing shall be provided between the housing and door assembly and between the lens and reflector, which shall exclude dust and moisture.

## 9-32.3(1)A HOUSING (New Section)

The housing shall be cast from aluminum alloy free from flaws, cracks, blowholes and other imperfections.

Each vehicular signal head shall have a 1/4 inch drain hole in the bottom of the head.

Each section shall house 1 individual optical unit complete with 1-piece hinged square door, mounting for the lens and other parts of the optical system and a simple noncorrodible door-locking device.

Sections shall be interchangeable and so constructed that sections can be added or removed. The top and bottom shall 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 pipe shall be provided for top and bottom.

The 4 backplate mounting holes (2 in the top of the backplate and 2 in the bottom of the backplate) shall be a maximum 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 housing.

## 9-32.3(1)B DOOR ASSEMBLY (New Section)

The door assembly shall consist of the door, lens and visor.

The door of each section shall be made of aluminum alloy and shall be hinged to the housing so as to permit access or removal. The door shall be secured to the housing by a finger type locking device. The door-locking device shall be easily removable to allow door removal.

Each section shall have a visor made from aluminum alloy sheet of a tunnel design attached to the door by means of 4 panhead screws. The mounting holes shall be slotted. Visor length shall be 8 inches for 8 inch signals and 12 inches for 12 inch signals.

The lens shall be glass, circular in shape of the color, type and size specified. The lens shall be designed to give an outward distribution of light with a minimum above the horizontal. Each lens shall be true to color and shall conform to the latest ITE Standard. The lenses shall have a minimum visible diameter of 7-3/4 inches (eight inches nominal) or 11-1/2 inches (12 inches nominal).

## 9-32.3(1)C OPTICAL UNIT (New Section)

The optical unit consists of the reflector and lamp receptacle and shall be so mounted to the housing that it can be swung open for ready access or removal without the use of tools. The optical unit lens and visor shall be designed as a whole to reduce sun-phantom. Lamp re-placement shall be through the parabolic side of the reflector, and shall not require removal of the lamp holder from the reflector unit.

The reflectors shall be constructed of silvered glass or specular alzak aluminum in a parabolic design. An opening in the back of the reflector for a lamp holder shall be constructed to eliminate dark spots on the lens.

Relamping and cleaning of reflectors shall be easily accomplished upon opening of the door without removal of screws or mounting framework inside the housing.

The lamp receptacle shall be of weather-proof molded construction immune to the operating temperatures in the unit and shall be provided with 2 wires of sufficient length to be connected to the terminal block.

Traffic signal lamps shall be of the following requirements and meet current Institute of Transportation Engineers' specifications:

Lens Size	Voltage	Rated Life	Initial Lumen Output
8 inch	130 V	8000 Hr.	610
12 inch	130 V	8000 Hr.	1750

## 9-32.3(1)D BACKPLATE (New Section)

The signal, with backplate, shall be designed to meet or exceed the load requirements in accordance with Section 2 of "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals," AASHTO 1975. Back plates shall be furnished and attached to each signal head assembly. Back plates shall be constructed of anodized, 3-S half-hard aluminum sheet, 0.058 inches minimum thickness. The back plates shall be riveted together with a minimum of 8 5/16-inch pop rivets.

No bolts or screws will be permitted. Back plates shall not interfere with either the operation of the door or the mounting of the signal. Mounting hole pattern shall match pattern on signal head housing. The front and back of the back plates shall be finished with 2 coats of flat black enamel.

Back plates shall be permanently attached so as to provide a 5 inch border for either 8 inch or 12 inch signal heads.

Back plates shall be provided with a minimum of 2 mounting holes per signal section, one on each side. The 2 top and 2 bottom backplate mounting holes shall be a maximum distance of 1 1/4-inch from the corners of a 8 inch signal housing, and 2 1/2-inch from the corners of a 12-inch signal housing.

#### 9-32.3(2) BI-MODAL VEHICLE SIGNALS SECTION (New Section)

The signal section shall display both yellow and green arrow indications from the same face and shall use a fail-safe 2-lamp system to direct either color light into a fiberoptic display. The section shall be adaptable to conventional 12-inch vehicle signal heads.

#### 9-32.3(3) OPTICALLY PROGRAMMED VEHICLE SIGNAL SECTION (New Section)

The signal shall permit the visibility zone of the indication to be determined optically and require no hoods or louvers. The projected indication may be selectively visible or veiled anywhere within 15 degrees of the optical axis. No indication shall result from external illumination nor shall one light unit illuminate a second.

The components of the optical system shall comprise: lamps; lamp collar; optical limiter - diffuser; and objective lens.

The lamp shall be nominal 150 watt (75 watt for distance-limiting applications), 120 volt AC, three-prong, sealed beam having an integral reflector with stippled cover and an average rated life of at least 6,000 hours. The lamp shall be coupled to the diffusing element with a collar including a specular inner surface. The diffusing element may be discrete or integral with the convex surface of the optical limiter.

The optical limiter shall provide an imaging surface at focus on the optical axis for objects 900 to 1200 feet distance, and permit an effective veiling mask to be variously applied as determined by the desired visibility zone. The optical limiter shall be provided with positive indexing means and composed of heat resistant glass.

The objective lens shall be a high resolution planar incremental lens hermetically sealed with a flat laminate of weather resistant acrylic or approved equal. The lens shall be symmetrical in outline and may be rotated to any 90 degree orientation about the optical axis without displacing the primary image.

The optical system shall accommodate projection of diverse, selected indicia to separate portions of the roadway such that only one indication will be simultaneously apparent to any viewer after optically limiting procedures have been accomplished. The projected indication shall conform to TIE transmittance and chromaticity standards.

#### 9-32.3(4) DIRECTIONAL LOUVERS (New Section)

Where so indicated on the Drawings, louvers shall be furnished and installed in signal visors. Directional louvers shall be so constructed as to have a snug fit in the signal visor. The outside cylinder shall be constructed of No. 22 U.S. gauge sheet steel, and the vanes shall be constructed of No. 27 U.S. gauge sheet steel. Dimensions and arrangement of vanes shall be as indicated on the Drawings.

Louvers shall be galvanized after fabrication by the hot dipped process in conformance with ASTM Designation A 153 and painted flat black.

#### 9-32.4 SIGNAL HEADS, PEDESTRIAN (New Section)

#### 9-32.4(1) GENERAL (New Section)

The pedestrian signal head shall consist of a message module, case, eggcrate visor, transformer, and directional louvers.

The entire pedestrian signal including neon tubing, transformers, and all ABS or polycarbonate plastic parts shall be warranted for 2 years from the date of shipment against defects in workmanship, or materials, or both.

The case, sun shield and mounting hardware shall be painted dark green in color. The eggcrate visor interior and directional louvers shall be painted flat black in color.

The maximum overall dimension of the signal shall be 19 1/2 inches wide, 19 inches high and 9 inches deep, not including eggcrate visor and hinges. In order to facilitate installation and maintenance, the signal shall be designed so that all components are readily accessible from the front by merely opening the signal door.

Pedestrian signals shall display international symbols (Portland orange "Hand" and the lunar white "Walking Person") illuminated by multiple configuration neon tubes encased in a molded plug-in plastic message module. The Hand-Person symbols shall be a minimum of 12 inches in height and 7 inches in width.

#### 9-32.4(2) MESSAGE MODULE (New Section)

The message module shall consist of 2 neon gas tubes enclosed and thus protected by a housing made of white acrylonitrile butadiene styrene or polycarbonate plastic and a screened message lens made of polycarbonate plastic.

The tube used for the Portland orange hand symbol shall be coated on the inside with fluorescent material producing the desired Portland orange output. Tubing for the lunar white person symbol shall be coated on the inside with fluorescent material producing the desired lunar white output. It shall be formed to the approximate shape of the person and shall be positioned for maximum lunar white intensity.

The 2 neon tubes shall be enclosed in a single plug-in plastic module via resilient rubber adhesive to prevent transfer of mechanical strain to the glass tubing and to provide effective shock mounting. The plastic housing shall be molded in a manner to provide positive location of the neon tubing in relation to the screened message lens.

The message lens shall consist of 1/8 inch minimum thickness clear, U.V. stabilized refractor type, polycarbonate plastic with outer prisms and shall be weather, craze and heat resistant. The prism pattern shall face the outside of the module with the screened message enclosed within the module.

The inside face of the message lens shall be painted in all areas except where the desired symbols are formed. The first coating of paint shall be black to form a contrasting background when viewed from the outside. The second coating of paint shall be white to reflect internal light.

The message module shall be sealed into an integral assembly with a 1 piece sponge neoprene gasket fitted around the perimeter to provide positive protection of the enclosed neon tubing from handling, weather, and moisture.

The message module shall be provided with electrical contacts which will plug directly into recessed contacts in the transformer enclosure when the module is in proper position and shall not require the use of tools for insertion or removal.

#### 9-32.4(3) CASE (New Section)

The case shall consist of a housing and door each made from 1 piece, aluminum alloy die casting. It shall be dustproof, weatherproof and corrosion resistant and shall provide for easy access to and replacement of all components. The housing shall have an integral cast top, bottom, sides, and back. 4 integrally cast hinge lug pairs shall be provided for operation of a swing down door.

The housing shall be suitable for clamshell mounting hardware, post-top mounting, or bracket mounting.

The top and bottom of the housing shall have an opening to accommodate 1-1/2 inch pipe brackets. The bottom opening of the signal housing shall have a standard 72 tooth locking boss integrally cast into the case. The teeth shall be clean and sharp and provide full engagement. The radial angular grooves

of the boss shall provide positive positioning of the entire signal to eliminate rotation or misalignment of the signal.

The door shall be attached to the case by means of 2 stainless steel spring pins. 2 stainless steel hinged bolts with captive stainless steel wingnuts and washers shall be attached to the case with the use of stainless steel spring pins. Hence, latching or unlatching of the door shall require no tools.

#### 9-32.4(4) EGGRATE VISOR (New Section)

Each signal shall be provided with an eggcrate type visor designed to eliminate sun phantom.

The eggcrate type visor shall be installed parallel to the face of the Hand -Person message lens and shall be held in place by stainless steel screws. The eggcrate assembly shall consist of vertical members and horizontal members. The completed assembly shall be approximately 1-1/2 inches deep.

The basic material used in construction of the eggcrate shall be nominally 0.030 inches thick and shall be polycarbonate plastic. Additional members may be employed outside the two legend areas but are not required unless dictated by structural strength of the particular assembly technique employed.

The assembly shall be enclosed in a mounting frame constructed of 0.040 inches minimum thickness aluminum or polycarbonate plastic. This frame shall be approximately 1-1/2 inches deep and may contain alternate mounting holes for use on alternate types of pedestrian signals.

#### 9-32.4(5) TRANSFORMERS (New Section)

2 transformers shall be provided with recessed secondary contacts. Both transformers shall have as a minimum 4000 volt, 30 milliamperes secondary.

Each transformer shall have 120 volt (nominal) primary windings and a power factor of 90 percent minimum.

A fused switch consisting of 2 cartridge fuses and a lever for disconnecting the fuses shall be provided inside the case on a terminal block for de-energizing the transformer primary circuit. The terminal blocks shall accommodate no less than 5 terminals.

#### 9-32.4(6) OPTICALLY PROGRAMMED PEDESTRIAN SIGNAL (2-SECTIONS) (New Section)

Each signal head shall permit the visibility zone of the indication to be determined optically and require no hoods or louvers. The projected indication may be selectively visible or veiled anywhere within 15 degrees of the optical axis. No indication shall result from external illumination nor shall one light unit illuminate a second.

The components of the optical system shall comprise: 1) lamp; 2) lamp collar; 3) optical limiter-diffuser, and 4) objective lens.

The lamp shall be nominal 75 watt PAR, 120 volt AC, three-prong, sealed beam having an integral reflector with stippled cover and an average rated life of at least 6,000 hours. The lamp shall be coupled to the diffusing element with a collar including a specular inner surface. The diffusing element may be discrete or integral with the convex surface of the optical limiter.

The optical limiter shall provide an imaging surface at focus on the optical axis for objects 900 to 1200 feet distance, and permit an effective veiling mask to be variously applied as determined by the desired visibility zone. The optical limiter shall be provided with positive indexing means and composed of heat resistant glass.

The objective lens shall be a high resolution planar incremental lens hermetically sealed with a flat laminated weather resistant acrylic or approved equal. The lens shall be symmetrical in outline and may be rotated to any 90 degree orientation about the optical axis without displacing the primary image.

The optical system shall accommodate projection of diverse, selected indicia to separate portions of the crosswalk such that only one indication will be simultaneously apparent to any viewer after optically limiting procedures have been accomplished. The projected indication shall conform to ITE transmittance and chromaticity standards.

The signal head shall display international symbols. The top section lens shall provide a Portland Orange "RAISED HAND" symbol and the bottom section lens shall provide a Lunar White "WALKING MAN" symbol.

#### 9-32.5 PEDESTRIAN PUSHBUTTON ASSEMBLY (New Section)

The Contractor shall install pedestrian pushbutton, signs and mounting hardware as indicated on the Standard Plans. The Contractor shall provide the pedestrian pushbutton signs and all other equipment and hardware. Pedestrian pushbuttons shall be tamperproof construction. The pushbutton shall be constructed of a single, round, chrome plated metal plunger approximately 2-1/4 inches in diameter, of direct push type, and a single momentary silver contact switch rated 125 volts, 10 amperes, all in a metal enclosure.

The assembly shall be made weatherproof and shockproof by means of synthetic rubber gaskets between the cover and the enclosure and between the plunger and the cover so that it will be impossible to receive an electrical shock under any weather conditions.

The pushbutton assembly and sign shall be located on the pole shaft such that they are generally parallel to the crosswalk they are intended to serve and on the same side of the pole as the crosswalk. The pushbutton shall be mounted directly beneath the sign unless otherwise indicated on the Drawings.

#### 9-32.6 DETECTOR LOOPS (New Section)

Detectors shall be used for actuating traffic-actuated controllers and sample stations. A complete detector loop installation shall consist of loop wire and lead-in cable from the loop to the amplifier.

Loop wire shall be #14 AWG Class B (104 X 34) stranded copper, high density polyethylene insulated with a .032 inch minimum thickness.

The lead-in from the detector junction box to the controller cabinet or remote detector amplifier cabinet shall be single pair #16 AWG 19 X 29 stranded copper, polyethylene insulated, PVC jacketed, twisted pair cable with copper foil or aluminum-polyester shield, and a No. 18 AWG stranded tinned-copper drain wire. The conductors shall be twisted together approximately 3 turns per foot. Connections of the loop wire to the lead-in wire shall be made only in a hand hole with a waterproof splice as indicated on the Drawings.

#### 9-32.7 INTERIOR ILLUMINATED SIGNS (New Section)

The equipment shall be designed and manufactured for operation under temperature and humidity conditions encountered in the Pacific Northwestern United States.

The sign, when mounted, shall be designed to meet or exceed the load requirements in accordance with Section 2 of "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals," AASHTO 1975.

The sign size shall be as indicated on the Drawings. The housing shall be a double faced design made of extruded aluminum alloy or polyvinyl, color shall be dark green or brushed aluminum finish. The interior shall be painted white.

Standard signal mounting hardware shall be used to mount illuminated signs to all street furniture. The sign shall be fitted with a 1-1/2 inch iron pipe (IP) tapped straight thread hub on top, for mast arm and span wire mount, and on top and bottom for bracket mount.

The front message panel shall be translucent white Rohm and Haas Plexiglass, or TufLite white fiberglass, or equal. The back message panel shall be constructed of aluminum alloy or polyvinyl, colored dark green or brushed aluminum finish to match the housing, unless the sign is double faced in which case it shall be the same as the front message panel. Sign message shall be as indicated on the Drawings.

A terminal block for power input hookup shall be accessible by opening either message panel.

Signs shall be completely wired and assembled.

The sign shall be equipped with, unless otherwise indicated on the Drawings, 4 24-inch T12-CW fluorescent tubes with weatherproof tube type sockets and ballast transformer. The ballast transformer shall be non-flashing 425 mil-amp type, 0 degree Fahrenheit starting, 120 VAC, 60 Hz.

Hardware (ie., rivets, screws, bolts, nuts, etc.) and parts not aluminum shall be stainless steel.



## 9-32.8 INTERIOR ILLUMINATED CROSSWALK SIGN (New Section)

The equipment shall be designed and manufactured for operation under temperature and humidity conditions encountered in the Pacific Northwest United States.

The sign, when mounted, shall be designed to meet or exceed the load requirements in accordance with Section 2 of "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals," AASHTO 1975.

The size shall be as indicated on the Drawings. The housing shall be a double faced design made of extruded aluminum alloy or polyvinyl colored dark green or brushed aluminum finish.

Standard signal mounting hardware shall be used to mount illuminated signs to all street furniture. The sign shall be fitted with a 1-1/2 inch I.P.S. tapped straight thread hub on top for mast arm and span wire mounting, and on top and bottom for bracket mount.

The message panels shall be translucent yellow Rohm and Haas Plexiglass, or Tufite yellow fiberglass, or approved equal.

Lettering shall be 10 inch high letters by 1-3/4 inch stroke formed with No. 900 fascal tape.

The sign shall be equipped with two 48-inch T48-HO fluorescent tubes with weatherproof tube type sockets and ballast transformer. The ballast transformer shall be high power factor type, 0 degree Fahrenheit starting, 120 VAC, 60 Hz.

Hardware (i.e., rivets, screws, bolts, nuts, etc.) and parts not aluminum shall be stainless steel.

A terminal block for power input hookup shall be accessible by opening either message panel. Signs shall be delivered completely wired and assembled.

## 9-32.9 INTERCONNECT CABLE (New Section)

## 9-32.9(1) UNDERGROUND (New Section)

Multiple pair communication cable rated at 300 volts for underground installation shall be #19 AWG solid or stranded copper conductors, shielded cable with a petroleum-polyethylene filling compound. Conductor shall be insulated with heat stabilized polyethylene or polypropylene. The jacket shall be polyethylene. Electrical shielding shall be copper or aluminum. The number of pairs shall be as indicated on the Drawings.

## 9-32.9(2) AERIAL ("FIGURE 8") (New Section)

Multiple pair communication cable rated at 300 volts for aerial installation shall be #19 AWG solid copper conductors, shielded cable with integral stranded galvanized E.H.S. steel messenger. Conductors shall be insulated with heat stabilized polyethylene. The jacket shall be a polyethylene. Electrical shielding shall be copper or aluminum. The number of pairs shall be as indicated on the Drawings.

Aerial communication cable shall be supported throughout the run by Joslyn Cable Hanger J2235 or equal. Termination and horizontal angle turns shall be supported by automatic dead-end devices.

## 9-32.9(3) TELEPHONE LINE INTERCONNECT (New Section)

Where shown on the Drawings, communications cable shall be used to interconnect traffic signal controllers within the traffic signal interconnect system. The telephone company will furnish and install the cable from their facilities to a junction box at each of the intersections. The Contractor shall furnish and install the junction box, which shall contain a fuseless station protector, together with all conduit and mounting hardware. The Contractor shall furnish and install a 2-pair, #16 AWG 19x29 stranded copper polyethylene insulated, PVC jacketed, twisted pair with copper foil or aluminum-polyester shield, and a No. 18 AWG stranded tinned-copper drain wire between the traffic signal controller cabinet and the fuseless station protector. The conductors shall be twisted together approximately 3 turns per foot.

## 9-32.9(3)A TELEPHONE PROTECTOR UNIT (New Section)

The interface unit shall be "Fuseless Station Protector" Cook Electric Type 2500 with tamper-proof cover or equivalent. The Contractor shall install all conduit connections to the protector and shall install the cable from the protector into the controller cabinet and from the protector to the weatherhead.

The City will make arrangements with the telephone company immediately after award for 3002 data grade service drop to the protector at the designated locations.

## 9-32.10 AERIAL TERMINAL COMPARTMENT (New Section)

The compartment shall be capable of encasing the sheath of "R" type and "T" type non-pressurized electrical cable and shall accommodate "Branch Type" splices of interconnect cables.

Compartment openings shall accommodate the various cable sizes indicated on the Drawings.

Compartment shall be watertight.

Compartment shall be supportable on span wire or messenger cable.

The terminal block shall have sufficient studs to terminate a minimum of 36 field circuits independently to the terminal block with separate screws.

The compartment shall be either cast aluminum or polyethylene.

All external hardware shall be stainless steel.

## 9-32.11 SIGNAL WIRING (New Section)

## 9-32.11(1) TRAFFIC SIGNAL CABLE (New Section)

Color Code (Base/Tracer)	1co	2co	3co	5co	7co	10co	13co
Black	#12	#14	#14	#14	#14	#14	#14
White	#12	#14	#14	#14	#14	#14	#14
Red			#14	#14	#14	#14	#14
Green				#14	#14	#14	#14
Orange				#14	#14	#14	#14
Blue					#14	#14	#14
White/Black					#14	#14	#14
Red/Black						#14	#14
Green/Black						#14	#14
Orange/Black						#14	#14
Blue/Black							#14
Black/White							#14
Red/White							#14

Signal Cable shall have solid copper conductors and shall conform to I.M.S.A. Specification No. 20-1 (polyethylene insulated, polyethylene jacketed signal cable).



## 9-32.11(2) PEDESTRIAN PUSH BUTTON CABLE (New Section)

Pedestrian push button cable shall be single pair #16 AWG 19x29 stranded copper, polyethylene insulated, PVC jacketed, twisted pair cable with copper or aluminum-polyester shield and a No. 18 AWG stranded tinned-copper drain wire. The conductors shall be twisted together approximately 3 turns per foot.

## 9-32.11(3) ELECTRICAL SERVICE CONNECTIONS (New Section)

All traffic signal services shall be 2 parallel 120 volt, 60 HZ AC electrical services with accompanying equipment.

Individual service conductors shall be color or number coded type XHHW No. 6 AWG stranded copper. The outer jacket of cable shall be flame retardant, moisture, heat and sun light resistant thermoplastic or cross linked synthetic polymer suitable for underground conduit or aerial installation with suitable non-hygroscopic fillers.

All final connections and energizing of signal systems (overhead secondary or secondary in vaults or handholes) shall be performed by City Light, at no cost to the Contractor.

## 9-32.11(4) FUSES AND FUSE BLOCKS (New Section)

The In-Line fuse shall consist of a 2-section fuseholder body, 2 insulating boots and a fuse. The fuse shall be of the voltage and amperage specified with the fuseholder body, and insulating boots rated at 60 amperes, 300 volts.

The fuse shall be a current limiting type with a high interrupting rating, high speed opening, and sufficient time delay to prevent needless opening due to harmless short lived overloads without any loss of safety on either overload or short circuit condition. The fuse shall have a capacity of 35 to 60 amps as required at 300 volts, be 13/32 inches in diameter x 2-1/4 inches long, with an interrupting rating of 100,000 rms symmetrical amperes and minimum time delay of 25 seconds at 200 percent load.

The fuseholder body shall be made of molded plastic, in two sections - the line-side section and the load-side section - to provide a visible means of disconnect for circuit repairs or maintenance. Each section shall be totally enclosed at the wire entrance end, and the sections shall be joined by means of a threaded and gasketed joint. The fuse shall be held in the load-side section only. The fuseholder body shall be such that should the fuseholder be closed on a live circuit, any arc is confined within the fuseholder body.

Each section of the fuseholder shall have a crimp type connector to take 1 #12 to #2 solid or stranded copper wire.

Insulating boots shall be used to seal the wire connections and eliminate taping. 2 types of insulating boots may be used. A single conductor boot for the load-side and either a 1- or 2-conductor boot for the line-side (two conductor boot when required for tap-off).

The design of the fuse shall be such that the carrying capacity or opening time is little affected by ambient temperature and will operate with low watt loss to reduce heating.

## 9-32.11(5) POLE JUNCTION BOXES AND TERMINAL BOXES (New Section)

Junction and terminal boxes shall be watertight (NEMA 4) rated, cast iron box and cover. Finish shall be hot dipped galvanized. Cover shall mount with a neoprene gasket and brass cover screws. Top and bottom conduit holes shall be bossed, drilled and tapped. Conduit holes in rear of terminal boxes shall be drilled and tapped. The threads in poles and junction boxes shall be sealed to prevent water entry and rusting. Cabinet size shall be as indicated on the Drawings.

## 9-32.11(6) GROUNDING AND BONDING (New Section)

Ground rods shall be 5/8 inch diameter by 10 feet long copper clad steel rods. A ground rod shall be driven in each new handhole.

Bonding jumpers and equipment grounding conductors shall be stranded or solid, bare copper wire of the same cross-sectional area as No. 8 AWG unless a larger equipment grounding conductor is required by Code. Where parallel circuits are enclosed in a common conduit, the equipment grounding conductor

shall be sized by the rating of the largest overcurrent device serving any circuit contained in the conduit.

Ground rods shall be fabricated from cold-finished carbon steel shafting in accordance with ASTM Specification A 108 as it applies to grade 1018.

The covering of the steel core shall be a molecularly-bonded sheath of electrolytic-grade copper having a minimum thickness of 0.010 inches. The rods shall have rolled threads at each end for joining together with couplings.

Couplings for sectional rods shall be made of high-strength, corrosion-resistant bronze, internally threaded to fit standard rods.

Driving studs shall be made of high-strength, hardened steel of SAE 1045 or equal quality.

Plate electrodes shall conform to Article 250-83-NEC.

The body of the ground clamp shall be manufactured of forged, cast or high-conductivity drawn copper alloy. Clamps shall provide high pressure contact directly between wire and rod by means of a set screw. The screw shall be of silicon bronze and shall have a square or hexagonal head.

Drawn copper shall be a 220 Alloy (nominal 90 percent Cu, 10 percent zinc) and have a minimum Rockwell hardness of 95 on the F scale. Clamps shall conform to Material Std. 5640.3.

## 9-32.11(7) SQUEEZE CABLE FITTINGS (New Section)

Cable fittings for entry of cable through metal walls of poles, signs and signals shall be squeeze-type cable fittings with water-tight neoprene bushings. Size shall be carefully chosen to match the cable diameter to assure a water-tight fitting without damaging the cable.

## 9-32.12 SPAN WIRE (New Section)

Span wire shall be 5/16 inch, 7-strand aluminum covered steel span wire conforming to ASTM B415 with rated breaking strength of 10,270 lbs. per Department of Lighting Material Standard No. 5664.1.

Catenary span wire will be 7/16-inch, 7-strand aluminum covered steel span wire conforming to ASTM B415 with rated breaking strength of 20,800 lbs. per Department of Lighting Material Standard No. 5664.1.

## 9-32.13 POLE LINE HARDWARE (New Section)

Strain insulators shall be wet process, porcelain, conforming to EET-NEMA TDJ-54 as follows:

5/16 inch wire	Class 54-2
7/16 inch wire	Class 54-3

Tether wire shall be 1/8 inch galvanized steel stranded wire conforming to ASTM A475, extra high strength grade (rated at 1500 pounds minimum), Class A galvanized unless otherwise noted.

Bull rings (purse seine rings) shall be low carbon steel C1008 or better with an ultimate strength of 25,000 pounds. The ring shall be closed with a weld equal to or greater than 90 percent of the unwelded steel. The ring shall be galvanized with at least 2 ounces of zinc per square foot, which is equivalent to 3 mils of thickness. The steel shall be 3/4 inches in diameter and shall form a ring with a 3-inch ID. Higher strength steel shall be used when more than 4 signal heads are being supported.

All pole hardware, bolts, plate rods, hangers, clamps, wire guards and pole bands shall be hot-dipped galvanized in conformance with the requirements of ASTM Designation A-153, or shall be stainless steel.

All miscellaneous pole line hardware required to complete the project as planned shall be standard material manufactured for pole line construction.

## 9-32.14 GALVANIZING REPAIR PAINT (New Section)

Field repair of galvanized surfaces shall be a coating of heated zinc alloy solder to a minimum thickness of 2 mils in accordance with ASTM A 780.

## SECTION 9-33 - POLES, PEDESTALS AND FOUNDATIONS (New Section)

## 9-33.1 GENERAL (New Section)

All metal poles, mast arms and luminaire extensions shall be designed and fabricated to conform with the requirements of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" (Hereinafter referred to as "AASHTO"), and EET-IDJ 135 and 139. All load requirements shall be accommodated as indicated in the Drawings.

Poles shall be galvanized steel, timber or aluminum in accordance with the Drawings. Only one type of pole shall be used throughout the project, unless specifically called out otherwise on the Drawings.

Poles shall be of sufficient length to support span wires, mast arms, bracket arms, luminaires or other loads as indicated on the Drawings.

Poles not meeting the requirements of the Drawings and Specifications will be rejected. Steel or aluminum poles received damaged or broken shall be repaired or replaced at the option of the Engineer. Wood poles received damaged or broken shall, at the option of the Engineer, be replaced or cut back.

## 9-33.1(1) ANCHOR BOLTS (New Section)

Steel anchor bolts and nuts as specified on the Drawings shall be provided with each metal pole. Anchor bolts shall conform to ASTM A307 or A576 unless stated otherwise on the Drawings, and shall be capable of resisting, at yield strength stress, the bending moment of the shaft at its yield strength stress. Each anchor bolt shall have a hexagonal leveling nut with a washer for leveling and a hexagonal nut with a flat washer and a lock washer for the top of the anchor base plate. All anchor bolts (full length), nuts and washers shall be galvanized in accordance with ASTM A153. No field cutting of threads will be allowed.

Anchor bolt extenders (sleeve nuts), where required, shall be of a strength greater than the existing anchor bolts. The bolt extenders shall have a hexagonal tightening nut, and shall be galvanized in accordance with ASTM A 153.

## 9-33.1(2) GALVANIZING (New Section)

Before galvanizing, all visible welds on the pole shaft, mast arm and luminaire extension shall be ground flush to base metal, and all sharp edges shall be removed on the interior to prevent damage to the wires in the pole.

Structural material shall be zinc-coated by hot-dip process in accordance with ASTM A 123 and the final coating shall measure 0.003 inches or more in thickness as determined by a magnetic thickness gauge. Hardware and appurtenances shall be coated in accordance with ASTM A 153. Threads shall be re-cut after galvanizing without exposing base metal. Galvanizing certification of compliance with the applicable ASTM Standards signed by an independent testing laboratory shall be submitted to the Engineer before shipment.

The finished pole shall be straight and free from injurious defects. Poles distorted by the galvanizing process shall be straightened without damage to the galvanizing coating. The finish coating shall be smooth and free of dross. After galvanizing, the interior of the pole and arms shall be free from sharp edges to prevent damage to wiring.

## 9-33.1(3) GROUND LUGS (New Section)

Metal poles shall have a 3/8 inch tapped hole in the bottom edge of the handhole inside the pole. A 3/8 inch stainless steel bolt with stainless steel lock washer suitable for grounding shall be provided.

## 9-33.1(4) ORNAMENTAL NUT COVERS (New Section)

On metal lighting poles the Contractor shall furnish and install ornamental nut covers to cover anchor bolts and nuts. Covers shall not extend beyond the outside edge of the pole flange. Ornamental nut covers shall be secured with stainless steel set bolts and shall fit snugly to the pole shaft. Nut covers shall be made of the same materials as the pole and shall be provided by the pole manufacturer.

## 9-33.1(5) CONCENTRICITY (New Section)

Poles, mast arms, and luminaire extensions shall be within plus or minus 1/16 inch of perfect round with a constant taper of approximately 0.14 inches per foot and of uniform thickness.

## 9-33.2 STEEL POLES, MAST ARMS, AND LUMINAIRE EXTENSIONS (New Section)

## 9-33.2(1) GENERAL (New Section)

The term "steel strain pole" as used herein refers to any steel pole subjected to a span wire load (including METRO trolley loads) or mast arm load. Luminaires or other street lighting appurtenances may be mounted on a "steel strain pole". The term "steel lighting pole" refers to any steel pole which carries a luminaire but does not carry a span wire or mast arm load.

The length of the mast arm, height of pole, and size and type of luminaire extension shall be as indicated on the Drawings. An aluminum or stainless steel pole identification plate shall be securely attached immediately above the handhole, and shall indicate gauge, manufacturer, bolt circle, design principle moment in kip-feet, length, and date of manufacture.

Outside diameter of pole shafts shall be not more than 11 inches for supporting mast arm lengths 30 feet and under, and shall be not more than 13 inches for supporting mast arm lengths of 35 and 40 feet.

Outside diameter of steel strain pole shall be (at the base), no greater than 11 1/2-inches unless otherwise noted on the Drawings.

## 9-33.2(2) STRENGTH AND DEFLECTION REQUIREMENTS (New Section)

The pole shaft shall have strength sufficient to support all indicated loads.

The following design loads shall be used: Dead load shall consist of the weight of the signals, luminaires and bracket arms, signs and supporting structure, and associated appurtenances; wind and ice loads shall be as indicated by AASHTO. The signal head mast arm shall be of such size and gauge as to resist the bending moment.

The design of steel strain poles that support overhead trolley loads shall be governed by METRO Transit design standards as detailed on the Drawings.

Structural steel having a yield point of 33,000 p.s.i. or more shall be used for all structural parts. Silicon content of the steel shall be no more than 0.06 percent to prevent discoloration during galvanizing.

The total deflection at the top of metal poles resulting from all dead loads applied shall not exceed 0.22 inch per foot of pole height.

The deflection of the mast arm after loading shall not cause the end of the mast arm to extend below a horizontal line from the center of the arm flange. The maximum rise of the mast arm after loading from a horizontal line shall be 2 degrees.

The tenon for the luminaire shall be between 1 and 4 degrees above horizontal with the luminaire installed and all other loads applied to the pole.

## 9-33.2(3) BOLT CIRCLE (New Section)

Mast arm flange and pole base bolt circles shall be as indicated on the Standard Plans.

## 9-33.2(4) WELDS (New Section)

Circumferential butt welds shall have permanent back-up rings and full penetration for 100 percent of the circumference. All exposed butt welds shall be ground flush. All welds shall conform to the requirements of Section 6-03.3(44).

## 9-33.2(5) HANDHOLES, FESTOONS AND WIRE INLETS (New Section)

Poles shall have one oval 4 x 6-1/2 inch handhole, and a 3 X 5 inch festoon outlet, reinforced so as to result in no loss of shaft strength. The handhole shall have matching cover attached with stainless steel bolts. The cover shall be raintight and removable. The handhole shall be fabricated into the pole in a position 90° clockwise from the side on which the bracket arm or mast arm is attached.

Wire inlets (on poles) as shown on the Drawings shall be Schedule 40 steel pipe extending downward from the pole. Both ends of the pipe shall be rounded for wire protection. Inlet shall be installed, drilled and edges rounded before galvanizing.

## 9-33.2(6) MAST ARM COUPLINGS (New Section)

Couplings for signals shall be 2 inch, Schedule 80 steel pipe extending out 4-1/8 inches from the mast arm with a 7/16 inch diameter hole for mounting plumb per the detail on the Drawings or in the Appendix to the Project Manual. Both ends of the pipe shall be rounded for wire protection. The coupling shall be installed, drilled and edge rounded before galvanizing.

## 9-33.2(7) ANCHOR BASE PLATES (New Section)

A one-piece steel anchor base plate shall be secured to the lower end of the shaft by two continuous electric arc welds. The base plate shall be fabricated with a hole sized such that the shaft will slip approximately halfway through the plate, leaving a fillet between the end of the shaft and the inside of the hole, which shall be welded around the full circumference. A second weld shall be made around the full periphery where the shaft exterior meets the top of the base plate. The welded connection shall develop the full strength of the adjacent shaft section.

## 9-33.2(8) POLE AND MAST ARM CAPS (New Section)

All metal poles (except davit poles) and mast arms shall be equipped with a rain-tight pole cap constructed of the same material as the pole, and attached with stainless steel bolts.

## 9-33.3 ALUMINUM POLES (New Section)

Aluminum street light poles shall meet the requirements of Material Standard 5739.8, except as modified herein and on the Drawings.

The shaft shall be round with a continuous taper of approximately 1/8 inch per foot, and shall be made of a high-strength, corrosion-resistant aluminum alloy. The shaft shall have a satin finish, and shall be protected with a wrapping during shipping and installation. A rip cord shall be provided for easy removal of wrapping. An aluminum pole cap shall be attached with stainless steel bolts. Bracket arm flange shall be as indicated on the Drawings. The diameter at the top of the pole shall be 4-1/2 inches plus or minus 1/8 inch.

Poles shall have an oval 4-inch x 6-inch minimum handhole fabricated into the pole in a position 90° clockwise from the side on which the bracket arm is located and reinforced so as to result in no loss of shaft strength. The handhole shall have a matching aluminum cover attached with stainless steel bolts and shall be located 18 inches above the base plate.

Cast aluminum anchor and transformer base shall be made of high-strength, corrosion-resistant aluminum alloy of sound and uniform quality.

Anchor base poles shall have a 3/8 inch tapped hole in the bottom edge of the handhole and 3/8 inch stainless steel bolt and lock washer for grounding. Transformer bases shall have the ground lug inside the base adjacent to the access door. The lug shall be equipped with a stainless steel bolt (1/4 inch minimum), nut and lockwasher.

Anchor bolts for aluminum poles shall be the same as required for steel poles. See Section 9-33.2(7).

## 9-33.4 WOOD POLES (New Section)

Strain poles shall be either Douglas Fir, class 1, or Western Red Cedar, class 1.

Street light poles shall be Western Red Cedar, class 4.

Poles shall be framed before treatment with a 1/2 inch deep by 2 inch high setting gain on the pole face, 12 feet from the pole butt.

Poles shall be branded by burning the pole face, as specified by ANSI 05.1, 12 feet 6 inches above the pole butt. Metal marking tags will not be accepted.

Poles shall be butt-treated in accordance with AWWA C7, and the entire butt section of the pole shall be incised. After framing and roofing, the cuts shall be well brushed with the hot preservative.

## 9-33.4(1) DOUGLAS FIR (New Section)

Poles shall conform to the latest ANSI Specifications and Dimensions for Wood Poles.

Poles shall be round, sound, well proportioned from butt to top, without short kinks or crooks, and shall be one of the class and length noted on the Drawings or Specifications.

Poles shall be machine shaved full length, and shall be free from "barber pole" and "wheel gouging" depressions.

Poles shall be incised full length after shaving but before seasoning. Minimum incising depth shall be 1/2 inch.

No check exceeding 3/8 inch is permitted. Adjacent maximum acceptable checks closer than 3/4 inch are not permitted.

Poles shall be roof sawed.

Poles shall be full length pressure treated in accordance with AWWA C1 and AWWA C4. Net retention of preservative in poles after treatment shall be not less than 0.4 pounds of pentachlorophenol per cubic foot of wood (equivalent to 8 pounds of 5 percent solution).

The depth of wood preservative penetration shall be not less than 3/4 inches as determined by boring.

Preservative shall be pentachlorophenol conforming to the requirements of AWWA P8.

Solvent for pentachlorophenol shall be a heavy petroleum conforming to the requirements of AWWA P9.

## 9-33.4(2) WESTERN RED CEDAR (New Section)

Poles shall be cut from live timber, and shall meet the requirements of ANSI 05.1, with the following additional requirements.

Poles shall have an average of at least 8 annular rings per inch, counted radially on the butt's surface between a point 3 inches from the center of the pole heart and the periphery of the pole.

The maximum top circumference for any class pole shall not exceed the minimum for that class by more than 8 inches.

Poles shall be machine shaved smooth above the groundline. Shaved areas shall be free from "barber pole" and "wheel gouging" depressions.

Poles shall be flat-roofed at an angle of approximately 15 degrees, with the roof sloped from the face of the pole to the back of the pole.

The tops of full-length treated poles shall not be cut, except upon approval of the Engineer. If cutting is deemed necessary, the top of the pole shall be painted with creosote compound and covered completely with a copper or aluminum cap plate. Under no circumstances shall the butt of the pole be cut.

Preservative shall be pentachlorophenol conforming to AWWA P8.

## 9-33.5 STEEL PEDESTALS (New Section)

Shafts shall be constructed of welded structural steel, open-hearth lap welded steel or standard steel pipe conforming to the requirements of ASTM A53. Shafts shall be 4-1/2 inches (O.D.) Schedule 40 galvanized steel pipe with threaded end for mounting to the base. The overall height of the shaft and base shall be as indicated on the Standard Plans.

Pedestal base shall be of cast iron conforming the requirements of ASTM A 48, Class 40 and made in accordance to the configuration on the Standard Plans. Bases for pedestals shall be threaded, octagonal cast iron equipped with an access door for wiring. A 13-1/2 inch diameter bolt circle size shall be used. The base shall have a grounding lug inside which is accessible from the handhole. The base shall be silver in color.

#### 9-33.6 PEDESTRIAN PUSHBUTTON POSTS (New Section)

Pedestrian pushbutton posts shall be constructed of 2 inch I.D. Schedule 40 galvanized steel pipe with length as indicated on the Drawings. The meter post collar, pipe flange, bolts, nuts and washers shall conform to the details of the Drawings.

#### 9-33.8 BACK GUY ASSEMBLIES (New Section)

Unless otherwise indicated in the Special Provisions, Guy Wire shall be 7/16 inch, aluminum covered steel strand wire conforming with Department of Lighting Material Standard 5664.1.

Guy assembly components including the deadend grips, the porcelain strain insulator, and the automatic feed-thru deadend shall be sized so as to meet or exceed the rated breaking strength of guy wire.

Guy assembly components shall conform with the requirements of Department of Lighting Material Standards as follows:

Component	Material Standard
Guy Hook with Integral Spurs	5651.15
Deadend Grip	5651.4
Porcelain Strain Insulator	6901.1
Plastic Wire Guard	5651.8
Automatic Feed-thru Deadend	5650.3

Anchors for back guys shall consist of one of the following types:

- A 4-way or 8-way steel expanding anchor, having a minimum of 300 square inches, made of pressed steel, coated with asphalt or similar preservative and fitted with 3/4 inch minimum guy eye anchor rod 8 feet long.
- Plate anchor meeting the requirements of Material Standard 5620.7 fitted with 3/4 inch minimum guy eye anchor rod 8 feet long.
- an approved steel screw, such as a power installed steel helix anchor with extension rods, extension rod coupling, and strand eye nut. The single strand eye nut shall be per Material Standard No. 5652.1. The steel screw will be sized based upon its load and soil conditions by the Engineer.

The pipe brace shall be galvanized extra strong steel pipe.

#### SECTION 9-34 - ELECTRICAL AND SIGNAL CONDUITS (New Section)

##### 9-34.1 GENERAL (New Section)

Conduit shall be PVC coated galvanized rigid metal, galvanized rigid metal, or Schedule 80 PVC conforming to Articles 330, 346 or 347 respectively of the NEC as indicated on the Drawings. All conduit and metallic junction boxes shall be UL labelled.

Conduit installed totally within the metering and disconnect enclosure shall be rigid metal and may be without the PVC coating.

Where galvanized coating on any material has been damaged it shall be thoroughly painted with galvanized repair paint per Federal Spec MIL-P-21035 per the manufacturer's written instructions.

Conduit cable runs shall be parallel to building lines and grouped together where possible.

Factory bends and elbows shall be utilized in all cases where they provide the required deflection.

Field bends, when required, shall be performed so as to result in no flattening of conduit or damage to the galvanizing or PVC coating.

It shall be the option of the Contractor to use larger size conduit when approved by the Engineer. Where larger size conduit is used, it shall be for the entire length of the run from outlet to outlet. Reducing couplings will not be permitted. Conduit shall not change size between handholes, or conduit access point.

Conduit terminating in enclosures (poles, cabinets, pedestals, etc.) shall extend vertically above the foundation a minimum of 1 inch, unless indicated otherwise on the Drawings.

Conduit entering through the bottom of a handhole shall be located near the end walls to leave the major portion of the box clear. Conduit shall enter from the direction of the run, terminating 6 to 8 inches below the handhole lid and near the box wall.

##### 9-34.2 RIGID STEEL CONDUIT (New Section)

Exterior and interior surfaces of all steel conduit, including threads, except field cut threads, shall be uniformly and adequately zinc coated by a hot dip galvanizing process. The average weight of zinc coating shall not be less than 0.80 ounces of zinc per square foot of single surface area as determined by tests on 12-inch samples taken from a standard length of conduit of each size. The weight of zinc coating on any individual test specimen shall be not less than 0.7 ounces of zinc per square foot of single surface area. The weight of zinc coating will be determined in accordance with AASHTO T-65. Determinations and nominal weights shall conform to the requirements of the Underwriters Laboratory Publication No. 6 (latest edition). In addition, the exterior as well as the interior conduit samples shall withstand 4 dips in the PRECE test in accordance with ASTM A 239.

Every length of rigid metal conduit shall bear the label of Underwriters Laboratories, Inc., or the label of the Canadian Standards Association, if affected items of Canadian manufacture are approved for use on the project. Installation shall conform to appropriate articles of the NEC.

Rigid steel conduit may be substituted where PVC is indicated on the Drawings at the Contractor's option when approved by the Engineer, except on pole risers.

Fittings for field and factory bends shall be identical and interchangeable.

##### 9-34.2(1) THREADS (New Section)

The exposed thread ends of rigid steel conduit shall be hot dipped galvanized in accordance with the foregoing. Field cut threads shall be painted with galvanized repair paint.

##### 9-34.2(2) COUPLINGS (New Section)

Couplings and fittings for rigid steel type conduits shall be hot-dip galvanized, with the same quantities of zinc noted above. Couplings shall withstand 4 dips in the PRECE test as specified above.



**9-34.2(3) PVC COATING (New Section)**

All conduit shall be polyvinyl chloride (PVC) coated where indicated on the Drawings, dark grey, and U.V. Resistant Type.

The zinc surface prior to plastic coating shall be conditioned with chromic acid to provide an anchor for the plastic coating.

The exterior will be coated with an epoxy acrylic primer not to exceed 0.0005 inches thick prior to the application of the PVC coating.

A PVC coating shall be bonded to the outside of the pipe (excluding the threads) with a thickness between 0.035 inch and 0.045 inch. The PVC coating shall be applied by the plastisol dip method and shall contain ultraviolet inhibitors.

A coupling with the same PVC coating shall be furnished loose with each length of conduit and shall have a plastic sleeve extending 1 pipe diameter or 2 inches (whichever is less) beyond the end of the coupling. The inside diameter of the plastic sleeve shall be the same as the outside diameter of uncoated pipe of the same nominal size. The wall thickness of the plastic sleeve shall be the same as the plastic coating on the pipe. The bond between the metal and the PVC coating shall be equal to or greater than the tensile strength of the PVC coating.

A phenolic coating shall be fusion bonded to the inside of the pipe with a nominal 0.003-inch thickness.

All conduit fittings which are hollow and serve as part of the raceway shall be coated with the same PVC coating on the outside and phenolic coating on the inside as described above. The fittings shall have PVC sleeves at all female openings similar to the sleeves on the couplings.

All plastic coatings shall be applied by the same manufacturer who produces the hot-dip galvanized conduit.

The coated conduit shall conform to NEMA Standard No. RNI-1974 (Type A).

All coated conduit brackets, supports, clamps, NEMA 4 junction boxes, drains, breathers, expansion/deflection fittings, seals, etc., shall be PVC coated by the producer of the conduit. Field repair and touch-up shall be made with materials approved by the Engineer.

**9-34.2(4) EXPANSION FITTINGS IN CLASS 1 GROUP D AREAS (New Section)**

Conduit expansion fittings shall be PVC coated and installed as noted on Drawings.

Expansion fittings shall be explosion proof rated for Class I group "D" use.

**9-34.2(5) EXPANSION/DEFLECTION FITTINGS IN NON HAZARD AREAS (New Section)**

Expansion/deflection fittings shall be installed in all structure expansion joints. The expansion portion of the set shall provide for 4 inches of movement, 2 inches in each direction, unless specified greater on the Drawings. The deflection portion of the set shall provide for a movement of 3/4 inch from normal in all directions, and an angular movement of 30 degrees from normal in any direction. Fittings shall be O.Z. Gedney Type AXDX or approved equal.

**9-34.2(6) CONDUIT SEALS AND BREATHERS IN CLASS 1 GROUP D USE (New Section)**

Conduit seals and breathers shall be rated for Class I Group "D" use and PVC coated.

**9-34.3 PVC CONDUIT (New Section)**

Plastic conduit and fittings shall be rigid PVC Type EPC Schedule 80.

PVC rigid non-metallic conduit may be used for all installations except the first 10 feet above ground on a pole riser and the adjacent bend, or where specifically called out otherwise on the Drawings or Specifications.

Rigid PVC shall meet the requirements of ASTM D1785 and ASTM D 2466. The conduit shall be suitable for use above ground, for direct burial, and for corrosive atmosphere areas.

**9-34.4 CONDUIT RISER (New Section)**

Conduit risers shall be the size indicated on the Drawings. The 90 degree bend, and conduit up the pole to 10 feet above the surface shall be rigid steel. The riser above the 10-foot level shall be PVC, Schedule 80. The riser shall be equipped with a PVC weatherhead and shall be grounded as indicated on the Standard Plans.