

**STANDARD
SPECIFICATIONS
FOR
MUNICIPAL PUBLIC WORKS
CONSTRUCTION**



**Prepared By
WASHINGTON STATE CHAPTER
AMERICAN PUBLIC WORKS ASSOCIATION**

1977

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FOREWORD

This, the fourth edition of the Standard Specifications for Municipal Public Works is a general revision of the 1975 edition. It has been prepared by the Washington State Chapter of American Public Works Association, and is financed and published by authority of the Washington State Highway Commission with funds allocated by law for cooperative endeavors by the state with the counties and cities.

Compilation of this 1977 edition was directed by the Construction Standardization Committee of the Washington State Chapter, APWA. Nine separate subcommittees, involving engineers, consultants, contractors, and materials suppliers, were actively engaged in the detailed review and updating of the Standard Specifications which has resulted in this edition. The work of these dedicated people, some of whom have been active since the inception of the Committee in 1959, has been strengthened by the review of preliminary drafts, and comments, by many members of the chapter who accepted the general invitation to participate in this manner. The 1977 edition reflects, therefore, the input from a broad spectrum of knowledgeable people, based on their collective experience with the three previous editions.

As is true with any work of this nature, the edition contains compromises where divergent views had to be reconciled. Generally these have to do with differences in established local practice with no clear-cut superiority of one method over another, and quality has not been sacrificed for the sake of uniformity. The first three editions have substantially advanced the Chapter toward its goal of maximum uniformity of engineering and construction practices among Washington municipalities, and this edition represents another major step toward that goal and the consequent stretching of public works funds.

Appreciation of the Chapter is expressed to all who contributed their expertise and their many hours of time to this work and specifically to the office of the State Aid Engineer, Department of Highways, for their valued assistance in organization and assembly of the edited work and handling of the details of printing and publication.

EDITOR

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SANITARY SEWERS AND STORM DRAINS
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STANDARD SPECIFICATIONS FOR MUNICIPAL PUBLIC WORKS CONSTRUCTION



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DIVISION I—GENERAL REQUIREMENTS AND COVENANTS

Section 1—Definitions and Terms

1-1 DESCRIPTION

In the interpretation and construction of these specifications and the contract, or in any documents or instruments dealing with the construction operations governed by these specifications, the following words, terms and abbreviations, or pronouns in place of them shall each be construed as defined below.

1-1.01 OWNER

The city, county, or other municipality, acting through its legally constituted officials, officers, or employees.

1-1.02 ENGINEER

The city engineer, county engineer, or an engineer of a municipality, including such assistants as are authorized to represent him.

1-1.03 CONSULTING ENGINEER

A licensed engineer or an authorized member of a licensed consulting firm or organization retained by the owner for design and the construction engineering of specific public works projects.

1-1.04 INSPECTOR

The Owner's Authorized Representative assigned to make all necessary inspections of the work performed or being performed, or of materials furnished or being furnished by the contractor.

1-1.05 SPECIFICATIONS

The directions and requirements of the standard specifications as contained herein, as supplemented by such special provisions as may be provided, pertaining to the manner of performing the work or the quantities and quality of materials to be furnished under the contract.

1-1.06 SPECIAL PROVISIONS

The contract requirements peculiar to the project and which are not otherwise thoroughly or satisfactorily detailed and set forth in the standard specifications.

1-1.07 SUPPLEMENTAL SPECIFICATIONS

Supplemental specifications are those adopted subsequent to the standard specifications and generally involve alterations and new construction items, or substantial changes in the standard specifications.

1-1.08 PLANS

The official drawings, plans, profiles, typical cross sections and supplemental drawings, or reproductions thereof, approved by the Engineer, which show the location, character, dimensions and details of work to be performed. All such documents are to be considered as a part of the plans whether attached to the specifications or separate therefrom.

The terms "standard drawing," generally used in the specification text, and "standard plan," generally appearing in the titles of drawings, are synonymous for reference purposes.

1-1.09 BIDDER

An individual, firm, copartnership or corporation, or combination thereof, submitting a proposal for the work contemplated and acting directly or through a duly authorized representative.

1-1.10 PROPOSAL

The written offer, or copy thereof, of the bidder to perform the work proposed, properly signed and guaranteed.

1-1.11 PROPOSAL GUARANTY, BID BOND

Cash, bid bond, cashier's or certified check accompanying the proposal submitted by the bidder as a guaranty that he will enter into contract with the Owner for performance of the work if the contract is awarded to him.

1-1.12 CONTRACT

The written agreement between the owner and the contractor covering the performance of the work and furnishing of labor, materials, tools, and equipment in the construction of the work. The contract shall include the notice to contractors, proposal, plans, specifications, special provisions and contract bonds; also any and all supplemental agreements amending or extending the work contemplated. Supplemental agreements are written agreements covering alterations, amendments or extensions to the contract and include contract change orders.

The contract documents are complementary and what is called for by one shall be as binding as if called for by all. In case of discrepancies, plans shall govern over specifications, supplemental specifications shall govern over standard specifications, and special provisions shall govern over specifications and plans. Where appearing on plans or drawings, dimensions denoted by actual figures shall govern over scaled dimensions. In case of any ambiguity or dispute over interpretation of the provisions of the contract, the decision of the owner shall be final.

1-1.13 AMOUNT OF CONTRACT

For the purpose of awarding the contract and determining the amount of the bond, the total amount of the bid and the full amount of the contract price will be the summation of the products of the quantities shown in the proposal by the unit bid prices, and state sales or use tax, whenever applicable. See Sec. 7-1.09.

1-1.14 CONTRACTOR

The individual, firm, copartnership or corporation, and his, their, or its heirs, executors, administrators, successors and assigns, or the lawful agent of any such individual, firm, partnership, covenantor or corporation, or his, their or its surety under the contract bond, constituting one of the principals to the contract and undertaking to perform the work herein specified. Where any pronoun is used as referring to the word "Contractor" it shall mean the Contractor as defined above.

1-1.15 SUBCONTRACTOR

The individual, firm, partnership or corporation to whom the Contractor, with written consent of the Owner, sublets any part of the work covered by the contract.

1-1.16 CONTRACT BOND, PERFORMANCE BOND

The approved form of security furnished by the Contractor and his surety, as required in the contract. It shall be conditioned that such person or persons who enter into contract with the Owner shall faithfully perform and fulfill all the provisions of the contract and complete the work in strict accordance with the plans and specifications including full payment for labor and materials used in the work.

1-1.17 SURETY

The surety (RCW 39.08.010) responsible for the bidder's acts in the execution of the contract, or which is bound with and for the Contractor to insure performance of the contract, the payment of all obligations pertaining

Section 1—Definition and Terms

to the work, and the fulfillment of such other conditions as may be specified or required by law.

1-1.18 WORK

All the work specified, indicated, shown or contemplated in the contract to construct the improvement, including all alterations, amendments or extensions thereto made by contract change order or other written orders of the Engineer.

1-1.19 DAYS

Unless otherwise designated, days as used in the specifications will be understood to mean calendar days.

1-1.20 LIQUIDATED DAMAGES

The amount prescribed in the specifications to be paid the Owner, or to be deducted from any payments due or to become due the Contractor, for each day's delay in completing the whole or any specified portion of the work beyond the time allowed in the specifications.

1-1.21 "OR EQUAL"

In order to establish a basis of quality for some things in the work, certain processes, types of machinery and equipment, or kind of material may be mentioned on the plans by designating a manufacturer by name and referring to his brand or model numbers. Such mention is not intended to exclude other processes, equipment or materials that will measure up to the designated standards of that mentioned. If the Contractor desires to use other products as equal thereto, he shall secure the approval of the Engineer before entering an order therefor. Wherever in the specifications a manufacturer's name, brand or model is mentioned, it is to be understood that the phrase "or equal" is assumed to follow thereafter whether or not it does in fact.

1-1.22 ABBREVIATIONS

Wherever the following abbreviations are used in these specifications or on the plans they are to be construed the same as the respective expressions represented:

A.A.N.	American Association of Nurserymen
A.A.R.	Association of American Railroaders
A.A.S.H.T.O.	American Association of State Highway & Transportation Officials
A.C.I.	American Concrete Institute
A.G.A.	American Gas Association
A.G.C.	Associated General Contractors of America
A.I.A.	American Institute of Architects
A.I.E.E.	American Institute of Electrical Engineers
A.I.S.C.	American Institute of Steel Construction
A.N.S.I.	American National Standards Institute
A.P.W.A.	American Public Works Association
A.R.A.	American Railway Association
A.R.E.A.	American Railway Engineering Association
A.S.C.E.	American Society of Civil Engineers
A.S.L.A.	American Society of Landscape Architects
A.S.T.M.	American Society for Testing & Materials
A.W.P.A.	American Wood Preservers' Association
A.W.W.A.	American Water Works Association
A.W.S.	American Welding Society
F.H.W.A.	Federal Highway Administration
F.S.S.	Federal Specifications and Standards General Services Administration
N.E.M.A.	National Electrical Manufacturer's Association
N.E.C.	National Electrical Code
S.A.E.	Society of Automotive Engineers
U.S.A.S.I.	United States of America Standards Institute

1-1.23 HIGHWAY, STREET, ROAD, OR ALLEY

The whole area within the right of way which is reserved for and secured for use in constructing the roadway and its appurtenances.

1-1.24 ARTERIAL STREET

A general term denoting a highway primarily for through traffic, usually on a continuous route.

1-1.25 RIGHT OF WAY, EASEMENT

The land provided by the Owner upon which to construct the roadway or other work and appurtenances specified in the contract.

1-1.26 ROADWAY

That portion of the highway included between curbs, gutters, or ditches, intended primarily for vehicular traffic, and including all appertaining structures and other features necessary to proper drainage and protection.

1-1.27 SUBGRADE

That portion of the roadbed surface which has been prepared, as specified, and upon which a layer of specified roadbed material or base, or surfacing, or pavement is to be placed.

1-1.28 SURFACING

The uppermost layer of material placed on the traveled way or shoulders. This term is used interchangeably with pavement.

1-1.29 TRAVELED WAY

That portion of the roadway intended for movement of vehicles, exclusive of shoulders and auxiliary lanes.

1-1.30 PAVEMENT

The uppermost layer of material placed on the traveled way or shoulders for riding surface, generally rigid or flexible in composition. This term is used interchangeably with surfacing.

1-1.31 BRIDGE

A structure, other than a culvert, which carries traffic over a water course, highway or railroad, or railroad traffic over a highway or street.

1-1.32 CULVERT

A drainage structure which may or may not directly support traffic, extending across and beneath a highway, street, driveway or alley.

1-1.33 TRAFFIC CONTROL DEVICES

Fixed or portable signs, signals, street lights, barricades, guard rails, pavement markings, channelization and other equipment or materials used for the purpose of regulating, warning and guiding traffic.

1-1.34 MAJOR CONTRACT (BID) ITEM

A major contract item is any item for which the contract price amounts to 10 percent or more of the total contract price as determined by the original proposed quantities and the unit contract prices.

1-1.35 WORKING DRAWINGS (SHOP DRAWINGS)

Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the contractor is required to submit to the engineer for approval.

Section 2—Proposal Requirements and Conditions

Section 2—Proposal Requirements and Conditions

2-1 PROPOSAL

2-1.01 CONTENTS OF PROPOSAL FORMS

Prospective bidders will be furnished with proposal forms which will state the location and description of the contemplated construction and will show the approximate estimate of the various quantities and kind of work to be performed and/or materials to be furnished, with a schedule of items for which unit bid prices are asked.

2-1.02 EXAMINATIONS OF PLANS, SPECIFICATIONS SITE OF WORK

The bidder will examine carefully the sites, including material sites, of the proposed work, the proposal, plans and special provisions, specifications, addenda, and contract forms therefor. The submission of a bid shall be conclusive evidence that the bidder has made such examinations and has investigated and is satisfied as to the conditions to be encountered, the character, quantity, quality, and scope of work, the quantities and qualities of materials to be supplied and equipment and labor to be used, and the requirements of the proposal, plans, special provisions, specifications and addenda for performance of the work in full.

The bidder must be familiar with all Federal, State and local laws, ordinances and regulations which in any manner might affect those engaged or employed in the work, the materials, equipment or procedures used in the work, or which in any other way would affect the conduct of the work. He is assumed to be familiar with such laws and regulations, and no plea of misunderstanding or ignorance of the law will be considered.

The bidder shall determine from his examination the methods, materials, labor and equipment required to perform the work in full and shall reflect the same in his bid prices. If in the performance of the work, methods, materials, labor or equipment are required beyond those anticipated by the bidder, he will not be entitled to additional compensation.

Where the owner has investigated the site of the proposed work, including investigation of possible subsurface conditions, such an investigation is made only for purpose of study and design. Bidders may inspect subsurface boring logs made by the owner in such investigations. Such inspections are deemed solely for the bidder's convenience and the owner assumes no responsibility whatsoever for the sufficiency or completeness of investigations made or interpretation thereof. Any such records of borings are not part of the contract and there is no representation or warranty expressed or implied, that the conditions interpreted from investigations are correct, that different materials or materials in different proportions or moisture content than indicated will not be encountered or that unanticipated developments will not occur. The availability of any such information from the owner shall not relieve the bidder or the Contractor of any duty to make his own examination and investigation as required in this section or of any other responsibility under the contract.

Where logs of test borings are included in the contract plans it is agreed that such logs do not constitute a part of the contract and are included only for the convenience of the bidder or Contractor and do not relieve him of his duties under this section or of any other responsibility under the contract.

No information derived from any inspection of records of investigation or compilation thereof made by the Owner, will in any way relieve the bidder or Contractor from any risks or from properly performing his obligations under the contract.

2-1.03 INTERPRETATION OF CONTRACT DOCUMENTS

The documents forming the contract are complementary and what is called for by one shall be as binding as if it were called for by all. They are intended to include all detail of labor and material reasonably necessary for the proper execution of the work.

If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the plans, specifications or other documents, he may submit to the Engineer a written request for an interpretation thereof. The person submitting the request will be responsible for its prompt delivery not less than five (5) days prior to the date set for opening bids. Any interpretation of the proposed documents will be made by an addendum duly issued, and a copy of such addendum will be mailed or delivered to each person receiving a set of the plans and specifications and each bidder shall acknowledge receipt of each such addendum received in order to have the bid considered. The Owner will not be responsible for any other explanations or interpretations of the proposed documents.

2-1.04 QUANTITIES AND UNIT PRICES

The quantities, for which unit prices are indicated in the proposal form, are approximate only, and do not constitute a warranty or guarantee by the Owner as to the actual quantities involved in the work. Such quantities are to be used for the purpose of comparison of bids and determining the amount of the performance bond. The Owner expressly reserves the right to increase or decrease the quantities during construction as outlined in Section 4-1.03 of the specifications; also to make reasonable changes in design, providing such changes do not materially change the intent of the basic contract. The amount of work to be paid for shall be upon the actual quantities performed.

2-1.05 QUALIFICATION OF BIDDERS

The bidder must be qualified by experience, financing and equipment to do the work called for in the plans and specifications. Whenever required in the special provisions, the bidder shall furnish upon a form for that purpose, a statement of his construction experience and his general ability to perform the work contemplated, and shall submit same along with his bid proposal.

The Owner shall have the right to take such action as he may deem necessary in determining the ability of the bidder to perform the work satisfactorily.

Upon request of the Owner, a bidder whose bid is under consideration for award of a contract, shall submit promptly to the Owner satisfactory evidence of financial resources, his construction experience and his organization available for performance of the proposed contract.

2-1.06 DISQUALIFICATION OF BIDDERS

The Owner in his discretion, may determine that a bidder is not responsible and reject his proposal for any of the following reasons:

(a) More than one proposal on the same project from a bidder under the same or different names.

(b) Evidence of collusion with any other bidder or bidders. Participants in such collusion shall be disqualified from submitting bids on any further work.

(c) If a bidder is not qualified for the work involved or to the extent of his bid.

(d) Unsatisfactory performance record, judged from the standpoint of conduct of work, workmanship, or progress, as shown by past or current work for the Owner.

(e) Uncompleted work, whether for the Owner or otherwise, which might hinder or prevent the prompt completion of the work bid upon.

(f) Failure to pay or settle bills for labor or materials on any former or current contracts.

(g) If the bidder has previously defaulted in the performance of or failed to complete a written public con-

Section 3—Award and Execution of Contract

tract, or has been convicted of a crime arising from a previous public contract.

(h) Any other inability, financial or otherwise, to perform the work.

(i) A bidder not authorized to do business in the State of Washington.

(j) For any other reasons deemed proper as determined from a pre-award survey of bidder's capability to perform.

2-1.07 PREPARATION OF PROPOSAL

Each bid shall be made on the forms furnished by the Owner and shall be signed by the bidder with the signature in full. If the proposal is made by a partnership, it shall contain the name of each partner and shall be signed in the firm name, followed by the signature of the person authorized to sign. If the proposal is made by a corporation it shall be signed in the name of the corporation by the officer or officers having authority to sign contracts. The address and telephone number of the bidder shall be typed or printed on the proposal.

A unit or lump sum price, as required in the proposal, shall be submitted on each item of work included in the group or division for which bids are requested. Each unit or lump sum price shall be typed or written with ink in both words and figures.

In case of a discrepancy as between the words and the figures, the words shall govern. Any omission of prices on items shown in the proposal form or any addition in writing to the form of bid, or any condition, limitation or provision not officially invited in the proposal or special provisions may render the proposal as being incomplete or modified and may become cause for rejection of the bid.

2-1.08 DELIVERY OF PROPOSAL

Each proposal or bid shall be completely sealed in a separate envelope, properly addressed to the Owner at the address indicated on the proposal form, with the name and address of the bidder and the name of the project for which the bid is submitted, plainly written on the outside of the envelope.

Proposals will be received at the time and place stated in the Call for Bids. It is the sole responsibility of the bidder to see that his bid is delivered in time. Any bid received after the scheduled closing time for receipt of bids will be returned to the bidder unopened.

Bids shall be submitted intact, including all proposal documents and acknowledgment of all addenda received from the Owner.

2-1.09 WITHDRAWAL OR REVISION OF PROPOSAL

A bidder may, without prejudice to himself, withdraw, modify, or correct a proposal after it has been deposited with the Owner, provided the request is filed with the Owner, in writing or by written telegrams, before the time set for opening proposals. The original proposal, as modified by such writing or telegraphic communication, will be considered as the proposal submitted by the bidder.

No bidder will be permitted to withdraw his proposal between the closing time for receipt of proposals and the execution of contract, unless the award is delayed for a period exceeding thirty (30) calendar days.

2-1.10 SUPPLEMENTAL PROPOSALS

If supplemental proposals are required due to the character of the improvement and uncertainties which may be encountered during construction, bidders shall submit supplemental bids on all items as shown on the supplemental proposal. The bidder shall bid on all alternates on the proposal form as provided therein. When bidding on an alternate for which there is no charge, the bidder shall insert the words "No Charge" in the space provided on the proposal form. The unit contract price bid shall be full compensation for furnishing all labor, tools and equipment which may be required under the

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several items listed and shall be a basis for final settlement.

Only the proposal for the basic contract shall be considered in the determination of the lowest and best bid. The supplemental proposal shall not be considered in this determination unless it is so provided in the special provisions.

2-1.11 PROHIBITION OF ALTERATIONS

The proposal form invites bids on definite plans and specifications. Only the amounts and information asked for on the proposal form furnished by the Owner will be considered as the bid. Each bidder shall bid upon the work exactly as specified and as provided in the proposal form.

Proposals which are incomplete or which are conditioned in any way, or which contain unauthenticated erasures, alterations or items not called for in the proposal, or which are not in conformity with the law may be rejected.

No oral or telephone proposals or modifications will be considered.

2-1.12 OPENING OF PROPOSALS

At the time and place set for the opening and reading of the proposals as indicated in the call for bids, each and every proposal (except any which may have been withdrawn in accordance with Section 2-1.09) received prior to the scheduled closing time for receipt of proposals, will be publicly opened and read aloud.

All items and totals will be tabulated and, in event of error, the corrected totals will be considered the official totals. The low bid will be determined on the basis of the aggregate sum of items as carried in the proposal.

2-1.13 REJECTION OF PROPOSAL

The Owner reserves the right to reject any and all proposals. (See causes in Sections 2-1.10 and 2-1.11.)

2-1.14 PROPOSAL GUARANTY

A certified check, cashier's check, cash or proposal bond in the amount equal to at least five percent (5%) of the total amount bid, including sales tax, must accompany each bid as evidence of good faith and as a guarantee that if awarded the contract, the bidder will execute the contract and give a performance bond as required. Checks shall be made payable to the fiscal officer of the Owner, such as the treasurer of a city, or other official designated in the specifications.

Bonds shall be furnished by a company authorized to do business in the State of Washington.

2-1.15 FAMILIARITY WITH LAWS AND ORDINANCES

The bidder is assumed to be familiar with all federal, state, and local laws, ordinances, and regulations, which in any manner affect those engaged or employed in the work or the materials or equipment used in the proposed construction, or which in any way affect the conduct of the work, and no plea of misunderstanding will be considered on account of ignorance thereof. If the bidder, or contractor, shall discover any provision in the plans, specifications, or contract which is contrary to or inconsistent with any law, ordinance, or regulation, he shall forthwith report it to the Owner in writing.

Section 3—Award and Execution of Contract

3-1 CONTRACTS

3-1.01 AWARD OF CONTRACT

The award of contract, if it be awarded, shall be made

Section 3—Award and Execution of Contract

within thirty (30) calendar days after the date of opening of bids to the lowest bidder deemed responsible by the Owner. The successful bidder will be notified, by letter mailed to the address shown on his proposal, that his bid has been accepted and that he has been awarded the contract.

3-1.01A BIDDING ERRORS

When, after opening and tabulation of bids, a Contractor claims error and requests to be relieved of award, he shall be required to, on the same day as the bid opening or if bid opening is in the P.M. then on the following business day, present his certified work sheets. The Owner shall review the work sheets to determine the validity of the Contractor's claim of error.

If the Owner is convinced that an honest, allowable (excusable mathematical) error has been made, the Contractor shall be relieved of responsibility and his bid bond shall be returned. The job then shall be awarded to the next low bidder. The Owner reserves the right to reject all bids and proceed to readvertise. The Contractor claiming error shall not be permitted to bid the project.

3-1.02 RETURN OF PROPOSAL GUARANTY

After the bids have been tabulated and compared, the Owner will return the guaranty deposits accompanying such of the proposals as in his judgment will not be considered in making the award. All other proposal guaranties will be held until the contract and bond have been executed and then be returned to the bidders who furnished them.

3-1.03 EXECUTION OF CONTRACT

Within ten (10) days after the date the bidder receives notification of award of contract, as evidenced by receipt from the Owner of properly prepared contract documents, the bidder to whom award is made shall execute and return the contract in the required number of copies, and shall furnish a performance bond and other required bonds and insurances satisfactory to the Owner. (See Section 8-1.05 for contract time.)

The Contractor shall, at the time of signing the Contract, notify the Owner in writing of the names of all proposed subcontractors and material suppliers for the work. All subcontractors and suppliers are subject to the approval of the Owner. The Contractor agrees that he is fully responsible to the Owner for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them.

Nothing contained in the contract documents shall imply any contractual relation between any subcontractor and the Owner.

3-1.04 PERFORMANCE BOND, CONTRACT BOND

The Contractor shall, at the time of delivery of the executed contract, furnish to the Owner a corporate surety bond in the full amount of the contract price conditioned for the faithful performance of the contract, as conditioned in Section 7-1.02. The surety must be authorized to do business in the State of Washington and be satisfactory to the Owner. Each bond must be approved in writing by the legal representative of the Owner.

3-1.05 FAILURE TO EXECUTE CONTRACT

Upon failure to enter into the contract and furnish the necessary bond within the time specified in Section 3-1.03, the proposal guaranty which accompanied the bid, whether in form of a bond, check or cash deposit, shall be forfeited to the Owner. The award may then, at the discretion of the Owner, be made to the next lowest responsible bidder or the work may be readvertised, or may be constructed by the Owner in any legal manner.

Any Contractor who refuses to enter into a contract and who forfeits his bid bond may be prohibited from

bidding on other work of the Owner for a period of 24 months.

3-1.06 NONCOLLUSION AFFIDAVIT

Each bid shall be accompanied by a properly executed noncollusion affidavit on the form furnished therefor by the Owner.

3-1.07 CONTRACTOR'S INSURANCE

The Contractor shall not commence work under the contract or under any special condition until he has obtained all insurance and all necessary permits, as required under the following sub-paragraphs, and until such insurances have been approved by the Owner, nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurances required of the subcontractor have been obtained and approved.

3-1.07A COMPENSATION INSURANCE

The Contractor shall take out and maintain during the life of this contract Workmen's Compensation Insurance for all of his employees employed at the site of the project and, in case any work is sublet, the Contractor shall require the subcontractor similarly to provide Workmen's Compensation Insurance for all the latter's employees unless such employees are covered by the protection afforded by the Contractor. In case any class of employees engaged in hazardous work under this contract at the site of the project is not protected under Workmen's Compensation statutes, the Contractor shall provide, and shall cause such subcontractor to provide compensation insurance with a private company in an amount equivalent to that provided by the Workmen's Compensation statute for the protection of his employees not otherwise protected.

3-1.07B PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE

The Contractor shall obtain and keep in force during the term of the contract, public liability and property damage insurance in companies and in form to be approved by the Owner. Said insurance shall provide coverage to the Contractor, any subcontractor performing work provided by this contract, and the Owner. The Owner shall be named as an additional insured on said policy insofar as the work and obligations performed under the contract are concerned. The coverage so provided shall protect against claims for personal injuries, including accidental death, as well as claims for property damages which may arise from any act or omission of the Contractor or the subcontractor, or by anyone directly or indirectly employed by either of them.

The minimum policy limits of such insurance shall be as follows:

Bodily injury liability coverage with limits of not less than \$200,000 for bodily injury, including accidental death to any one person, and subject to that limit for each person, in an amount of not less than \$500,000 for each accident; and property damage coverage in an amount of not less than \$100,000 for each accident.

3-1.07C INDEMNIFY OWNER FROM LOSS

The Contractor hereby agrees to save the Owner harmless from all loss or damage occasioned to it or to any third person or property by reason of any acts or omissions on the part of the Contractor, subcontractors, agents, and employees in the performance of the contract and will, after reasonable notice thereof, defend and pay the expense of defending any suit which may be commenced against the Owner by any third person alleging injury by reason of such acts or omissions and will pay any judgment which may be obtained against the Owner in such suit.

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Section 4—Scope of Work

3-1.07D STREET OBSTRUCTION BOND

Where required by law or by municipal procedures, the Contractor shall furnish the Owner a Street Obstruction bond in the amount required by ordinance prior to commencement of any work covered by the contract. The award of the contract shall be considered to be the permit to work upon the roads, streets, alleys, easements or public places as specified in the contract.

3-1.08 PROOF OF CARRIAGE OF INSURANCE

Refer to Sections 3-1.07B and 3-1.07D.

3-1.09 PROTECTION OF CONTRACTOR'S WORK AND PROPERTY

The Contractor shall protect his work, supplies, and materials from damage due to the nature of the work, the action of the elements, trespassers or any cause whatsoever, until the completion and acceptance of the work.

Neither the Owner nor any of its officers, employees or agents assume any responsibility for collecting indemnity from any person or persons causing damage to the work of the Contractor.

Section 4—Scope of Work

4-1 SCOPE OF WORK

4-1.01 INTENT OF CONTRACT

The intent of the contract is to prescribe a complete work or improvement which the Contractor undertakes to do, in full compliance with the provisions and requirements of the contract. The Contractor for all or any part shall furnish all labor, materials, tools, equipment, transportation, necessary supplies and incidentals required to make each and every item complete as contemplated by the contract. Any deviation from these requirements must be stipulated in the special provisions.

4-1.02 ADDITIONAL INSTRUCTIONS

In the event it is found that the instructions and drawings contained in the contract documents are not sufficiently clear to permit the Contractor to proceed with the work, the Engineer shall, either upon his own initiative or upon the request from the Contractor, furnish such additional written instructions, together with such additional drawings as may be necessary. When such request is made by the Contractor, it must be in ample time to permit the preparation of the instructions and drawings by the Engineer before the construction of the work covered by them is undertaken. Such additional instructions and drawings shall be consistent with the contract documents and shall have the same force and effect as if contained in the contract documents.

For the purpose of avoiding delays in the preparation of such additional instructions and drawings, the Engineer and the Contractor shall jointly prepare a schedule showing the time for the commencement of the work to be included in them and the time the Contractor shall furnish the necessary shop drawings, which may be necessary for their preparation. The Contractor shall do no work without proper drawings or instructions and shall at his own expense, replace any work wrongly executed.

4-1.03 INCREASE OR DECREASE OF WORK

The Owner reserves the right to make such alterations in the plans or in the quantities of work as may be considered necessary. Such alterations shall be submitted in writing to the Contractor by the Engineer and shall not be considered as a waiver of any conditions of the contract nor to invalidate any of the provisions thereof; provided, however, that the execution of a supplemental agreement acceptable to both parties of the contract will be necessary before any alteration is made which in-

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volves (1) an extension or shortening of the length of the project by more than 25%, (2) an increase or decrease of more than 25% of the total cost of the work calculated from the original proposal quantities and the unit contract prices, or (3) an increase or decrease of more than 25% in the quantity of any one major contract item as defined in Section 1-1.34.

When an alteration requires the execution of a supplemental agreement, the agreement shall be fully executed before any work on the alteration is started. Alterations involving an increase of more than 25% in the net of any one minor contract item will not require a supplemental agreement.

4.1.04 EXTRA WORK

Any extra work made necessary by alteration or additions to the plans or by other reasons for which no price is provided in the contract, shall be performed by the Contractor as directed by the Engineer and he shall be compensated therefor as elsewhere provided herein.

Extra work which by reason of its character or extent is covered by a supplemental agreement between the Owner and the Contractor, must have the written consent of the surety on the bond, but extra work and change orders not covered by a supplemental agreement will not require the consent of the surety.

4-1.05 CHANGED CONDITIONS

Should the Contractor encounter subsurface or latent physical conditions at the site differing materially from those indicated in the contract, or unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract which changed or unusual conditions will be considered by the Contractor as the basis for a claim for extra compensation, the Contractor shall promptly notify the Engineer of the alleged conditions in writing. Changed conditions that occur as a result of any negligence or inattention on the part of the Contractor or his agent shall not be considered eligible for extra payment.

If the Engineer is not given written notice, the Contractor will be deemed to have waived any claim or claims for extra compensation in any manner arising out of the changed or unusual conditions.

If the Owner shall determine the conditions to be such as to justify a claim for additional compensation, he may provide for additional payment as specified in Section 9-1.03 for the particular phase of work in question, or by any other equitable arrangement mutually agreed upon by the Owner and the Contractor and consented to in writing by the surety to the bond. In any event, the Contractor shall not be relieved, unless permitted to do so by the Owner, from his obligation of resuming construction operations pending decision as to the validity of a claim, or pending the execution of a negotiated agreement to cover additional costs if a claim shall be recognized under the provisions of this section of the specifications.

4-1.06 WASTE SITES

The various sections of these specifications require three different types of waste sites which are: (1) private property abutting the improvement, (2) waste sites designated on construction plans, and (3) waste sites to be provided by the Contractor.

In all cases, all waste sites shall be operated in such a manner as to meet safety and health requirements of state, county, and city. Sites, operations, or the result 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 will be furnished the Owner.

Section 5—Control of Work

4-1.06A PRIVATE PROPERTY ABUTTING THE PROJECT

It shall be required that waste excavation not needed on the project shall be equitably distributed among those private properties abutting the project and desiring waste material. The Contractor will be required to haul and dump the excavated material at no expense to the property owner or to the Owner. The material shall be dumped as the Engineer may direct at the location designated by the property owner, except that no leveling or dressing will be performed under this contract other than as may be necessary to provide access for the material to be dumped. Where conditions are such as to require additional work such as clearing and grubbing, the providing of drainage, leveling and shaping (other than previously mentioned), the property owner shall make necessary arrangements with the Contractor for payment of such additional work. The Engineer shall make final determination of responsibility in event of controversy.

4-1.06B WASTE SITES DESIGNATED ON THE CONSTRUCTION PLANS

Where waste sites are designated on the plans, the operations shall be performed as the Engineer may direct, and upon completion, the area shall be uniformly cleaned and shaped as directed by the Engineer. Other requirements shall be as provided in the special provisions.

4-1.06C WASTE SITES TO BE PROVIDED BY THE CONTRACTOR

Where there is additional waste excavation in excess of that needed for the project and that needed for compliance with requests of abutting properties, the Contractor shall, unless otherwise provided for in the special provisions, secure and operate his own waste site at his own expense. In such case, the Contractor shall meet the general requirements hereinbefore described.

4-1.07 SALVAGE

Unless otherwise indicated on the plans or in the special provisions, all castings, pipe and any of the discarded facilities shall be carefully salvaged and stockpiled within the construction area, to be disposed of by the Engineer.

4-1.08 FINISHING AND CLEAN UP

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 twenty-four (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. Upon completion of the work, the Contractor shall remove all his equipment and put the area of the work in a neat and clean condition and do all other cleaning required to complete the work in a workmanlike manner, ready for use and satisfactory to the Engineer.

All cleanup shall be performed as specified in the various sections of these specifications, in the special provisions, or in Section 57.

If no bid item is included in the proposal for "Finishing and Cleanup," per lump sum, or for "Finishing and Cleanup," per station (100-foot), then all work of cleaning up as required shall be considered as incidental to the construction and the costs thereof shall be included in other items of the work.

4-1.09 PROTESTS

If the contractor considers any work demanded of him to be outside the scope of the contract or considers any ruling of the Engineer to be unfair, he shall immediately, upon such work being demanded or such ruling being

made, proceed without delay to perform the work or to conform to the ruling, and within ten (10) days after date of receipt of the instructions or ruling, he shall file a written protest with the Engineer, stating clearly and in detail the basis of his objection, and include an itemized statement of any extra costs which may have resulted. Except for such protests or objections as are made of record in the manner herein specified and within the time limit stated, the records, rulings, instructions or decisions of the Engineer will be final and conclusive.

Section 5—Control of Work

5-1.01 AUTHORITY OF ENGINEER

It is understood and agreed by and between the parties hereto that the work included in the contract is to be done in accordance with the plans and specifications and to the satisfaction of the Engineer. The Engineer shall determine the unit quantities and the classification of all work done and materials furnished under the provisions of the contract.

The Engineer may appoint assistants and inspectors to inspect the materials used and the work performed.

Nothing contained in the contract shall be construed as requiring the Engineer to direct the method or manner of performing the work.

5-1.01A APPROVAL OF CONTRACTOR'S PLANS

The approval by the Engineer of any drawing or any method of work proposed by the Contractor shall not relieve the Contractor of any of his responsibility for any errors therein and shall not be regarded as any assumption of risk or liability by the Owner or any officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure or partial failure or inefficiency of any plan or method so approved. Such approval shall be considered to mean merely that the Engineer has no objection to the Contractor's using, upon his own full responsibility, the plans or method proposed.

5-1.01B SUGGESTIONS TO CONTRACTOR

Any plan or method of work suggested by the Engineer to the Contractor, but not specified or required, if adopted or followed by the Contractor in whole or in part, shall be used at the risk and responsibility of the Contractor; and the Engineer and the Owner shall assume no responsibility therefor.

5-1.02 AUTHORITY AND DUTIES OF INSPECTORS

The Engineer may appoint assistants to inspect all materials used and all work done. Such inspection may extend to any or all parts of the work and to the preparation or manufacture of the materials to be used. The assistants will not be authorized to revoke, alter, enlarge or relax the provisions of these specifications. An assistant is placed on the work to set the necessary lines and grades and to keep the Engineer informed as to the progress of the work and the manner in which it is being done; also to call the attention of the Contractor to any infringements upon plans, or specifications, but failure of the assistant or the Engineer to call the attention of the Contractor to faulty work or infringements upon the plans or specifications shall not constitute acceptance of said work.

An assistant will not be authorized to approve or accept any portion of the work or to issue instructions contrary to the plans and specifications. The assistant will have authority to reject defective material and to suspend any work that is being improperly done, subject to the final decision of the Engineer. The assistant will exercise such additional authority as may, from time to time, be especially delegated to him by the Engineer.

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Section 5—Control of Work

5-1.03 COOPERATION BY CONTRACTOR

A set of approved plans, specifications and any special provisions and authorized alterations will be supplied to the Contractor and these must be kept available on the job at all times. The Contractor shall be present either in person or by duly authorized representatives on the site of the work continually during its progress. The Contractor or his representative shall receive from the Engineer all explanations and directions necessary for the satisfactory prosecution and completion of the work. The Contractor shall not cause any unnecessary delay or hindrance to other Contractors on the work, but he shall cooperate with other Contractors to the fullest extent.

5-1.04 INTERFERENCE WITH OTHER CONTRACTORS

Bidders are required to inform themselves fully of the conditions relating to construction and labor under which the work will be or is now being performed, and the Contractor shall employ, as far as possible, such methods and means in the carrying out of his work as will not cause any interruption or interference with any other Contractor or agency.

If the performance of any contract for the project is likely to be interfered with by the simultaneous execution of some other contract or contracts, the Engineer shall decide which Contractor shall cease work temporarily and which Contractor shall continue, or whether the work under the Contractors can be co-ordinated so that the Contractors may proceed simultaneously. The Owner shall not be responsible for any damages suffered or extra costs incurred by the Contractor, resulting directly or indirectly from the award or performance or attempted performance of any other contract or contracts on the project, or caused by any decision or omission of the Engineer respecting the order of precedence in the performance of the contracts other than for an extension of time.

5-1.05 NOTIFICATIONS RELATIVE TO CONTRACTOR'S ACTIVITIES

The Engineer will initially notify the agencies concerned as to the time bids will be called, and the approximate time of starting work. The Engineer will also define what the project consists of and will point out particular problems. The Contractor shall be responsible for making detailed notifications as follows.

The Contractor performing work in street and alley rights of way and easements shall notify all of the affected agencies in regard to his operations so as to properly co-ordinate and expedite his work in such a manner as to cause the least amount of conflict and interference between his operations and those of other agencies.

Notification may be verbal and must be in such detail as to give the time of commencement and completion of work, names of streets or location of alleys to be closed, schedule of operations, routes of detours where possible, etc. Those agencies usually concerned with construction activities will be as indicated elsewhere in the specifications under special provisions.

Notification of commencement shall be made sufficiently ahead of time to provide for proper rerouting of traffic and the erection of signs. On larger projects requiring extended periods of time to complete, the Contractor shall make such additional notifications as the conditions may require.

5-1.06 PROTECTION OF LINE AND GRADE STAKES

The work shall be done in strict conformity with the plans and specifications and to the lines and grades as fixed by the Engineer, and be according to such instructions as may be given by the Engineer. The Contractor shall protect and preserve in their original position all stakes, points, or marks set for the work by the Engineer. If such stakes and markings are carelessly destroyed or defaced by the Contractor operations before their use is ended, the full cost of replacing them will be

at the Contractor's expense by deduction from any money due him.

The Contractor shall provide sufficient and safe facilities to enable the Engineer to set the control points for structure work such as bridges, piers, towers, and similar works where control points need to be set above ground level.

Any claim by the Contractor for extra compensation by reason of alterations or reconstruction work allegedly due to error in the Engineer's line and grade, will not be allowed unless the original control points set by the Engineer still exist, or unless other satisfactory substantiating evidence to prove the error is furnished the Engineer.

The Contractor shall keep the Engineer informed in advance as to when and where he intends to work, thus enabling the Engineer to set the engineering control points, lines and grades with a minimum of delay and interference. If the schedule of work be such as to handicap the setting of necessary engineering control, the Contractor shall suspend his operations at the particular place in sufficient time for the Engineer to complete his urgent work. Any additional expense to the Contractor arising from the temporary suspension of work shall be considered as incidental to the construction and be included in various bid items of the contract.

5-1.07 REMOVAL OF DEFECTIVE OR UNAUTHORIZED WORK

Defective work or material may be condemned by the Engineer any time before the final acceptance of the work. Notice of such condemnation shall be given in writing by the Engineer. Such condemned work shall be immediately removed or disposed of to the satisfaction of the Engineer. Failure or neglect on the part of the Engineer to condemn unsatisfactory material or reject inferior workmanship will in no way release the Contractor, nor shall it be construed to mean the acceptance of such work, nor shall the final acceptance bar the Owner from recovering damages in case fraud was practiced, or for defective work resulting from the Contractor's dishonesty. No compensation will be made for defective work or materials.

Work done contrary to or regardless of the instructions of the Engineer, work done without lines, grade and/or cross section stakes and grades shown on the plans or as given by the Engineer, or any deviation made from the plans and specifications without written authority will be considered unauthorized and at the expense of the Contractor, and will not be measured or paid for by the Owner. Any and all work so done may be ordered removed and replaced immediately at the Contractor's expense.

5-1.08 MOVING OF PUBLIC AND PRIVATE UTILITIES

Prior to awarding the contract, the Owner will notify all affected utilities to move such of their installations as would be within the confines of the finished improvement. This kind of work by the utilities will normally have been accomplished in most instances before the Contractor is working at points affected. Under some circumstances, however, the work of the utilities may have to be performed during the construction. It shall be the responsibility of the Contractor to co-ordinate his work with that of the utilities in such manner as to cause the least possible interference, and as may be further provided in the special provisions.

It is provided that no utility, private or public, shall be moved to accommodate the Contractor's equipment or his method of operation when such utility does not interfere with the improvement under construction unless the costs of such removal shall be at the expense of the Contractor.

5-1.09 PROTECTION OF PUBLIC AND PRIVATE UTILITIES

The Contractor shall support and protect by timbers or otherwise, all pipes, conduits, poles, wires or other

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apparatus which may be in any way affected by the work, and do everything to support, sustain and protect the same, under, over, along or across said work. In case any of said pipes, conduits, poles, wires, or apparatus should be damaged they shall be repaired by the authorities having control of same, and the expense of such repairs shall be charged to the Contractor.

The Contractor shall further be responsible for any damage done to any street or other public property, or to any private property by reason of the breaking of any water pipe, sewer or gas pipe, electric conduit, or other utility by or through his negligence.

Specific requirements in other sections of these specifications or special provisions shall prevail over the foregoing requirements in case of conflict.

5-1.10 DAMAGE TO EXISTING IMPROVEMENTS AND UTILITIES

The Contractor's work shall be confined to the Owner's premises, including easements and construction permit limits, whenever possible. He shall not enter upon or place materials on other private premises except by written consent of the individual owners, and he shall save the Owner harmless from all suits and actions of every kind and description that might result from his use of private property.

Underground utilities of record, except services will be shown on the construction plans insofar as it is possible to do so. These, however, are shown for convenience only and the Owner assumes no responsibility for improper locations or failure to show utility locations on the construction plans.

The Contractor shall take adequate precautions to protect existing lawns, trees and shrubs outside rights of way, sidewalk, curbs, pavements, utilities, adjoining property, and structures, and to avoid damage thereto. He shall at his own expense completely repair any damage thereto caused by his operations to the satisfaction of the Engineer, except as otherwise provided in other sections of these specifications.

5-1.11 INSPECTION BY ENGINEER

All materials furnished by the Contractor shall be subject to the inspection and approval of the Engineer at any time during the progress of the work and until final completion thereof. The materials shall be delivered by the Contractor sufficiently in advance of the work to enable the Engineer to make the proper tests and inspections. As soon as materials have been tested and inspected, the Contractor shall immediately remove all rejected materials from the work to such place distant therefrom as the Engineer may require, and shall arrange for replacement of rejected materials and things at his own expense. The neglect or failure on the part of the Engineer to condemn or reject inferior materials or work shall not be construed as an acceptance of the materials or work.

The Contractor shall furnish, at his own expense, such labor and facilities as may be required to enable the Engineer to make a thorough inspection and culling of the materials.

In lieu of inspection, the Owner may require certified statements from the producer as to quality.

5-1.12 MAINTENANCE OF WORK AFTER ACCEPTANCE

The work occasionally involves such items as buildings, machinery or other mechanical equipment and/or the setting of same, or may otherwise be of such a nature that it is desirable to have the Contractor maintain or guarantee the work for a period of time after final acceptance by the Engineer. (Sections 1-9.06 and 1-9.07.)

When such maintenance or guarantees are desired by the Owner and are not specifically provided for in these specifications, the requirements and terms shall be defined in the special provisions. Such maintenance or guarantees shall not affect the manufacturer's warranties.

The Contractor shall be responsible for the entire improvement and maintain it until it has been accepted

by the Owner. The Owner reserves the right to utilize any portion of the improvement prior to final acceptance and in such event the Owner will assume responsibility for its use in case of damage.

When maintenance or guarantees are desired by the Owner and are not specifically provided for in these specifications, the requirements and terms shall be defined in the special provisions. Such maintenance or guarantees shall not affect the manufacturer's warranties. (See Section 9-1.06.)

5-1.13 WATER AND POWER

In instances, other than those specifically mentioned in the specifications or special provisions, the Contractor shall make all necessary arrangements for power and water. All costs thereof shall be borne by the Contractor.

5-1.14 METHOD OF SERVING NOTICE

Any written notice to the Contractor which may be requisite under these specifications may be served on him, either personally, by mailing, or by leaving at his last postoffice address known to the Owner.

5-1.15 VERBAL AGREEMENTS

No verbal agreement or conversation with any officer, agent, or employee of the Owner, either before or after execution of the contract, shall affect or modify any of the terms or obligations contained in any of the documents comprising the contract. Any such verbal contract shall be considered as unofficial information and in no way binding upon the Owner.

5-1.16 FINAL INSPECTION

The Engineer will not make the final inspection until the work required by the contract, including final cleanup and all extra work ordered by the Engineer, has been completed.

In order that the Engineer may determine whether the Contractor has complied with those requirements of this contract compliance with which is not readily ascertainable through inspection and tests of the work and materials, the Contractor shall, at any time requested, submit to the Engineer properly authenticated documents or other satisfactory proofs as to his compliance with such requirements.

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6-1.01 SOURCE OF SUPPLY AND QUALITY OF MATERIALS

Promptly after the approval of the award, the Contractor shall notify the Engineer of the proposed sources of supply of all materials to be furnished by him. At the option of the Engineer the source of supply of each of the materials shall be approved by the Engineer before the delivery is started. Representative preliminary samples of the character and quality prescribed shall be submitted by the Contractor or producer for examination and tests by the Engineer. Only materials conforming to the requirements of these specifications and approved by the Engineer shall be used in the work. Any of the materials proposed to be used may be inspected or tested at any time during their preparation and use. If, after trial, it is found that sources of supply which have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the Contractor shall furnish approved material from other approved sources. No material which, after approval, has in any way become unfit for use shall be used in the work.

6-1.02 SAMPLES AND TESTS

All tests of materials furnished by the Contractor shall be made by the Engineer in accordance with com-

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monly recognized standards of national organizations, and such special methods and tests as are in use at the laboratory of the Department of Highways or as set forth in the special provisions.

Field tests of materials will also be made by the Engineer when deemed necessary and these tests shall be made in accordance with standard practices of the Department of Highways.

The Contractor shall furnish without charge such samples of all materials as may be requested by the Engineer. Materials shall not be used until they have been approved by the Engineer. Samples will be secured and tested whenever necessary to determine the quality of the material.

Materials shall be delivered on the work in advance, in such quantities as to afford the Engineer an opportunity to make tests before the materials are to be used.

The following shall apply in the use of specifications and methods of tests of the organizations named below:

ASTM—American Society for Testing Materials. The ASTM designation number refers to the latest adopted standard or tentative standard of this society. The standard or tentative standard in effect at the time of call for bids shall apply in each case. Revisions shall be considered as becoming effective on the first day of December in the year in which they are adopted.

USASI—United States of America Standards Institute. Specifications may be obtained from United States of America Standards Institute, 10 East 40th Street, New York 16, N.Y.

AASHO—American Association of State Highway Officials. The specifications or test method shown by number refers to the "Standard Specifications for Highway Materials and Methods of Sampling and Testing," currently published by the association, or to such revisions as may have been subsequently adopted by the association or to the "Interim Specifications and Methods adopted by the AASHO Committee on Materials." Revisions and Interim Standards in effect at the time of award of the Contract shall apply. Revisions shall be considered as becoming effective 60 days after announcement of adoption is published in the "Annual Reports of the Permanent Committees" of the Association. Interim Standards shall be considered as becoming effective on the first day of December of the year indicated in the Specification or test method designation number.

AWWA—American Water Works Association. The effective date of the AWWA specifications is on the first day of the second month after publication in the American Water Works Journal. The AWWA specifications and revisions thus in effect at the time of the call for bids shall apply whenever referenced in these specifications. Copies of AWWA specifications may be obtained from American Water Works Association, Inc., 2 Park Avenue, New York 16, N.Y.

Federal Specifications—U. S. Government Federal Stock Catalogue. The specification number refers to the latest revised specifications adopted by the Federal Specifications Board. Revisions in effect at the time of call for bids shall apply. Revisions shall be considered as becoming effective sixty days after adoption by the Board. Copies of Federal Specifications may be obtained from the Business Service Center, Room 101, Federal Office Building, Seattle 4, Washington.

PUBLICATIONS

Copies of any separate ASTM specifications or method of test may be obtained from the American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. 19103.

Copies of "Standard Specifications for Highway Materials and Methods of Sampling and Testing" may be obtained from the American Association of State Highway Officials, 917 National Press Building, Washington, D. C.

Copies of standard grading and dressing rules may be obtained from the West Coast Lumber Inspection Bureau, Seattle, Washington, or Portland, Oregon, and from the Western Pine Association, Portland, Oregon.

6-1.03 SPECIAL METHODS OF TEST

The methods of tests which follow shall apply when so designated elsewhere in these specifications or in the special provisions. Details of test methods are available from the Materials Laboratory of the Department of Highways, Olympia, Washington.

1. **Stabilometer Resistance Value and Swell Pressure Test:** The resistance value (R-value) is measured by the stabilometer test which is a form of triaxial test. The test is performed on untreated or treated soils or aggregates for use as subgrades, subbases, or bases. The test result is reported as an R-value on a scale from 0 to 100 which is a numerical index of the ability of the material to resist plastic deformation under vehicle loads.
2. **Test for Moisture Retaining Effectiveness of Concrete Curing Compounds:** This test measures the ability of concrete curing compounds to prevent loss of water from a fresh concrete mixture made under definite specified conditions.
3. **Modified Immersion-Compression Test:** The modified immersion-compression test measures the degree to which a compacted bituminous specimen resists the action of water. The test is performed by soaking a compacted briquette 4 inches in diameter and 2½ inches high in water at 140° F., for 24 hours. The ratio of the stabilometer value of the soaked specimen to the stabilometer value of a companion specimen that has not been soaked is the measure of the resistance of the material to water action.
4. **Mortar Strength Test:** The mortar strength test is a procedure to determine the strength developed by mortar using a given concrete sand in relation to that developed by mortar using Ottawa sand. The test indirectly measures the concrete making properties of the sand under test.
5. **Sand Equivalent Test:** The sand equivalent test indicates the proportion of detrimental fine dust or clay-like materials in soils or fine aggregates.
6. **Test for Effectiveness of Concrete Waterproofing Materials:** The test for effectiveness of concrete waterproofing materials measures the ability of those materials to prevent moisture absorption by concrete specimens under standardized test conditions.
7. **Stabilometer Test (Asphalt Concrete Mixtures):** The stabilometer test is a form of triaxial test employing compacted test specimens of asphalt concrete mixtures having a height-diameter ratio of approximately 0.6. The results are reported as stabilometer values in units on a scale ranging from 0 to 100, indicating the relative ability of the pavement to resist distortion under the action of traffic.
8. **Cohesimeter Test (Asphalt Concrete Mixtures):** The cohesimeter test is a measure of the cohesive resistance or tensile strength of a compacted asphalt concrete mixture.
9. **Thin Film Oven Test:** The thin film oven test is a method of determining the amount which an asphalt changes when subjected to prolonged, elevated temperature.
10. **Penetration Ratio:** The penetration ratio is the ratio of the penetration at 39.2° F. to that at 77° F., and is a means of determining the effect of low temperatures on the characteristics of the asphalt.

6-1.04 STORAGE OF MATERIALS

All materials intended for use in the work shall be stored by the Contractor by means that will prevent damage from exposure to the elements, from admixture of foreign material, or from any other cause. The Engineer will refuse to accept, or to sample for testing, any materials that are improperly stored.

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6-1.05 DEFECTIVE MATERIALS

All materials not conforming to the requirements of these specifications will be rejected by the Engineer, and all such materials whether in place or not, shall be immediately removed from the site of the work by the Contractor.

6-1.06 SIEVES FOR TESTING PURPOSES

Sieves for testing purposes shall be woven wire cloth sieves or square hole perforated plates conforming to the requirements of AASHO Designation M92 or ASTM Designation E11.

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7-1.01 LAWS AND REGULATIONS

The Contractor shall observe and comply with all federal and state laws and with the county, city and municipal resolutions, ordinances and regulations that will in any way affect the work; and he shall indemnify and save harmless the Owner against any claims arising from the violation of any such laws, resolutions, ordinances or regulations.

7-1.02 CONTRACT BOND, PERFORMANCE BOND

The contract bond or performance bond furnished by the Contractor, as provided in Section 3-1.04, shall be payable to the Owner in the full and just sum of the total amount of the contract, conditioned that all the provisions of the contract shall be faithfully performed by the Contractor, or the surety if so required, and shall indemnify the Owner against any direct or indirect damages that shall be suffered or claimed, for injuries to persons or property, during the carrying out of the work of the contract, and further conditioned as required by law for the payment of all laborers, mechanics, subcontractors and material men, and all persons who shall supply such person or persons or subcontractors with provisions or supplies for the carrying on of such work. If the Engineer shall have reason to believe that the security on said bond has become impaired since the execution thereof, or is insufficient, he may require the Contractor to furnish other or additional security.

7-1.03 ACCIDENT PREVENTION

Precaution shall be exercised at all times by the Contractor for the protection of persons, employees and property. The safety provisions of applicable laws and local building and construction codes shall be observed. The operations of the Contractor for the protection of persons, and for guarding against hazards of machinery and equipment, shall meet the requirements of state law and all safety regulations as set out in "Safety Standards for Construction" and "General Safety Standards," published and in effect at the time of call for bids. These publications may be obtained from the Department of Labor and Industries, Olympia, Washington.

The requirements of the Washington Industrial Safety and Health Act of 1973 (WISHA) shall apply to all excavation, trenching and ditching operations.

7-1.04 PROTECTION OF WORKMEN AND PROPERTY

The Contractor shall erect and maintain good and sufficient guards, barricades, and signals at all unsafe places at or near the work, and shall in all cases maintain safe passageways at all road crossings, crosswalks, street intersections, and shall do all other things necessary to prevent accident or loss of any kind.

When work is being performed below the standards established in the State Safety Code, or when the Engineer believes the condition endangers the safety of the

general public and employees of the project, the Engineer may immediately issue a written stop-work order describing the substandard work and deliver same to the Contractor. The Contractor shall cease work and not resume work on the estopped portion of the project until acceptable remedial action has been taken. Such protective measures shall not be construed as releasing the Contractor of any obligation or liability arising under the contract.

7-1.05 LABOR

The Contractor shall at all times employ workmen who are skilled in their respective lines. The Contractor is restricted in his selection of labor and payment therefor by certain legal requirements which must be observed for compliance with the public policy enunciated in RCW 49.28. This refers to the eight hour day, payment for overtime, cancellation of contract for violations, and penalties for violations of provisions therein. The Contractor should be thoroughly familiar with all provisions of this and other statutes that are subsequently noted herein before commencing work on his contract.

7-1.05A EQUAL EMPLOYMENT OPPORTUNITY RESPONSIBILITIES

Contractor shall comply with all state laws and regulations which are in effect pertaining to nondiscrimination, and in addition shall comply with the provisions of local ordinance(s), the general provisions of which are contained in the special provisions.

7-1.06 SELECTION OF LABOR (Chapter 246, Laws of 1943, RCW Chapter 39.16)

In all contracts awarded by the Owner for the erection, construction, alteration, demolition or repair of any public building, structure, bridge, highway, or any other kind of public work or improvement, the Contractor, subcontractor, or person in charge thereof, shall employ ninety-five (95) percent or more bona fide Washington residents as employees where more than fifty (50) persons are employed, and ninety (90) percent or more where fifty (50) or less are employed. The term "resident" as used in this act shall mean any person who has been a bona fide resident of the State of Washington for a period of ninety (90) days prior to such employment; *Provided*, That in contracts involving the expenditure of Federal-aid funds this act shall not be enforced in such a manner as to conflict with or be contrary to the Federal statutes, rules and regulations prescribing a labor preference to honorably discharged soldiers, sailors and marines, or prohibiting as unlawful any other preference or discrimination among the citizens of the United States.

In the event that a sufficient number of Washington residents shall not be available, the Contractor or subcontractor shall immediately notify the Owner and shall state the number of non-residents needed. The Engineer shall immediately investigate the facts and report to the Owner, and if the conditions are as stated the Owner may by written order designate the number of non-residents and the period for which they may be employed; *Provided*, That should residents become available within the period such residents shall be immediately employed and the period shortened consistent with the supply of resident labor.

The provisions of this act shall be written into every such public contract including the following penalty: Any Contractor or subcontractor who shall employ a nonresident in excess of the percentage preferences, excepting as herein permitted, shall have deducted from the amount due him for every violation, the prevailing wages which should have been paid to a displaced resident. The money so deducted shall be retained by the public body for whom the contract is being performed.

Any person, firm or corporation violating any of the provisions of this act shall be guilty of a misdemeanor.

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7-1.07 LEGAL WAGES ON PUBLIC WORKS

Under the provisions of RCW 39.12, as amended by the 1965 Legislature in extraordinary session, the hourly wages paid to laborers, workmen, or mechanics upon all public works of this State and upon work contemplated in this contract, shall be not less than the prevailing rate of wage for an hour's work in the same trade or occupation in the locality within the State where such labor and work herein contemplated is to be performed.

All laborers, workmen or mechanics shall be paid not less than the minimum hourly rate of wage hereinafter specified, *Provided, however*, That nothing herein contained shall be construed to prohibit the Contractor, subcontractor or other person doing or contracting to do the whole or any part of the work under this contract, from paying any such laborers, workmen or mechanics wages in excess of the hourly minimum rate above specified.

The "prevailing rate of wage," for the purposes of the contract, shall be the rate of hourly wage, usual benefits and overtime paid in this locality, as hereinafter defined, to the majority of workmen, laborers or mechanics, in the same trade or occupation. In the event that there is not a majority in the same trade or occupation paid at the same rate, then the average rate of hourly wage and overtime paid to such laborers, workmen, or mechanics in the same trade or occupation shall be the prevailing rate.

The usual benefits for the purpose of these specifications shall include the amount of:

(a) The rate of contribution irrevocably made by a Contractor or subcontractor to a trustee or to a third person pursuant to a fund, plan, or program, and

(b) The rate of costs to a Contractor or subcontractor which may be reasonably anticipated in providing benefits to laborers, workmen, or mechanics pursuant to an enforceable commitment to carry out a plan or program which was communicated in writing to laborers, workmen or mechanics affected for medical, pensions, workmen's compensation insurance to cover the above, vacation and holiday pay, for defrayment of costs of apprenticeship, or other bona fide fringe benefits, *but only* where the Contractor or subcontractor is not required by other Federal, State or local law to so provide.

All determinations of the prevailing rate of wage shall be made by the industrial statistician of the Department of Labor and Industries.

The specifications for every contract for the construction, reconstruction, maintenance, or repair of any public work to which the State or any of its political subdivisions created by its laws is a party, shall contain a provision stating the hourly minimum rate of wage, not less than the prevailing wage, which may be paid to laborers, workmen, or mechanics in each trade or occupation required for such public work, employed in the performance of the contract either by the Contractor, subcontractor or other person doing, or contracting to do the whole or any part of the work contemplated by the contract; and the contract shall contain a stipulation that such laborers, workmen, or mechanics shall be paid not less than such specified hourly minimum rate of wage.

Before payment is made by or on behalf of the Owner of any sum or sums due on account of a contract for a public works improvement under these specifications, a certified statement of hourly wage paid shall be filed with the Owner's fiscal officer and with the Director of the Department of Labor and Industries by the Contractor and each subcontractor, and, further provided, that before any payment is made by or on behalf of the Owner, the Director of the Department of Labor and Industries shall issue a statement certifying that the prevailing wage requirements of this section have been satisfied.

The certified statement of hourly wage paid shall be in the following form:

State of Washington, }
County of _____ } ss.

I, the undersigned, having been duly sworn, depose, say and certify that in connection with the

performance of the work, payment for which this voucher is submitted, I have paid the following rate per hour for each classification of laborers, workmen, or mechanics, as indicated upon the attached list, now referred to and by such reference incorporated in and made an integral part hereof, for all such employed in the performance of such work; and no laborer, workman or mechanic so employed upon such work has been paid less than the prevailing rate of wage or less than the minimum rate of wages as specified in the principal contract; that I have read the above and foregoing statement and certificate, known the contents thereof and the substance as set forth therein is true to my knowledge and belief.

Attention is called to RCW 39.12.050, which reads as follows:

"Any Contractor or subcontractor who shall, upon his oath, verify any statement required to be filed under this act which is known by him to be false, or is made without knowledge in reckless disregard of the truth, shall be guilty of perjury in second degree and shall be punished as provided in RCW 9.72.030."

In case any dispute arises as to what are the prevailing rates of wages for work of a similar nature to that contemplated under the contract and such dispute cannot be adjusted by the parties involved, the matter shall be referred for arbitration to the Director of the Department of Labor and Industries of the State of Washington, and his decision therein shall be final, conclusive, and binding on all parties involved in the dispute.

The hourly minimum rate of wage, not less than the prevailing rate of wage, which may be paid to laborers, workmen or mechanics in each trade or occupation required in the performance of this contract, either by the Contractor, subcontractor or person doing or contracting to do the whole or any part of the work contemplated by this contract, is shown in the special provisions.

The Owner does not guarantee that labor can be procured for the minimum wages set forth. The rates of wages listed are minimum only, below which the Contractor cannot pay and they do not constitute a representation that labor can be procured for the minimum listed. It will be the responsibility of the Contractor to ascertain for himself the wages above the minimum set forth he may have to pay.

7-1.08 FAILURE TO PAY FOR LABOR AND MATERIALS

If, at any time the Contractor fails to pay the subcontractor or the laborers employed upon the work, or fails to pay for the materials used therein, the Owner may withhold from the money which may be due the Contractor under this agreement such amount or amounts as may be necessary for the payment of such subcontractors, laborers, or materials, and may, acting as agent for the Contractor, deduct such amount or amounts from the final estimate and reserve the same, plus an amount sufficient to pay such claims, costs of action and attorney fees, for final disposition as provided by law. This provision is intended to protect the subcontractors and laborers employed upon the work and the parties who may be furnishing the materials to be used herein.

7-1.09 STATE SALES TAX

Pursuant to the existing laws of the State of Washington and rulings of the Tax Commission, certain activities relating to the building, repairing, or improving of public streets are not subject to a retail sales tax. Most other construction activities are deemed to be retail sales and hence subject to the sales tax.

The Owner will claim any exemption from the retail sales tax authorized by law, and the Contractor should determine which activities are subject to tax in order to properly evaluate the work. The Owner will furnish such information as it has available regarding the application of sales tax, but in no event shall the furnishing of such information constitute a representation or warranty and the Contractor shall be responsible for the correct in-

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terpretation of any laws or regulations relating to the application of the State sales tax.

7-1.10 PERMITS AND LICENSES

The Contractor shall procure all necessary permits, pay for the same, and obtain all official licenses for the construction of the work and for temporary obstructions, inclosures, opening of streets for pipes, walls, etc., arising from the construction and completion of the work described in the specifications. He shall be responsible for all violations of the law for any cause in connection with the construction of the work, or caused by obstruction of the work, or caused by obstructing streets, sidewalks, etc., and he shall give all requisite notice to public authorities. A copy of each permit or license will be furnished the Owner.

7-1.11 ROYALTIES AND PATENTS

The Contractor shall be liable for all suits brought against the Owner by reason of infringement of patent rights on any material, machine or appliance that he may use on the work or incorporate in the finished job, except where specifically exempted by the special provisions. Unit prices named in the proposal shall include payment of royalties, if any.

7-1.12 USE OF PREMISES

The Contractor shall confine his equipment, storage of materials and operation of work to the limits indicated by law, ordinances, permits or direction of the Engineer, and shall not unreasonably encumber the premises with his materials. The Contractor shall comply with the Engineer's instructions regarding signs, advertisements, fires, and smoking.

7-1.13 CONFINE OPERATIONS WITHIN RIGHTS OF WAY AND EASEMENTS

Property lines, limits of easements, and limits of construction permits are indicated on the plans and it shall be the Contractor's responsibility to confine his construction activities within these limits, unless he makes arrangements for use of private property. Before using any private property adjoining the work, the Contractor shall file with the Engineer a written permission of the property owner, and upon vacating the premises the Contractor shall furnish the Engineer with a release from all damages, properly executed by the property owner.

7-1.14 SAFEGUARDS

The Contractor shall provide and maintain on a 24-hour basis all necessary safeguards such as watchmen, warning signs, barricades, and night lights at his own expense. Special care shall be exercised to prevent vehicles, pedestrians, and livestock from falling into open trenches or being otherwise harmed as a result of the work. The Contractor shall, in all cases, hold the Owner harmless for any and all damages resulting from any of his operations.

Any emergency safeguard or action which must be undertaken by the Owner for safety of the public shall be regarded as a legitimate charge against the Contractor.

7-1.15 MAINTENANCE OF TRAFFIC

7-1.15A DIVISION OF RESPONSIBILITY

The Contractor shall be responsible for maintenance, control, and the safeguarding of traffic within and immediately abutting the project as further outlined herein, and as may otherwise be provided in the special provisions. The Owner will be responsible for maintenance, control, and safeguarding of traffic on all detours which do not lie within the project limits, unless otherwise required in the special provisions.

7-1.15B STREET CLOSURES OR PARTIAL CLOSURES

Streets may be closed to through traffic unless otherwise provided for in the special provisions. Streets shall not be closed to traffic until such closure has been approved by the Engineer or an authorized traffic officer. Street closures shall be made in such a manner as to provide for maximum public safety and public convenience. They shall be opened to through traffic at such time as the work has been completed, or as the Engineer may direct.

7-1.15C NOTIFICATIONS

Notifications for street closers shall be made in accordance with Section 5-1.05.

7-1.15D EXISTING TRAFFIC SIGNS AND FACILITIES

The Owner will make all necessary adjustments to traffic signals and traffic signal activators at no cost to the Contractor. Existing traffic and street name signs which will interfere with construction shall be removed by the Contractor and stored in a safe place. These signs shall not be removed until the Engineer has so directed and until the necessary measures have been taken to safeguard traffic after the signs have been removed. Preservation and maintenance of the signs shall be the sole responsibility of the Contractor. Upon completion of the project, the Owner will reset all such signs in their permanent location at no cost to the Contractor.

7-1.15E DETOURS

Detours outside the limits of the project shall be the sole responsibility of the Owner unless otherwise provided in the special provisions. Detours within the limits of the project such as side street crossings, temporary bridges over freshly placed concrete, utilization of one or more lanes of the construction area for maintenance of traffic, and such related facilities for the maintenance of traffic shall be the responsibility of the Contractor, the costs for which shall be included in the unit contract prices unless otherwise provided in the special provisions.

7-1.15F LOCAL AND EMERGENCY TRAFFIC

Local traffic shall be provided access to private properties at all times, except during some urgent stages of construction when it is impracticable to carry on the construction and maintain traffic simultaneously, such as for the placing of asphalt concrete pavement, placing and curing of portland cement concrete pavement, and deep sewer excavations which prohibit safe travel of vehicular traffic.

No private driveway may be closed without the approval of the Engineer unless written permission has been given the Contractor by the owner of the property affected.

Emergency traffic such as police, fire, and disaster units shall be provided reasonable access at all times. The Contractor shall be liable for any damages which may result from his failure to provide such reasonable access.

7-1.15G PROTECTION OF PEDESTRIAN AND VEHICULAR TRAFFIC

The Contractor shall take every precaution to protect pedestrian and vehicular traffic. Wherever, in the opinion of the Engineer, the Contractor has not provided sufficient or proper safety precautions and safeguards, he shall do so immediately and to whatever extent the Engineer deems advisable.

The posting of flagmen, advance warning signs, barricades, traffic cones, flashers, etc., shall be in accordance with the current edition of Part V of the "Manual on Uniform Traffic Control Devices for Streets and Highways" prepared by the National Joint Committee on Uniform Traffic Control Devices.

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7-1.15H RESTRICTION OF PARKING

Where parking is a hazard to through traffic or to the construction work, it shall be restricted either entirely or during the time when it creates a hazard. Signs for this purpose will be initially furnished and placed by the Owner. The Contractor shall be responsible for and shall maintain the signs if they are used on any street which is directly involved in the construction work. If the parking signs are to be used beyond the confines of the work area such as another street being used as a detour, the signs will be the responsibility of the Owner.

7-1.15I FLAGMEN

The Contractor shall furnish at his own expense all flagmen who may be needed unless otherwise provided in the special provisions.

7-1.15J DUST CONTROL

It shall be the Contractor's responsibility to control dust by watering as directed by the Engineer. The volume of water used shall be paid for by the Owner at unit price set forth in the proposal.

7-1.16 TRAFFIC CONTROL WITHIN AND ABUTTING THE PROJECT

The Contractor shall place and maintain all signs, barricades and warning lights within the limits of the project on all streets, alleys and driveways entering the project so that approaching traffic will turn right or left on existing undisturbed streets before reaching the warning signs and barriers immediately abutting the project. Signs which are required will, unless otherwise provided in the special provisions, be furnished by the Owner as provided in Section 7-1.17.

Barricades shall be furnished by the Contractor. The barricades shall be of a conventional design normally used in street construction work and painted a current traffic yellow with black stripes.

Unless otherwise provided in the special provisions, the Owner will assume responsibility for signs and traffic control devices beyond the limits hereinbefore described.

7-1.17 TRAFFIC CONTROL SIGNS

Standard traffic control signs required for construction will be furnished to the Contractor at no charge. He shall maintain them in a neat condition until the need for them has ceased, after which he shall carefully remove the signs and return them to the Engineer in good condition. All signs lost or destroyed shall be replaced in kind by the Contractor or else a deduction will be made on estimates due him to cover the value of signs not returned in acceptable condition.

All costs incurred by the Contractor in placing and maintaining the signs shall be considered as incidental to the cost of the construction and be included in the unit contract prices of the work.

7-1.18 PROCEDURE FOR PROCURING SIGNS

The Contractor shall call the Engineer for those signs the Owner is to furnish. Except in an emergency, the call shall not be less than eighteen (18) hours before signs are required. Where special signs are involved, the notification shall be not less than one (1) week before delivery.

The Contractor shall pick up the signs at the point designated by the Engineer and return them at such time as they are no longer needed on the particular project. At the time the Contractor picks up the signs, he or his representative shall sign an itemized receipt showing the number and types of signs delivered to him. Any signs not returned, or which have been damaged, will be charged against the Contractor at a rate to be determined by the Engineer, and the cost thereof shall be deducted from the pre-final estimate.

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7-1.19 MAINTAINING POSTAL SERVICE

Postal service shall be maintained in accordance with the instructions of the U.S. Post Office Department. The Contractor shall be responsible for moving mail boxes to temporary locations designated by the Post Office Department, and at completion of the work he shall replace them in location and in condition satisfactory to the Post Office Department.

It will be the Contractor's responsibility to contact the U.S. Post Office Department for their requirements in maintenance of postal service and to follow the requirements.

In cases where the posts upon which the box or boxes are fastened are in such condition that they cannot be reset, the Contractor shall furnish posts for this purpose at his own expense unless payment therefor is otherwise provided in the proposal or special provisions.

All cost incurred in work outlined above shall be considered as incidental to the construction of the contract unless otherwise provided in the proposal or special provisions.

7-1.20 USE OF EXPLOSIVES

Blasting will not be permitted in any case without specific authority of the Owner, and then only under such restrictions as may be required by the proper authorities. Explosives shall be handled and used in strict compliance with "Safety Standards for Construction," by the Department of Labor and Industries, Olympia.

When the use of explosives is necessary for the prosecution of the work, the Contractor shall have a special clause in his insurance permitting the blasting. He shall use the utmost care so as not to endanger life or property, cause slides or disturb the materials outside the neat lines of the cross section.

Blasting shall be completed in the vicinity of new structures before construction on such structures is undertaken. All explosives shall be stored in a secure manner and place in compliance with local laws and ordinances and all such storage places shall be clearly marked "Dangerous—Explosives". No explosive shall be left in an unprotected manner along or adjacent to any existing highway or public place.

7-1.21 RAILROAD CROSSINGS

Wherever a project is being constructed beneath, at grade or above railroad tracks, the permits for the construction will have previously been secured by the Owner. It shall be the Contractor's responsibility to conform to the terms and provisions of the permits as may be described in the special provisions.

The Contractor shall hold the Owner harmless from any and all damages resulting from the Contractor's construction operations at such railroad crossings.

7-1.22 SANITARY PROVISIONS

The Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as may be necessary to comply with the requirements and regulations of the State Department of Health and of other bodies or officers having jurisdiction thereover. He shall permit no public nuisance.

7-1.23 USE AND OCCUPANCY PRIOR TO COMPLETION OF CONTRACT

The Owner reserves the right to use and occupy any portion of this improvement which has been sufficiently completed, but such use and occupancy shall not be construed as an acceptance of any portion of the work, and any claims which the Owner may have against the Contractor shall not be deemed to have been waived by such occupancy.

Section 8—Prosecution and Progress

7-1.24 PERSONAL LIABILITY OF PUBLIC OFFICIALS

Neither the Engineer nor any of his assistants, nor any other officer of the Owner shall be personally responsible for any liability arising under or growing out of the contract.

7-1.25 NO WAIVER OF LEGAL RIGHTS

Should an error be discovered in or payment of unauthorized work be made by the final estimate or should dishonesty on the part of the Contractor be discovered in the work, the Owner reserves the right, after the final payment has been made, to claim and recover by process of law such sums as may be sufficient to correct the error, to recover the overpayment, or to make good the defects in the work resulting from the Contractor's dishonesty.

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8-1.01 CONSTRUCTION SCHEDULE

After being awarded the contract and having been duly notified of the same, the Contractor, if requested by the Engineer, shall immediately prepare and submit to the Engineer for approval a progress schedule which will insure the completion of the project within the time specified. Adequate equipment and forces shall be made available by the Contractor to start work immediately upon order of the Engineer and to carry out the schedule to completion of the contract within the time specified.

8-1.02 NOTICE TO PROCEED AND PROSECUTION OF THE WORK

Written notice to proceed shall be given after the contract has been executed and the performance bond and all required insurances have been filed with and approved by the Owner. The Contractor shall not commence work under the contract until such written notice has been given by the Engineer.

The Contractor shall begin work as specified in Section 8-1.05, and shall prosecute the work vigorously and continuously to completion except when it is physically impossible to do so on account of weather conditions or other unavoidable handicaps.

The necessity of discontinuing and resuming work on any portion of the contract shall be determined by the Engineer.

8-1.03 SUSPENSION OF WORK

When, in the judgment of the Engineer, unfavorable weather makes it impractical to secure first class results, or other conditions warrant the granting of a suspense order, he shall issue to the Contractor a written order to suspend work wholly or on any part of the contract. When conditions are again favorable for prosecution of the work the Engineer shall issue to the Contractor a written order to resume the suspended work. Orders to suspend work will not be written for intermittent shutdowns due to weather conditions unless the suspension of work is to be for an extended period of time. The Contractor shall take every precaution to prevent any damage or unreasonable deterioration of the work during the time it is closed down.

Suspension of the work by the Engineer shall not furnish any grounds for claims by the Contractor for damages or extra compensation, but the period of such suspensions shall be taken into consideration in determining the revised date for completion as hereinafter provided. The Contractor shall not suspend work under the contract without the written order of the Engineer as stated in the preceding paragraph. The Contractor will be required to work a sufficient number of hours per day in order to complete the project within the work days specified. The question as to the necessity of discontinuing any portion of the work by reason of unfavorable weather conditions shall be determined by the Engineer.

Suspension orders will not be issued for the unavoidable delays mentioned in Section 8-1.07.

Upon failure of the Contractor to carry out the orders of the Engineer or to perform work under the contract in accordance with its provisions, the Engineer may suspend the work for such period as he may deem necessary. Time lost by reason of such failure or in replacing improper work or material shall not furnish any grounds to the Contractor for claiming an extension of time or extra compensation, and shall not release the Contractor from damages or liability from failure to complete the work within the time prescribed.

8-1.04 SUSPENSION OF WORK FOR AN EXTENDED PERIOD

In the event that a suspension of work is ordered in writing by the Engineer for an extended period of time due to unsuitable weather, which work in the opinion of the Engineer could have been performed prior to the occurrence of unsuitable weather conditions had the Contractor diligently prosecuted the work when conditions were suitable, the Contractor, at his own expense, shall do all work necessary to provide a safe, smooth and unobstructed roadway through the construction area for use by public traffic, and particularly for access to abutting property, during the period of suspension, or as provided in the special provisions. If the Contractor fails to do the work as above specified, the Owner will perform such work and deduct the cost thereof from any moneys due or to become due the Contractor.

In the event that a suspension of work for an extended period of time is ordered in writing by the Engineer due to unsuitable weather or unforeseen conditions and, in the opinion of the Engineer the Contractor has prosecuted the work with energy and diligence prior to the time of suspension of operations and has so constructed the temporary roadway or detour that it may be maintained by routine maintenance forces of the Owner during the period of suspension, the cost of maintaining a smooth and unobstructed roadway will be borne by the Owner at no cost to the Contractor.

In the event that a suspension of work for an extended period of time is ordered in writing by the Engineer on oiling or resurfacing projects, which do not require disturbing the existing traveled surface and on which the existing surface or shoulders have not been disturbed by the Contractor, the owner will maintain the roadway at no cost to the Contractor during the period of suspension.

If a suspension of work for an extended period, under which the Owner assumes the responsibility of maintenance, is granted in writing by the Engineer, the Owner will assume no responsibility except for routine maintenance which shall include and be restricted to the following:

- Maintenance of the traveled roadway and/or detour surface.
- Maintenance of roadway surface drainage along the roadway and/or detour.

Any areas which are closed to traffic shall be maintained and safeguarded by the Contractor at his own expense.

In the event that the Owner has assumed maintenance of a project during a period of suspension, the Contractor agrees to accept the roadway or detour as it has been maintained by the Owner and no claim for extra payment shall be made on account of its condition or the manner in which the maintenance has been performed by the Owner. Such suspensions of work shall not relieve the Contractor of his responsibility of restoring the roadway and its slopes to the designated roadway section at his unit contract prices and for performing all other remaining work in accordance with the contract.

An extended period of time as expressed in these specifications is intended to mean shutdowns ordered in writing by the Engineer to cover extended shutdowns due to winter or seasonal weather, or extended shutdowns due to delays occasioned by the failure of another contractor to complete a portion of the work on which progress of the contract is dependent, or for other causes approved by the Engineer.

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8-1.05 CONTRACT TIME

The improvement contemplated by the contract shall be completed in its entirety within the number of working days, or by definite completion date specified in the special provisions. The contract time shall commence ten (10) days after execution of the contract. The Contractor will be notified of the actual starting date by letter from the Owner.

A working day is defined as any day not otherwise defined herein as a non-working day. A non-working day is defined as Saturday, Sunday, a recognized holiday, a day on which the Contractor is specifically required by the special provisions to suspend construction operations, a day on which a suspension order is in effect, or a day on which work is not performed for reasons set forth in Section 8-1.07. Recognized holidays shall be: January 1st, February 22nd, May 30th, July 4th, Labor Day, Presidential Election Day, Thanksgiving Day, and December 25th. When any of the above days fall on Sunday, the following Monday shall be counted as a holiday. Lincoln's Birthday, Columbus Day and Veterans' Day are additional holidays for city and other political subdivision employees. When any of these holidays occur on Saturday or Sunday, the preceding Friday or the following Monday may be a legal holiday for these employees only; the above named days are working days with respect to the contract time.

A suspension order covering a certain portion of the work only, will affect a working day by the percentage set forth on the suspension order, which percentage is intended to compensate for anticipated time lost in completing the contract on the time specified.

The Engineer shall furnish the Contractor a weekly statement showing the number of working days charged to the contract for the preceding week, the number of working days specified for completion of the project, the number of working days remaining to complete the contract, and the revised date for completion. The Contractor shall be allowed ten (10) days from the date of this report in which to file written protest of any alleged discrepancies in said weekly statement; otherwise, this statement shall be deemed to have been accepted by the Contractor as correct.

The Owner shall have the right at his discretion to extend the time for completion of the contract. Any extension of time requested by the Contractor for the consideration of the Owner shall be submitted in writing and shall be accompanied by the written consent to such extension by the surety on the bond.

8-1.06 DATE OF COMPLETION OF CONTRACT

Upon completion of all work and the incorporation of materials required under the provisions of the contract, the Engineer will inform the Contractor of the date on which all work and materials were considered as being completed. Further requirements shall be as outlined in Section 9-1.06, Acceptance of Construction.

Notification to the Contractor of the date of completion will not constitute acceptance of the work by the Owner. The acceptance of the work by the Owner is further outlined in Sections 9-1.05 and 9-1.06.

8-1.07 UNAVOIDABLE DELAYS

Should the Contractor be delayed in the prosecution or completion of the work by the act, neglect, or default of the Owner, any of its officers or employees, any other contractor employed by the Owner upon the work, or by any damage caused by fire or other casualty for which the Contractor is not responsible, or by combined action of workmen, in no way caused by or resulting from default or collusion on the part of the Contractor, then the time herein set for the completion of the work shall be extended for a period equivalent to the work time lost by reason of any or all of the causes aforesaid. The extended time period shall be determined and fixed by the Owner, which determination shall be final, but no such allowance shall be made unless a claim therefor is

presented in writing to the Owner within ten (10) days after the occurrence of such delay.

The Contractor shall cooperate with the contractor of an adjoining or interdependent project to the fullest extent possible so that the operations of both will suffer a minimum of interference and delay. In case of disagreement between the Contractors, the decision of the Engineer shall be accepted as final. Any unavoidable delays to the Contractor resulting therefrom shall be adjusted as to contract time in accordance with specifications of this section.

In general, the number of working days allowed for completion of the project has been extended sufficiently to provide for the procurement of all materials necessary for construction and, unless otherwise noted in the special provisions, failure to procure the materials involved for any reason other than listed above will not be considered as an adequate reason for an extension of time.

The Contractor shall not be entitled to any claim for damages because of unavoidable delays, but may be entitled to an extension of time in the above cases.

8-1.08 FAILURE TO COMPLETE WORK ON TIME—LIQUIDATED DAMAGES

Time for completion of the work as provided by the contract is admitted to have been sufficiently advanced to allow resulting benefit to the Contractor from earlier completion of the work. Time, therefore, shall be of the essence of the contract.

If the Contractor shall fail to complete the work within the time specified in the contract, he shall pay the Owner as liquidated damages the amount per day (calendar or working day as specified) for each day that the work remains uncompleted beyond the specified completion date or time period, unless there shall have been an extension of time granted by the Owner. In the event of an extension of time, the Contractor shall pay the Owner as liquidated damages the specified amount per day for each day that the work remains uncompleted beyond the date or time period fixed by the extension of time.

The Contractor does hereby authorize the Owner to deduct such liquidated damages from the amount due, or to become due, the Contractor. The Contractor further agrees that any such deduction shall not in any degree release him from further obligations and liabilities in respect to the fulfillment of the entire contract.

Liquidated damages shall not be assessed the Contractor for unworkable days caused by weather conditions, or for any other days for which any extension of time will have been granted.

8-1.09 ASSIGNMENT OF CONTRACT AND SUBLETTING

The Contractor shall not assign this contract or any part thereof, or any moneys due or to become due thereunder, without the prior written approval of the Owner. The Contractor shall not sublet any part of this contract without first having obtained the written consent of the Engineer to do so.

Requests for permission to sublet, assign, or otherwise dispose of any portion of the contract shall be in writing and accompanied by the consent of the surety. In the event consent is given, it shall in no way release the Contractor from any responsibility, but he shall be held in all respects accountable for the same as if no consent had been given. The Contractor shall be required to give his personal attention to the work which is sublet.

8-1.10 FORFEITURE OF CONTRACT

Should the Contractor at any time refuse or neglect to supply a sufficiency of properly skilled workmen or of material of the proper quality, or fail in any respect to prosecute the work with promptness and diligence, or fail in the performance of any of the agreements herein contained, the Owner may at his option, after giving ten (10) days written notice to the Contractor, provide such sufficiency of labor or materials and deduct the cost

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thereof from any moneys due or thereafter to become due under this contract.

In the event of such refusal, neglect, or failure, the Owner may, by written notice to the Contractor and his surety or his representative, or, if the Contractor abandons the work undertaken under the contract, the Owner may, at his option with such written notice to the surety and without any written notice to the Contractor, transfer the employment of said work from the Contractor to the surety.

Upon receipt of such notice, the surety shall enter upon the premises and take possession of all materials, tools, and appliances thereon for the purpose of completing the work included under this contract, and employ by contract or otherwise, any person or persons to finish the work and provide the material therefor, without termination of the continuing full force and effect of the contract.

In case of such transfer of employment to the surety, the surety shall be paid in its own name on estimates covering the work subsequently performed under the terms of the contract and according to the terms hereof, without any right of the Contractor to make any claim for the same or any part thereof. In lieu of the foregoing, if the Owner so elects, he may terminate the employment of the Contractor for said work and enter upon the premises and take possession of all materials, tools and equipment thereon for the purpose of completing the work included under the contract, and employ by contract or otherwise, any person or persons to finish the work and provide the materials therefor.

In case of the discontinuance of employment by the Owner as aforesaid, the Contractor shall not be entitled to receive any further balance of the amount to be paid under this contract until the work shall have been fully finished. At this time, if the unpaid balance of the amount to be paid under this contract exceeds the expense incurred by the Owner in finishing the work, and all damages sustained or which may be sustained by the Owner by reason of such refusal, neglect, failure, or discontinuance of employment, such excess shall be paid by the Owner to the Contractor. If such expense and damages shall exceed the unpaid balance, the Contractor and his surety and each thereof shall be jointly and severally liable therefor to the Owner and shall pay the difference to the Owner.

8-1.11 CONTRACTOR ORGANIZATION, SUPERINTENDENCE AND EQUIPMENT

All machinery and equipment shall be adequate for the purpose used and shall be kept in good workable condition and be operated by experienced operators.

The Contractor shall provide at all times during the progress of the work, competent and necessary superintendence. During the Contractor's absence, the superintendent shall have full authority to execute the orders or directions of the Engineer without delay and to promptly supply such materials, tools, plant equipment and labor as may be required.

All work under the contract shall be performed under the continuous supervision of competent personnel thoroughly experienced in the class of work specified.

Incompetent, careless or negligent employees or agents shall be forthwith discharged by the Contractor upon written request of the Engineer, and failure to comply with such request shall be sufficient grounds for termination of the contract.

The lack of proper supervision by the Contractor or by his supervisory personnel shall be just cause for termination of the contract, as set forth in Section 8-1.10.

8-1.12 OVERTIME WORK BY OWNER EMPLOYEES

Where the Contractor elects to work on a Saturday, Sunday, a holiday, or longer than an eight-hour work shift on a regular working day, as defined in the standard specifications, such work shall be considered as overtime work. On all such overtime work an inspector will be

present, and a survey crew if required. The Contractor shall reimburse the Owner for the full amount of the straight time plus overtime costs for employees of the Owner required to work overtime hours.

Recognized holidays shall be as listed in paragraph 2 of Section 8-1.05.

The Contractor by these specifications does hereby authorize the Owner to deduct such costs from the amount due or to become due him.

Overtime due to special construction problems such as concrete finishing, asphalt rolling, making live sewer hookups, alleviating traffic problems, et cetera, will not be charged if the Engineer considers the overtime to be mutually justified.

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9-1.01 MEASUREMENT

The determination of pay quantities of work performed under the contract will be made by the Engineer based upon the lines, grades, and cross section given, or measurements made by him or his assistants. All items will be computed in the units in the proposal.

9-1.02 SCOPE OF PAYMENT

The Contractor shall accept the compensation, as herein provided, in full payment for furnishing all materials, labor, tools and equipment necessary to the completed work and for performing all work contemplated and embraced under the contract; also for loss or damage arising from the nature of the work, or from the action of the elements, or from any unforeseen difficulties which may be encountered during the prosecution of the work until the final acceptance by the Owner, and for all risks of every description connected with the prosecution of the work; also for all expenses incurred in consequence of the suspension or discontinuance of the work as herein specified; and for completing the work according to the plans and specifications.

Neither the payment of any estimate nor of any retained percentage shall relieve the Contractor of any obligation to make good any defective work or material. Payment will be made only for materials actually incorporated in the work. For payment of materials on site, see Section 9-1.05, Progress Payments.

The unit contract prices for the various bid items of the contract shall be full compensation for all labor, materials, supplies, equipment, tools and all things of whatsoever nature required for the complete incorporation of the item into the work the same as though the item were to read "In Place," unless the plans and special provisions shall provide otherwise.

When specified, the Contractor shall submit a schedule of estimated breakdown of costs for lump sum items in a form acceptable to the Engineer before partial payments will be made for such items. This estimated breakdown of costs shall include items for the main classification of the work, and shall total the amount of the lump sum bid item. Unless otherwise provided in the Special Provisions, partial payments for materials will be made only after such materials have been incorporated in the work. The values in the schedule will be used for determining partial payments, and, so far as they apply, as a basis for payment for additional ordered work changes.

9-1.03 PAYMENT FOR EXTRA WORK

Adjustments, if any, in the amounts to be paid the Contractor by reason of any change, addition, or deduction, shall be determined by one or more of the following methods:

- By an acceptable lump-sum proposal from the Contractor.
- By unit contract prices contained in the contract proposal, or by unit prices mutually agreed upon by the Contractor and the Owner.
- By force account.

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It shall be the responsibility of the Contractor before proceeding with any change to satisfy himself that the change has been properly authorized in behalf of the Owner. No charge for extra work or any other change in the contract will be allowed unless the extra work or change has been authorized in writing by the Owner, and the compensation or method thereof is stated in such written authority.

When payment for extra work is by lump sum agreed price or by unit prices mutually agreed upon by the Contractor and the Owner, the Contractor shall include in his agreed prices, retail sales tax on taxable materials when such extra work is for improving public roads. When the extra work is for water systems, sanitary sewer systems, sewage disposal facilities, or other work not related to public roads, the Contractor shall not include retail sales tax in his agreed prices. The Contractor is advised that the sale to him of necessary material, supplies, etc., are sales for resale and the Owner will pay the retail sales tax on the entire extra work.

9-1.03A NOTICE OF POTENTIAL CLAIM

The Contractor shall not be entitled to any additional compensation otherwise payable for any act or failure to act by the Engineer or the Owner, the happening of any event or occurrence, or any other cause, unless he shall have given the Engineer a written notice of potential claim.

The written notice of potential claim shall set forth the reasons for which the Contractor believes additional compensation will or may be due, the nature of the costs involved, and, insofar as possible, the amount of the potential claim. If based on an act or failure to act by the Engineer or the Owner, except in case of emergency, such notice shall be given to the Engineer prior to the time that the Contractor has started performance of the work giving rise to the potential claim for additional compensation. In all other cases, notice shall be given within fifteen (15) days after the happening of the event or occurrence giving rise to the potential claim.

It is the intention of this section that differences between the parties arising under and by virtue of the Contract shall be brought to the attention of the Engineer at the earliest possible time in order that such matters may be settled, if possible, or other appropriate action promptly taken.

9-1.04 FORCE ACCOUNT

Whenever in the opinion of the Owner the schedule of unit or itemized prices forming a part of the contract does not apply to items of extra work ordered in writing by the Engineer, such items of work shall be paid for at a price agreed upon in writing between the parties to the contract before such work is done, or on the basis of force account in the following manner:

1. Labor.

For all labor, including such foreman supervision, but excluding general superintendents as may be necessary upon any particular operation, the contractor shall be reimbursed for labor costs, overhead and profit as outlined hereinafter.

Payment made for labor shall be computed by the Engineer and shall be the sum of the following:

(a) **Weighted Wage Rate:** The agreed weighted wage rate for all labor used shall include and be restricted to the current prevailing basic wage plus fringe benefits made the obligation of the Contractor by regional labor agreement as shown in the contract "minimum wage rate schedule" and benefits paid on behalf of labor by the Contractor as follows:

- (1) Federal Insurance Compensation Act (FICA)
- (2) Federal Unemployment Tax Act (FUTA)
- (3) State Unemployment Compensation Act (SUCA)

The above items shall be combined into a single wage rate for each classification of labor used which shall be designated as the "Weighted Wage Rate" for the identified class of labor.

(b) **Travel Allowance and/or Subsistence:** The Contractor shall be reimbursed the actual cost of travel and/or subsistence allowances paid to labor engaged upon the work when said allowances are required by regional labor agreement.

(c) **Industrial Insurance and Medical Aid Premiums:** The Contractor shall receive reimbursement for Marine Industrial Insurance, State of Washington Industrial Insurance and Medical Aid premiums which become an obligation of the Contractor and are chargeable to the force account work on the basis of time worked. The agreed rate(s) of compensation for the above premiums shall be a composite rate(s) based upon the full premium for Industrial Insurance and one-half the premium for Medical Aid which premiums are prescribed by the regulatory body for the Contractor(s) actually performing the force account work. This composite rate may be adjusted upon request to conform with adjustments prescribed by the regulatory body.

(d) **Overhead and Profit:** The Contractor shall be reimbursed an amount equal to twenty percent (20%) of the sum of the items hereinbefore listed under (a), (b) and (c) above as the cost of labor, which percentage payment shall constitute full compensation for overhead, profit and all other payments made to or on behalf of labor in addition to those items specifically set forth above.

2. Materials.

For all materials furnished by the Contractor for the work, payment shall be made for his actual invoice cost of such materials including actual freight and express charges and this state's Retail Sales and Compensating Taxes; and less all offered or available discounts and rebates, notwithstanding the fact that they may not have been taken by the Contractor. To the above cost shall be added a sum equal to fifteen percent (15%) for overhead and profit and any other costs incurred in supplying such materials.

The Contractor shall furnish as support for all charges for materials valid copies of vendor's invoices including freight and express bills, except that such materials as may be furnished from Contractor's stocks for which an invoice is not available the Contractor shall furnish an affidavit certifying to his actual cost of such materials.

In the event the Contractor's cost of such materials furnished is in the opinion of the Engineer excessive, or if the Contractor does not furnish satisfactory evidence of his costs, the Owner reserves the right to establish the cost of all or part of such materials at the lowest current wholesale prices less all applicable discounts and exemptions at which said materials are available in the quantities required delivered to the location of the work.

The Owner reserves the right to furnish such materials as it deems advisable, and the Contractor shall have no claims for costs and profit on such materials.

3. Equipment

For any machine-power tools or equipment which the Engineer may deem necessary or desirable to use, the Contractor will be compensated in accordance with the current AGC-Dept. of Highways equipment rental agreement and the included "Maximum Hourly Rental Rates for Force Account Work" schedule for each and every hour that such tools or equipment are in use on such work. To the sum of the amount due the Contractor for rental of tools and equipment shall be added an amount equal to fifteen percent (15%) of that sum for overhead and profit and all other costs incidental to furnishing and operating such equipment.

The rates in effect at the time of the performance of the force account work, as set forth in the schedule

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of "Maximum Hourly Rental Rates for Force Account Work," are the maximum rates allowable for equipment of modern design and in good working condition and shall include and be full compensation for furnishing all fuel, oil, lubrication, repairs, maintenance, insurance and incidental expenses except labor for operation thereof. In the event equipment is required for which a rental rate is not included in the current schedule, an agreed rental rate shall be established for that equipment based upon the same elements of cost used in establishing the current schedule of rental rates. Such rates must be approved by the Engineer prior to use of the equipment on the force account work.

A current schedule of "Maximum Hourly Rental Rates for Force Account Work" will be maintained at each district office of the Department of Highways and at each of the offices of the Associated General Contractors of America, located at Seattle (Mountain Pacific), Spokane, Tacoma and Portland, where the schedule is available for inspection.

In event the necessary equipment is not already at the site of the project and it is not anticipated that it would be required for the performance of work under the terms of the contract other than force account, the

Contractor will be paid an agreed amount for the necessary transportation of the equipment. To the agreed amount shall be added an amount equal to fifteen percent (15%) of that sum.

The compensation as herein provided shall be payment in full for all work done on a force account basis and shall cover all expenses of every nature, kind and description, including overhead expenses, payments required under the Social Security Act, State Unemployment Compensation Act, occupational tax and any other Federal or State revenue acts, together with all premiums on public liability and property damage insurance policies, use of small tools and equipment for which no rental is allowed, and profit.

No claim for such force account work shall be allowed except upon written order by the Engineer prior to the performance of such work. No work shall be construed as force account work which can be measured under the specifications and paid for at the unit prices named in the contract.

The amount and cost of any such force account work shall be computed by the Engineer. The Contractor shall submit, on force account sheets provided to him, an itemized statement of the cost of work, purpose and location of the work, a complete breakdown of labor, materials, equipment, and taxes in accordance with the above provisions. The statement will be submitted to the Engineer for approval within ten (10) days following the day on which the work was completed.

Failure to submit force account statements in the time specified will be considered cause for denial of payment for work done by such force account.

The Contractor's cost records pertaining to work paid for on a force account basis shall be open to inspection or audit by representatives of the Owner during the life of the contract and for a period of not less than 3 years after the date of acceptance thereof, and the Contractor shall retain such records, for that period. Where payment for materials or labor is based on the cost thereof to forces other than the Contractor, the Contractor expressly guarantees that the cost records of such other forces shall be open to inspection and audit by representatives of the Owner on the same terms and conditions as the cost records of the Contractor. If an audit is to be commenced more than 60 days after the acceptance date of the contract, the Contractor will be given a reasonable notice of the time when the audit is to begin.

9-1.05 PROGRESS PAYMENTS, FINAL PAYMENT, RETAINED PERCENTAGE

Payments will be made for work and labor performed and materials furnished under the contract according to the schedule of rates and prices and the specifications attached and made a part thereof. Partial payments under the contract will be made at the request of the

Contractor once each month upon partial estimates by the Engineer, as hereinafter specified, provided they are in accordance with the provisions of RCW-60.28/010. There will be reserved and retained from monies earned by the Contractor, as determined by such monthly estimates, a sum equal to ten (10) percent of the first One Hundred Thousand Dollars and five (5) percent of all amounts over One Hundred Thousand Dollars of such estimates.

Cost of materials, properly stored, protected and insured at the site of the work will be paid on monthly estimates only when so provided for in the special provisions, and then only for the specific materials listed therein for partial payment. In preparing the monthly estimates, advancement will be made therein for ninety percent of the cost of such materials, as evidenced by invoices to the Contractor. Advancement will not be made for any item of material amounting to less than five hundred dollars (\$500.00). All materials must conform to the requirements of the specifications; however, advancement for materials will not constitute acceptance, and any faulty material will be condemned although advancement may have been made for same in the estimates. Deductions at the same rates, and equal in amount to the advancements, will be made on the estimates as the material is used.

Quantities used for progress estimates shall be considered only as approximate and provisional, and shall be subject to recalculation, adjustment and correction by the Engineer in subsequent progress estimates and in final estimates. Inclusion of any quantities in progress estimates, or failure to disapprove the work at the time of progress estimate, shall not be construed as acceptance of the corresponding work or materials.

In the event that an unforeseen condition beyond the control of the Contractor will materially delay the final completion of a contract and if the retention of the monies reserved in accordance with the provisions of Chapter 236, Laws of 1955 will work undue hardship upon the Contractor, he may request payment of the retained percentage in accordance with the provisions of Chapter 91, Laws of 1957. If no claims have thus far been filed against the contract and if no taxes have been certified as due or about to become due by the State Tax Commission, the Owner, at its discretion, may pay the retained percentage or so much of it as appears to be proper, but no payment shall be made until the Contractor will have delivered to the Owner an acceptable bond in the full amount of the retained percentage thereupon released.

Payment of the retained percentage shall be withheld for a period of thirty (30) days following the final acceptance by the Owner, and shall be paid the Contractor at the expiration of said thirty (30) days in event no claims, as provided by law, have been filed against such funds; and provided further, that releases have been obtained from the State Department of Labor and Industries and also, except for contracts totaling less than \$20,000.00, the Washington State Tax Commission, the State of Washington Employment Security Department, and all other departments and agencies having jurisdiction over the activities of the Contractor. In the event such claims are filed, the Contractor shall be paid such retained percentages less an amount sufficient to pay any such claims, together with a sum sufficient to pay the cost of such action, and to cover attorney fees as determined by the Owner.

9-1.05A OWNER'S RIGHT TO WITHHOLD CERTAIN AMOUNTS

The Owner may withhold from payments to the Contractor, in addition to retained percentage, such an amount or amounts as may be necessary to cover:

- (a) Payments that may be earned or due for just claims for labor or materials furnished in and about the work;
- (b) Defective work not remedied;
- (c) Failure of the Contractor to make proper payments to a subcontractor;
- (d) Reasonable doubt that this contract can be completed for the balance then unpaid;

Section 9—Measurement and Payment

(e) Damage to another Contractor, where there is evidence thereof.

The Owner will disburse and shall have the right to act as agent for the Contractor in disbursing such funds as have been withheld pursuant to this paragraph to the party or parties who are entitled to payment therefrom. The Owner will render to the Contractor a proper accounting of all such funds disbursed in behalf of the Contractor.

9-1.06 ACCEPTANCE OF CONSTRUCTION

Acceptance of construction shall be defined as final approval of the project only in that it has been constructed, cleaned up, and completed in accordance with plans and specifications. See Section 8-1.06 for date of completion of the contract.

It is mutually agreed between the parties to the contract that a certificate of completion of the project, submitted by the Engineer or other officer of the Owner and approved by the governing body of the Owner, shall constitute final acceptance of the work and materials included in the contract on the date of such approval. It is provided further that such approval shall not constitute an acceptance of any unauthorized work, that no payment made under the contract except the final payment shall be evidence of the performance of the contract, either wholly or in part, and that no payment shall constitute an acceptance of unauthorized or defective work or improper material.

Projects will generally be accepted in respect to construction at such time as they are entirely completed; however, on projects consisting of several disconnected streets, sewer lines, or water lines, the Engineer may accept any of these separate sections if he so elects. On continuous street projects of less than twelve (12) city blocks, the Contractor shall be required to complete the entire project before acceptance. Street projects longer than twelve (12) blocks may be accepted in sections of six (6) blocks or more, as the Engineer may determine

Continuous sewer projects will not be accepted until completed in their entirety.

The acceptance of the contract work shall not prevent the Owner from making claim against the Contractor for any defective work if same is discovered within one (1) year from the date of acceptance. See Section 5-1.12.

9-1.07 FINAL GUARANTY

All work shall be and is guaranteed by the Contractor for a period of one year from and after the date of final acceptance of all the work by the Owner.

If, within said guaranty period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Engineer, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the contract, the Contractor shall, promptly upon receipt of notice from the Owner, and without expense to the Owner (a) place in satisfactory condition in every particular all of such guaranteed work, correct all defects therein; and (b) make good all damage to the building or site, or equipment or contents thereof, which in the opinion of the Engineer, is the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the contract; and (c) make good any work or material, or the equipment and contents of building, structure or site disturbed in fulfilling any such guarantee.

If the Contractor, after notice, fails within ten (10) days to proceed to comply with the terms of this guaranty, the Owner may have the defects corrected, and the Contractor and his surety shall be liable for all expense incurred, provided, however, that in case of an emergency where, in the option of the Engineer, delay would cause serious loss or damage, repairs may be made without notice being given to the Contractor and the Contractor shall pay the cost thereof.

Section 9—Measurement and Payment

...the Contractor shall have the right to...
 ...the Contractor shall have the right to...
 ...the Contractor shall have the right to...

9-1.01 ACCEPTANCE OF CONSTRUCTION

Acceptance of construction shall be defined as final...
 ...the Contractor shall have the right to...
 ...the Contractor shall have the right to...

It is mutually agreed between the parties to the...
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**STANDARD
 SPECIFICATIONS
 FOR
 MUNICIPAL PUBLIC WORKS
 CONSTRUCTION**



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DIVISION II—STREETS AND RELATED CONSTRUCTION

Section 12—Clearing and Grubbing

12-1 CLEARING

12-1.01 DESCRIPTION

This item shall consist of clearing the areas shown on the plans or as described in the special provisions of all trees, brush, and other vegetation, down timber, rotten wood, rubbish, and other objectionable material. It shall include, but not limited to removing buildings, fences, lumber, trash piles and other obstructions interfering with the proposed work, and salvaging such of these materials as may be designated in the special provisions, burning or otherwise disposing of the debris as directed by the Engineer. All work under this item shall be done in accordance with these specifications and in conformity with the plans.

12-1.02 LIMITS OF CLEARING

-1.02A Sewers and Water Mains (Clearing and Grubbing)

The limits of clearing, as well as grubbing operations, on sewer and water main projects are dependent to a considerable degree upon the Contractor's operations and it shall be his responsibility to determine these limits providing he does not go beyond right-of-way or easement lines. The clearing and grubbing shall be to such width as will provide for the excavation of the trench, storage area alongside the trench for material excavated as trench excavation and backfill, an area for pipe and material storage, and for any haul roads which may be necessary. Clearing and grubbing of waste sites required for sewer and water main construction shall be considered as part of the project clearing. Clearing and grubbing on sewer and water main projects shall be measured and paid for at the unit contract price for "Clearing and Grubbing," per acre or per lump sum.

-1.02B Streets

In developed and semi-developed areas where drivable streets exist and where the project calls for grading and/or paving, the limits of clearing will be outlined on the plans or in the Special Provisions.

In undeveloped areas where development is very scattered or nonexistent, clearing shall be performed for the entire width of the roadway section shown on the plans, plus ten (10) feet beyond the slope stakes, but not beyond right-of-way or easement lines indicated on the construction plans. Intersecting side street shall be cleared to the width described above and for such distance along them as will provide for the construction required, as shown on the plans.

-1.02C Landscaping Area

When an area is to be cleared prior to landscaping, the limits of the clearing will be outlined on the plans and will be staked by the Engineer.

12-1.03 CONSTRUCTION DETAILS

Within the limits described, all vegetable growth such as trees, shrubs, brush, logs, fences, upturned stumps and roots of down trees, and other similar items not specifically covered by unit prices shall be removed and disposed of. All trees shall be felled *within* the area to be cleared. Where the tree limb structure interferes with utility wires, or where the trees to be felled are 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. Any work pertaining to utility poles shall comply with Section 5.08.

All fences adjoining any excavation or embankment that may be damaged or buried shall be carefully removed and placed on the adjoining property.

No debris of any kind shall 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 owner.

Trees, shrubbery, and flower beds designated by the Engineer shall be left in place and care shall be taken by

the Contractor not to damage or injure such trees, shrubbery or flower beds by any of his operations.

Removal of ornamental or danger trees may or may not be a separate item of work on a project.

The refuse resulting from the clearing operation shall be hauled to a waste site secured by the Contractor and shall be disposed of in such a manner as to meet all requirements of State, county and municipal regulations regarding health, safety, and public welfare. When authorized by the proper fire authorities, the Contractor may dispose of such refuse by burning on the site of the project provided all requirements set forth by the authorities are met.

On easement through private property, such as is sometimes met in sewer construction, the Contractor shall not burn on the site unless specifically permitted in the special provisions, in which case he shall obtain permission as previously stated.

In all cases, the authority to burn shall not relieve the Contractor in any way from damages which may result from his operations. In no case shall any material be left on the project, shoved onto abutting private properties, or be buried in embankments or sewer trenches on the project.

Clearing operations shall be carried well in advance of the construction operations so as to permit a well planned schedule of work.

Where ornamental trees exist in planting areas and are not to be removed, it shall be the Contractor's responsibility to trim low limbs which will interfere with the normal operation of his equipment. The trimming shall be performed in a professional manner by competent personnel prior to his machine operations and in such a manner as the Engineer may direct.

The Contractor shall be responsible for all damages to existing improvements resulting from his operations.

12-1.04 MEASUREMENT

-1.04A Acreage Basis

When shown in the bid proposal, clearing will be paid on an acre basis, in which case clearing will be measured by the acre for the area cleared within the bounds staked by the Engineer, provided however, that the area within the existing street or highway where no clearing is required shall be excluded from the measurement.

In determining the pay area of clearing for intermittent or isolated areas in any fifty (50) foot station, the minimum area shall be fifty (50) feet by fifty (50) feet. If there is no clearing in a fifty (50) foot station, such area shall be excluded from the measurement.

-1.04B Lump Sum Basis

When shown in the bid proposal, clearing shall be upon a lump sum basis, in which case the lump sum shall include all clearing within limits outlined herein, or as otherwise defined in the plans or special provisions.

12-1.05 PAYMENT

When clearing is measured and paid for as a separate item it will be at one of the unit prices shown below:

"Clearing," per acre.

"Clearing," per lump sum.

The unit contract price for "Clearing," per acre, or "Clearing," per lump sum shall be full compensation for furnishing all labor, equipment and materials to complete the work as specified. See paragraph 2 of Section 12-3.03 when no pay item for "Clearing" is contained in the proposal.

12-2 GRUBBING

12-2.01 DESCRIPTION

This item shall consist of grubbing the areas outlined herein or as otherwise defined in the special provisions. The work shall include the removal of all stumps, roots, vegetable matter, and all structures in or upon the ground, the removal of which is not prescribed under the item of "Clearing," such as wood curb, planking, existing wooden culverts, wooden catch basins, drains, and stairways, et cetera.

Section 12—Clearing and Grubbing

12-2.02 LIMITS OF GRUBBING

-2.02A Sewers

Limits of grubbing for sewers shall be the same as the limits for clearing.

-2.02B Streets

Limits of grubbing for streets shall be the same as the limits for clearing.

12-2.03 PROTECTION OF EXISTING IMPROVEMENTS DURING GRUBBING OPERATIONS

Where it is necessary to remove stumps and where there are surface or subsurface improvements, the Contractor shall be responsible for determining which of the agencies, public or private, have underground or service utilities in the vicinity of the stump to be removed; and further, he shall notify each agency and request its assistance in locating its services. The Contractor will not be responsible for the cost of locating services.

Where sewer, water, electric, telephone, steam, gas and similar underground services into residences will be imperiled by stump removal, the utility agency affected will cut the service and replace same at no cost to the Contractor. Where telephone cable and/or ducts, water mains, gas mains, steam mains, and sewer trunks exist and are likely to be damaged, special care shall be taken, and roots of stump shall be cut off in such a manner that the existing utility installations will not be damaged in any way.

Regardless of the cooperation of affected agencies and utilities, the Contractor shall be responsible for any damage to services and utilities that are attributable to his operations, and he shall be responsible for the necessary repairs thereto as specified in Section 5-1.09.

Any damage resulting from the Contractor's operations to existing improvements within the area to be grubbed but which are not required to be removed by the grubbing shall be repaired by the Contractor at his expense. He will not be held responsible for damage to such improvements if the damage occurred previous to beginning of the contract.

If the Contractor removes stumps for private property owners along the project, he shall be responsible for all damage resulting therefrom.

12-2.04 CONSTRUCTION DETAILS

All stumps, roots, foundations and planking embedded in the ground within the limits described herein or otherwise described in the special provisions, shall be removed and disposed of. Piling shall be removed to a minimum depth of two (2) feet below subgrade or two (2) feet below original ground, whichever is lower. Disposal requirements for grubbing shall be the same as those described for clearing.

Removal of sod and lawns which are not to be replaced shall be considered as incidental to other work of the project and no payment will be made therefor. Grubbing shall otherwise meet requirements previously outlined under "Clearing."

12-2.05 MEASUREMENT

Measurement of grubbing shall be the same as described for clearing in Section 12-1.04.

12-2.06 PAYMENT

When grubbing is measured and paid for as a separate item, it will be at one of the unit prices shown below:

"Grubbing," per acre.

"Grubbing," per lump sum.

The unit contract price for "Grubbing," per acre, or for "Grubbing," per lump sum shall be full compensation for furnishing all labor, equipment and materials to complete the work as specified. See paragraph 2 of Section 12-3.03 when no pay item for "Grubbing" is contained in the proposal.

12-3 CLEARING AND GRUBBING

12-3.01 DESCRIPTION

This item shall consist of all clearing and grubbing hereinbefore described under the separate headings of "Clearing" and "Grubbing." It will include all areas for bridge sites, streets, highways, borrow pits, sewers, and related work whenever the special provisions and proposal provide for lump sum or per acre payment therefor.

12-3.02 CONSTRUCTION DETAILS

The construction details outlined under the preceding specifications for "Clearing" and for "Grubbing" shall prevail in all respects.

12-3.03 MEASUREMENT AND PAYMENT

There will be no specific unit of measurement under the lump sum item of "Clearing and Grubbing," and all work hereinbefore specified under the headings of "Clearing" and "Grubbing" shall be paid for at the unit contract price for "Clearing and Grubbing," per lump sum or per acre, which shall be full compensation for all work required by the specifications.

If the proposal does not include a pay item of any kind pertaining to the work of clearing and grubbing, then the work specified therefor shall be considered as incidental to the construction of the project and all costs thereof incurred by the Contractor shall be included in other items of the construction.

12-4 ORNAMENTAL AND DANGER TREES

12-4.01 DESCRIPTION

Ornamental trees growing in areas that are to be graded or paved and which must be removed, shall be considered as part of the "Clearing and Grubbing." Trees other than those which have not been specifically shown on the construction plans or in the special provisions as part of the clearing and which are required to be removed, shall be considered as ornamental trees and their removal be paid for as such.

An ornamental tree is further defined as a woody perennial having a main stem (trunk) measuring 12 inches or more in circumference at a point 4 feet above average ground level. Where more than one stem exists, they shall be considered as individual trees as determined above. Trees of lesser dimensions, shrubs, and bushes which are not located in the areas to be cleared and grubbed but which are ordered to be removed, shall be paid for by force account.

It shall be the responsibility of the Contractor to preserve any tree for which the special provisions or plans so provide or for which the Engineer may direct the saving. If removal is required, the removal and disposition shall be by the same specifications as hereinbefore recited for clearing and grubbing, but the measurement and payment shall be upon the basis hereinafter defined.

In most cases, ornamental trees requiring removal will be shown on the plans. Failure to indicate them on the plans shall not, however, relieve the Contractor from responsibility of performing the work upon the unit price basis per each if there shall have been included in the proposal a range of circumferences pertaining to payment; otherwise he shall do the work upon a force account basis or upon a negotiated price basis.

The removal of all ornamental trees will be paid for in accordance with items set up in Section 12-4.03. All such trees shall be removed to a minimum of ten (10) inches below grade.

Danger trees are those trees which the Engineer determines shall be removed to eliminate danger. They shall be considered in the same category as for ornamental trees and measurement and payment will be made in the same manner by ranges of circumferences, force account, or negotiated price per each or otherwise as may be mutually agreed upon by the Engineer and the Contractor.

Section 13—Street and Drainage Excavation

12-4.02 MEASUREMENT, ORNAMENTAL AND DANGER TREES

Measurement shall be by four (4) ranges of circumferences measured at four (4) feet above ground and classified as follows:

- 12 inches to 36 inches, CLASS I
- 36 inches to 72 inches, CLASS II
- 72 inches to 126 inches, CLASS III
- 126 inches and more, CLASS IV

12-4.03 PAYMENT

Payment will be made at the unit contract price per each of the following items:

1. "Remove Tree, Class I," per each.
2. "Remove Tree, Class II," per each.
3. "Remove Tree, Class III," per each.
4. "Remove Tree, Class IV," per each.

The unit contract price per each tree shall be full compensation for all labor, equipment, and materials required to perform the work in accordance with the specifications and directions of the Engineer.

12-5 PRESERVATION OF EXISTING TREES

It shall be the responsibility of the Contractor to preserve any tree for which the special provisions or plans so provide or for which the Engineer may direct.

If the Contractor damages or destroys a tree which he has been directed to preserve, he shall replace it in species, size and grade with a healthy tree acceptable to the Engineer, and guarantee the tree to live for a period of one (1) year. In the event the tree fails to survive for the one-year period, it shall be replaced in species, size and grade. If the Contractor fails to replace a tree damaged or destroyed as a result of his operations, he shall forfeit twelve (12) dollars per square inch of sectional area measured six (6) inches above the ground line of the damaged or destroyed tree. The calculated value of the tree as described above shall be withheld from the final payment to the Contractor.

Section 13—Street and Drainage Excavation

13-1 DESCRIPTION

This item shall consist of excavating and grading the roadway, side streets, alley and driveway approaches, sidewalk and planting areas, and alleys, and all work necessary for the completion of the cuts, embankments, slopes, roadway ditches, side street approaches, sidewalks and planting areas, alleys and subsidiary work, including disposal of all surplus material. All work shall be performed in accordance with the alignment, grades, and cross sections shown on the construction plans.

13-1.01 CLASSIFICATION

Roadway excavation, comprising all materials within the roadway, planting and sidewalk areas, but excluding trench excavation and borrow pits, will be classified under headings of "Common Excavation" and "Solid Rock Excavation," in accordance with specifications therefor.

"Solid Rock Excavation" shall cover the removal and disposal of solid rock, i.e. ledge rock that requires systematic drilling and blasting for its removal and also boulders exceeding one-half cubic yard in volume. Hard pan, hard clay or glacial till will not be classified as solid rock excavation. Sandstone, siltstone, shale or other sedimentary rocks which are soft, weathered or extensively fissured will 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 or unconfined compressive strength at field moisture content of less than 2,000 psi.

"Common Excavation" shall include all other material not classified as solid rock.

13-2 PROTECTION OF EXISTING IMPROVEMENTS

13-2.01 SURFACE IMPROVEMENTS

The Contractor shall be responsible for the protection of existing surface improvements as described elsewhere

in the various applicable sections of the specifications, and any damage resulting from his operations shall be his sole responsibility.

13-2.02 SUBSURFACE IMPROVEMENTS

-2.02A General

Utilities of record will be shown on the construction plans insofar as it is possible to do so. Failure of the Owner to show the existence of subsurface objects or installations on the plans shall not relieve the Contractor from his responsibility to make independent check on the ground, nor relieve him from all liability for damages resulting from his operations unless otherwise provided in the special provisions or by exceptions hereinafter mentioned.

It shall be the responsibility of the Contractor to give proper written notification to the agencies that have utilities in place and to cooperate with these agencies in the protection and relocation of the various underground installations. These agencies will give assistance in the location of the various utilities, but this shall not relieve the Contractor from responsibility for any damage incurred, except in case where the installations are not located as closely as is normally possible with electronic pipe locator. In such case the Contractor will not be liable if he has proceeded with due caution.

-2.02B Lighting Cables

Where lighting cables exist within the areas to be excavated and are not more than six (6) inches below the final grade of the excavation, the Contractor shall not be responsible for any damage done, provided he has given proper and timely notification, and has cooperated to keep damage to a minimum.

-2.02C Sewers and Appurtenances

In order to prevent the falling of earth or debris into sewer manholes in which construction work is being done, all existing manholes on grading and paving improvements shall be located and uncovered by hand work and a shield placed over the manhole channel. This shield shall remain in place until the grading or subgrading operation is completed. Within twenty-four (24) hours thereafter all earth or debris shall be carefully cleaned off and the shield removed. Special care shall be exercised to see that no earth or debris falls into the sewer channel. No direct payment shall be allowed for the above mentioned work. Payment for the cost thereof shall be included in the price bid for various items which comprise the improvement.

Where house services are damaged through no fault of the Contractor, they shall be repaired and payment will be made therefor in accordance with the unit contract price, or by force account as the Engineer may determine.

-2.02D Water Mains and Appurtenances

The Contractor shall be responsible for any damage to water mains and water facilities caused by his operations, except that he will be relieved therefrom under the following conditions: (1) He has not excavated below or beyond the required excavation lines and, (2) he has given proper and timely notice of his work plans and, (3) he has used reasonable care and has cooperated in minimizing the damages, and (4) except as may be modified hereinafter.

Any damage to water gates, hydrants, valve chambers and other surface appurtenances which results from the Contractor's operation shall be his sole responsibility.

-2.02E Private Utilities

Utilities other than those owned and operated by Owner are in streets pursuant to franchises or to rights claimed under the laws of the U. S. A. or the State of Washington, and therefore, the respective utility agencies are responsible for all adjustments and relocations of their facilities. These agencies will locate their facilities for the Contractor and assist him in their protection. The Contractor shall co-ordinate his work with that of the affected agencies and shall protect them from damage.

Section 13—Street and Drainage Excavation

The Contractor shall be liable for all damages to private utilities resulting from his operations, and hold the Owner harmless.

13-3 CONSTRUCTION DETAILS

Off-highway earth moving equipment will not be allowed to haul on or across any streets not being improved in the contract.

13-3.01 SIDE STREET, ALLEY AND DRIVEWAY APPROACHES

Approaches to the project shall be excavated to the limits indicated on the plans or to such limits as the Engineer may direct. This excavation shall be made in conjunction with the street excavation and in such a manner as to provide for easy and safe access for local and emergency traffic at all times.

13-3.02 EXCAVATION BELOW GRADE

Where the Engineer deems subgrade material to be unsatisfactory, excavation below grade will be required to such depths as he may direct. Excavation below grade shall be of the same classification as that above it provided it is removed in the same operation as the normal excavation. Where the Contractor has completed the roadway excavation and is required to move back to remove unsuitable material, or where the additional depth requires special equipment because of the presence of shallow utilities or other unforeseen conditions, the work shall be performed as directed and a payment for excavation below grade will be made on the basis of extra work as provided in Section 9-1.03.

If the excavation below grade is required because of negligence on part of the Contractor, the necessary excavation below grade and the backfilling required to restore the surface satisfactorily shall be at his expense.

13-3.03 PLANTING AND SIDEWALK AREAS

The class of excavation as specified shall include all excavation of planting and sidewalk areas and shall extend to the lateral and terminal limits shown on the construction plans. Planting areas shall be defined as those areas existing between the roadway surface and property line, exclusive of the areas occupied by other improvements such as sidewalks. On planting strips in developed areas, the excavations shall be made and be terminated to blend neatly with the existing contours. Where planting strips are low, they shall be filled with soil comparable to that which exists and conform to the plan grade.

13-3.04 PAVEMENT REMOVAL

Pavement removal shall be accomplished and compensation be made therefor in accordance with the requirements of Section 52. Where existing streets are to be excavated and are presently surfaced with asphalt concrete or bituminous mats on earth or granular base, these surfaces shall be considered as part of the excavation unless otherwise specified in the special provisions. Where existing street pavements extend beyond the back of the new curb line, the Contractor will also be required to remove the pavement as part of the excavation. It shall be the Contractor's responsibility to determine the thickness of such surfaces before submitting his proposal.

13-3.05 DISPOSAL OF EXCAVATED MATERIAL

Suitable excavated material shall be used for the making of all required project embankments. The more suitable portions of the excavated material shall be stored on or off the project, as the Contractor may elect, and used for backfilling of curbs and dressing up the planting areas, the cost of which shall be considered as incidental to the excavation. Excavated material in excess of that needed to complete all embankments and for backfilling curbs and dressing planting areas shall be wasted by an equitable distribution of the material to properties within the project limits, as directed by the

Engineer. Any excess materials remaining shall be disposed of by the Contractor at his own expense.

The Contractor shall not waste any excavated material until he is certain there is sufficient material to complete all necessary project embankments and plantings. If an undue amount is wasted, the Contractor shall secure and furnish necessary borrow material at his own expense.

13-3.06 DITCHES

All ditches shall be constructed as shown on the plans and shall be so graded as to conform to the natural flow of the water to inlets, catch basins, culverts or channels. Ditches from cuts shall be located in such manner as to bypass any part of the adjacent fill so that no damage will be caused thereto by running water.

13-3.07 SELECTED MATERIAL

When called for on the plans or in the special provisions, or when ordered by the Engineer, suitable selected material encountered in excavating or widening the roadway prism or encountered in any other excavation within the street right of way, including the excavation of local borrow, shall be used for finishing the top portion of the subgrade or for structure backfill, or used as otherwise shown on the plans or in the special provisions, or as directed by the Engineer.

Unless otherwise specified in the special provisions, selected material shall be defined as material which is excavated from one or more of the above sources designated by the Engineer, and which is used for selective purposes by direction of the Engineer.

Selected material shall be placed on the roadbed in accordance with the requirements of Section 13-3.10E for constructing earth embankments, or Section 13-3.10F for embankments at trestles or bridge ends.

When the transporting of selected material directly from excavation to its final position on the roadway will be impracticable, the selected material shall be left in place until it can be placed in final position and no additional compensation will be made because of the delayed excavation. If, however, the conditions are such that the undisturbed selected material will hamper ordinary grading operations or cause unnecessary movements of equipment, the Engineer may allow the removal of sufficient selected material and the stockpiling thereof to enable practical hauling operations. If excavation and stockpiling of selected material is specified in the special provisions or is ordered by the Engineer, the excavation and stockpiling shall be at locations designated by the Engineer, and thereafter be removed from the stockpile and placed in final position upon the roadbed when directed by the Engineer.

Measurement and payment for selected material stockpiled as above provided shall apply in accordance with Sections 13-4 and 13-5 respectively, both for excavation and haul of the selected material from its natural position, and also from the stockpile. Measurement of the material taken from stockpile will be made of the neat line volume actually removed.

13-3.08 SLIDES

Side slopes in cuts and on embankments shall be constructed as staked or reestablished by the Engineer. In case a slope finished to the lines as staked or reestablished by the Engineer shall slide back of the established slope onto the roadway prism, or out of an embankment before final acceptance of the work, such slide material shall be removed by the Contractor from the roadway, or be replaced in the embankment by him, at the unit contract price for the class of excavation involved, and the slopes shall be refinished as directed by the Engineer. The resloping will be paid for upon a force account basis as defined in Section 9-1.04.

In event the slide material cannot be measured accurately, or if the slide material will require a different type of equipment than that available on the project, payment therefor may be made on a force account basis when so authorized by the Engineer.

Materials to replace embankment slides shall be obtained from sources designated by the Engineer. Slopes

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undercut at the base or destroyed in any manner by act of the Contractor shall be resloped by him parallel to the damaged slope, or as reestablished by the Engineer, at his own cost.

13-3.09 OVERBREAK

In all materials encountered in the performance of the contract, overbreak is that portion of any such material which is excavated, displaced or loosened outside and beyond the slopes, lines, or grades as staked or reestablished, with the exception of such material which occurs as slides as described hereinbefore, regardless of whether any such overbreak is due to blasting, to the inherent character of any formation encountered, or to any other cause. All overbreak as so defined shall be removed by the Contractor at his own expense and shall be disposed of by the Contractor in the same manner as provided for the surplus under the heading of "Excavation," but at his own expense and without any allowance for haul.

Whenever it is agreed to in writing and in advance between the Contractor and the Engineer, overbreak may be used in forming any embankment as planned to replace borrow which otherwise would have to be provided for. In this event payment will be made for the volume of common borrow or solid rock borrow, as the case may be, which the overbreak replaces, at the respective contract prices per cubic yard for such borrow with the additional allowance for haul, if any, on such available borrow; provided however, that no allowance will be made for overbreak which is placed in the embankment as planned in lieu of available material coming from within the neat lines of the roadway prism.

13-3.10 EMBANKMENTS

-3.10A Foundation Treatment

The materials composing the embankments must be entirely imperishable and wherever the natural surface upon which the embankment is to be placed is of such nature as, in the judgment of the Engineer, will impair the stability or usefulness of the street, the natural surface shall be stabilized or removed and disposed of as the Engineer may direct.

Where embankments are to be made on hillsides or where a new fill is to be applied upon an existing embankment, the slopes of the original ground or embankment (except rock embankments) shall be terraced or stepped by plowing deeply or by other approved means before filling is commenced.

If ordered by the Engineer, material at the point of transition from cut to fill or in areas upon which shallow embankments are to be placed shall be excavated to a minimum depth of two (2) feet below subgrade elevation for a lateral width three (3) feet greater than the traveled roadway and for such longitudinal distance as ordered by the Engineer. The excavated material shall be deposited in the lower portion of adjacent fills or wasted if directed by the Engineer. Payment for the excavated material shall be made at the unit contract price for the class of material involved, plus haul if included. No further compensation will be made.

If ordered by the Engineer, the earth remaining in the excavated area shall be loosened to a depth of eight (8) inches or such lesser depth as ordered by the Engineer, and then be compacted. Payment for compaction of the loosened material shall be made at the unit contract price per cubic yard for "Embankment Compaction".

Following preparation of the excavated area, the void shall be filled in layers with selected material from adjacent cuts and compacted as provided in the contract. Material used to backfill the excavated areas will be paid for at the unit contract price for the class of material involved. Such payment, plus payment for haul if provided for in the bid proposal, embankment compaction (of the method specified), and water shall be full compensation for all costs involved in excavating, loading, hauling and compacting the backfill materials.

-3.10A1 Unsuitable Foundation Excavation

When shown on the plans or when specified in the special provisions, unstable natural ground shall be exca-

vated prior to the placement of embankment over the area. The unstable material may consist of peat, muck, swampy or unsuitable materials, including buried logs and stumps. The material shall be excavated by the Contractor as directed by the Engineer to give the constructed embankment full bearing on solid ground.

Materials excavated from the roadway or channel change prisms, the classification of which is covered by Section 13-1.01 will not be classified as unsuitable foundation excavation unless the removal must be accomplished by dragline operation or by special excavation methods requiring different equipment from that used for roadway excavation, in which case measurement and payment as "Unsuitable Foundation Excavation" on a per cubic yard basis will apply.

When no unit contract price is provided in the contract for "Unsuitable Foundation Excavation," such work as may be ordered by the Engineer shall be accomplished as extra work and payment will be made as provided in Section 9-1.03.

-3.10A2 Displacement of Unsuitable Foundation Materials

Where shown on the plans or where specified by the special provisions, the roadway embankments to be constructed across low, swampy ground shall be constructed on solid ground to the elevation as indicated by the roadway section on the plans. To obtain this result, the overburden of peat, muck, swampy or other unsuitable material lying above the elevation of solid ground shall be displaced or removed by the Contractor, as directed by the Engineer, to give the constructed embankment full bearing on the solid ground, as shown by the plans.

The Contractor shall displace the overburden of unsuitable materials in constructing the embankment by such methods as the Engineer may approve. The overburden material outside of the new embankment slopes which is upheaved through displacement by the fill shall be leveled off as directed by the Engineer, and left in a neat condition.

All costs and expense involved in accomplishing displacement and/or removal of unstable materials encountered below the existing surface of the ground, and for leveling the upheaved material outside of the embankment slopes, will be paid for on a basis of extra work as defined in Section 9-1.03. All other costs in connection with the work shall be considered incidental to the construction of the embankment and shall be included in the unit contract prices for the various pay items of work involved.

-3.10A3 Backfilling

Where soft or unstable materials are removed the area shall be drained, if possible, in order that the backfill may be compacted. Where drainage is impossible, backfill to be placed in water shall be granular in character except when otherwise provided in the special provisions.

-3.10B Accelerated Subsidence by Vertical Sand Drains

Where shown on the plans or where specified by special provisions the overburden of soft or unstable material lying above the elevation of firm ground shall be stabilized by the construction of vertical sand drains and a sand drainage blanket.

-3.10B1 Vertical Sand Drains Including Backfill

Prior to constructing the vertical sand drains, a working platform consisting of roadway excavated material or common borrow shall be constructed to a depth of two (2) feet, or as shown on the plans or as ordered by the Engineer, and shall be placed over the entire area where sand drains are to be constructed, and be capable of supporting light construction equipment. This platform will provide access to the areas for the construction of sand drains.

If the equipment used cannot be supported on the working platform without displacement of the underlying soft soil, the equipment shall be supported on mats. The material may be placed in one lift, but in such a manner that will cause a minimum of displacement of the underlying soil.

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Vertical holes eighteen (18) inches in diameter shall be constructed to the underlying firm strata, or to such a depth as the Engineer may direct, and the holes backfilled as hereinafter provided. The holes may be constructed by driving or jetting a casing down to the required depth, or by other approved methods.

The holes shall be vertical and shall be accurately spaced as indicated on the plans or as staked by the Engineer. Holes drilled out of place or that are damaged in excavating or backfilling shall be backfilled and abandoned, if so ordered by the Engineer, and no compensation will be allowed for excavating and backfilling holes that are abandoned.

If holes are excavated by jetting a casing to the desired depth, the jetting shall be continued for a sufficient length of time after the casing has reached final depth to remove all solid material within the casing.

After the hole has been backfilled, the casing shall be removed.

Each hole shall be inspected and approved by the Engineer before any filling material is placed therein.

Any method of construction that, in the opinion of the Engineer, is appreciably disturbing the adjacent ground, shall be discontinued.

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.

Materials for use in backfilling sand grains shall consist of clean, coarse sand or fine gravel, shall be uniformly graded from coarse to fine, and shall be of such size that when tested on U. S. Standard sieves it will conform to the following:

Passing a 1/2 inch sieve	90% - 100%
Passing a 3/4 inch sieve	65% - 100%
Passing a No. 10 sieve	40% - 100%
Passing a No. 50 sieve	3% - 30%
Passing a No. 100 sieve	0% - 4%
Passing a No. 200 sieve (wet sieving)	0% - 3%

It is the intent of these specifications that each hole be completely filled with backfill material. The Contractor shall use compressed air, or such other means as are necessary, to force the sand backfill from the casing in the event the sand does not fill the hole completely by gravity flow when the casing is removed.

-3.10B2 Sand Drainage Blanket

Before placing the sand drainage blanket the surface of the working platform shall be smoothed, and the surface of each drain shall be free of any clay or other material which may impede drainage.

The sand for the drainage blanket shall be spread uniformly over the area to a thickness of two feet above the working platform, or to such depth as directed by the Engineer.

Sand for the drainage blanket shall consist of granular material, free from wood, bark or other extraneous material and shall meet the following requirements for grading:

Passing 2 1/2 inch square opening	90% - 100%
Passing 1/4 inch square opening	30% - 100%

The portion passing 1/4 inch shall meet the following requirements for grading:

Passing U.S. No. 10 sieve	50% - 100%
Passing U.S. No. 50 sieve	0% - 30%
Passing U.S. No. 100 sieve	0% - 7%
Passing U.S. No. 200 sieve (wet sieving)	0% - 3%

It shall be the responsibility of the Contractor to select or treat the material in such a manner as to meet fully the grading requirements as specified above.

-3.10C Embankment Construction

Embankment construction shall be divided into two classes, rock embankments and earth embankments. Rock embankments shall be all, or any part, of an embankment in which the material contains 10% or more by volume of gravel or stone four (4) inches or greater in diameter. Embankments of all other material shall be considered as earth embankments.

When embankments are constructed across wet or swampy ground which will not support the weight of heavy hauling and spreading equipment, the Contractor will be required to choose such methods of spreading construction and to use such hauling and spreading equipment as will least disturb the soft foundation. When soft foundations are encountered, the lower part of the fill may be constructed by dumping and spreading successive vehicle loads in a uniformly distributed layer of thickness not greater than that necessary to support the vehicle while placing subsequent layers, after which the remainder of the embankment shall be constructed in layers and compacted as specified.

It is not the policy of the Owner to allow an increase in the planned depth of embankment material over soft, wet, or swampy ground for the sole purpose of providing support for heavy hauling and spreading equipment, unless the Contractor proves to the satisfaction of the Engineer that the planned depth is inadequate to support lighter hauling vehicles. If it proves necessary for the Contractor to use smaller hauling vehicles or different methods of embankment construction than he had originally contemplated in order to comply with the foregoing, such shall not be the basis for a claim for extra compensation. The unit contract price for the various pay items involved shall be full compensation for all labor, materials and equipment necessary to perform the work as outlined herein.

At the time of compaction, the moisture content of that portion of embankment material passing a three-fourth inch (3/4") sieve shall be not more than three (3) percentage points above or below the optimum moisture content as determined in the "Compaction Control Test" specified in Section 13-3.10E5. 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 heretofore. All costs and expenses involved in drying embankment materials shall be considered incidental to the various unit contract prices, unless a bid item or items for "Aeration Equipment" are included in the contract.

-3.10D Rock Embankment Construction

Rock embankments shall be constructed in layers not exceeding eighteen (18) inches in depth, except that when the average size of the fragments exceeds eighteen (18) inches, the layers may be as deep as required to allow their placement. Occasional fragments exceeding the average size shall be disposed of as directed by the Engineer instead of being incorporated in the embankment.

Each layer shall be compacted by routing the loaded and unloaded hauling equipment over the entire width of the roadway. In addition to compacting with hauling equipment, each layer shall be further compacted with at least one coverage of a 50-ton roller or four coverages of a 10-ton roller per six-inch depth of layer, or fraction thereof. The number of coverages for rollers weighing more than 10 tons and less than 50 tons shall be as directed by the Engineer. Rollers shall be so constructed that they will exert a reasonably uniform pressure over the area covered. Rolling may be omitted on any layer, or portion thereof when, in the opinion of the Engineer, it is not necessary.

The material shall be placed carefully so that the larger pieces of rock or boulders are well distributed. The intervening spaces and interstices shall be filled with the smaller stone and earth as may be available so as to form a dense, well compacted embankment. Each layer shall be compacted by routing the loaded transporting equipment over the entire width of the layer.

In making rock embankments, the Contractor will be required to bring the fills to within twelve (12) inches below grade, as designated by the Engineer, and to construct the remainder from fragmentary rock not to exceed six inches (6") in size from granular material to be obtained from the roadway excavations or from borrow pits as directed by the Engineer. The finer materials from rock excavations shall be saved as far as practica-

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ble for use in topping out rock fills and backfilling over the subgrade excavation in rock cuts.

-3.10E Earth Embankment Construction

Earth embankments shall be constructed in compacted layers of uniform thickness by one of the three methods, A, B and C, described in subsequent subsections. Under all methods the layers shall be carried up full width from the bottom of the embankment to avoid widening the edges after the center has been brought to grade.

On tangents, the center of embankment layers shall be constructed higher than the sides. Side hill embankments shall be constructed with the intersection with the original ground as the high point of the layer and shall uniformly slope to the outer side with a slope not to exceed 1 foot in 20 feet.

-3.10E1 Compacting Earth Embankments

Earth embankment shall be compacted with modern, efficient, compacting units satisfactory to the Engineer. The compacting units may be of any type provided they are capable of compacting each lift of the material to the specified density. The use of hauling equipment to obtain partial compaction will be allowed but the Contractor will be required to compact the full width and depth of each layer of material to the required density. The right is reserved for the Engineer to order the use of any particular compacting unit discontinued if it is not capable of compacting the material to the required density in a reasonable time.

Embankments normally shall be constructed in successive horizontal layers not exceeding eight (8) inches in loose thickness when constructed by Method B or C as specified hereinafter. If approved by the Engineer, successive horizontal layers up to a maximum depth of eighteen (18) inches may be placed, provided the required density is obtained throughout the full width and depth of each layer. Unless otherwise stated in the special provisions, earth embankments shall be constructed by Method B.

-3.10E2 Method A

Under Method A, earth embankments shall be compacted in successive horizontal layers not exceeding two (2) feet in thickness, and each layer shall be compacted by routing the loaded haul equipment over the entire width of the layer. When permitted by the Engineer, side hill fills too narrow to accommodate the hauling equipment may be placed by end dumping until the embankment material can be spread to sufficient width to permit the use of the hauling equipment upon it. Thereafter, the remainder of the embankment shall be placed in layers and compacted as specified above. Suitable mechanical tampers shall be used to compact the layers adjacent to structures that are inaccessible to the loaded haul equipment.

-3.10E3 Method B

Under Method B, earth embankments shall be compacted in accordance with Section 13-3.10E1 and in addition thereto each layer in top two (2) feet shall be compacted to at least ninety-five (95) percent of the maximum density and each layer in the lower lifts to at least ninety (90) percent of the maximum density determined by the "Compaction Control Test" specified in Section 13-3.10E5.

At all locations that are inaccessible to a roller, the embankment shall be brought up in horizontal layers and compacted thoroughly with mechanical tampers. The horizontal layers shall not exceed eight (8) inches in loose thickness, except that the layers of the top two (2) feet shall not exceed four (4) inches in loose thickness.

-3.10E4 Method C

Under Method C, earth embankments shall be compacted in accordance with Section 13-3.10E1 and in addition thereto each layer shall be compacted to at least 95 percent of the maximum density as determined by the "Compaction Control Test" specified in Section 13-3.10E5. The moisture content of the earth at the time of compaction shall be uniform throughout the layer and shall be such that the specified density can be obtained, but in no case shall it vary more than three (3) percentage points

above or below the optimum moisture content as determined in Section 13-3.10E5.

At all locations that are inaccessible to a roller the embankment shall be brought up in horizontal layers and compacted thoroughly with mechanical tampers. The horizontal layers shall not exceed eight (8) inches in loose thickness except that the layers of the top two (2) feet shall not exceed four (4) inches in loose thickness.

-3.10E5 Compaction Control Test

Optimum moisture content and maximum density for other than granular materials shall be determined in accordance with the Method of Test for Moisture-Density Relations of Soils, ASTM Designation D698, Method C.

The maximum density for granular materials shall be determined in accordance with the Washington Method for compaction control test of granular materials developed by the Materials Laboratory of the Department of Highways, Olympia, Washington, or in accordance with such other methods as may be outlined in the special provisions. Instructions for using the Washington Method may be had without charge upon request to the Materials Laboratory, Department of Highways, Olympia, Washington, 98501.

-3.10F Embankments at Structures, Trestle and Bridge Ends

The work of filling around structures and the ends of trestles and bridges and the constructing of embankments shall be undertaken and completed as soon as possible after each structure is completed, or when ordered by the Engineer.

In filling around the structure, trestle and bridge ends, the Contractor shall bring the fill up equally on all sides of the bracing and the columns of the bridge to prevent distortion of the bents and columns. This method shall also be used in bringing up the fill on both sides of the bulkheads as shown in the sketch on the plans, or as directed by the Engineer. The embankments shall be constructed under the bridge to the height and dimensions as shown on the plans, or directed by the Engineer.

The embankment and backfill at both ends of all rigid frame concrete structures which do not have provisions for expansion shall be brought up and compacted simultaneously to prevent lateral displacement of the structure due to unbalanced earth loading.

All costs in connection with the above work shall be considered as incidental to the construction of the improvement and shall be included in the unit, contract prices of the various pay items of work involved.

13-3.11 BORROW

Borrow shall consist of suitable material obtained from pits for the construction of embankments, subgrade, planting strips, sidewalk areas or shoulders and other facilities. The widening of street cuts and ditches will be considered as street excavation and not borrow.

Borrow materials, approved by the Engineer, shall be secured by the Contractor at his own expense and from a source of his own choosing.

13-3.12 STRIPPING QUARRIES AND PITS

Stripping of quarries and pits shall consist of the removal, after clearing and grubbing, of the surface material and overburden which is unsuitable for the kind of material to be borrowed or produced for use. The stripping shall be disposed of by the Contractor unless otherwise provided in the special provisions.

Whenever the Contractor elects to obtain material from a source other than that provided by the Owner, or whenever the Contractor is required by the special provisions to provide a source of material, the clearing, grubbing, and stripping therefrom shall be performed as directed by the Engineer and all costs incurred therefor shall be considered as incidental to the project and shall be included by the Contractor in his unit contract prices of borrow or processed materials to be removed.

13-3.13 COMPACTING CUT SECTIONS

When the density of the natural ground of a graded

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roadbed in a cut section, upon which a specified layer of surfacing or selected material is to be placed, is less than the requirements specified under Section 13-3.10 for the method of compaction used, the top two (2) feet of the graded roadbed shall be compacted in accordance with the requirements of Method B or Method C, whichever is specified. If ordered by the Engineer, the material shall be excavated to depth of sixteen (16) inches and stockpiled temporarily, and the underlying eight (8) inches be then loosened, watered if necessary, and compacted to the required density. The excavated material shall then be replaced in successive layers as required under Section 13-3.10E1, watered if necessary and compacted to the required density.

Where the subgrade material is excavated and temporarily stockpiled, measurement and payment will apply as specified in Section 13-3.07.

When compaction of cut sections is ordered by the Engineer, payment for compaction shall be on a cubic yard basis as outlined in Sections 13-4 and 13-5. The quantity to be paid for shall include a layer eight (8) inches in depth across the full width of the compacted area below the lowest depth excavated, but shall not exceed a total depth of twenty-four (24) inches.

13-3.14 AERATION EQUIPMENT

If test holes bored within the excavation or borrow areas show that substantial portions of either one contain moisture in excess of the optimum for proper compaction of embankments, the Owner will provide pay items for aeration equipment to reduce the moisture content of the embankment material prior to compaction. Aeration equipment may be used in the roadway excavation area, the borrow area, or on the embankments as the Engineer may direct.

Neither the exact extent of the excessively wet areas nor the climatic conditions that will prevail during construction can be determined accurately prior to construction. Consequently the Owner will assume no responsibility for the cost of aeration other than to pay the Contractor in accordance with the bid items of his proposal for furnishing and operating the equipment intended to accelerate evaporation of excess moisture.

The inclusion of bid items for aeration equipment shall not relieve the Contractor of the responsibility for employing such sound and workmanlike procedures in the prosecution of his work as are generally recognized to be effective in constructing embankments with wet materials. Open ditching to provide surface or subterranean drainage, or the placing of alternate layers of dry and wet material to reduce or control the moisture content of the composite layers, shall be considered as incidental to the excavation and all costs involved shall be included in the unit contract prices per cubic yard for "Common Excavation," per cubic yard for "Borrow (kind)," and per unit for "Haul" if "Haul" is included in the proposal.

The function of aeration equipment is to provide thin, loose layers of material from which moisture can evaporate. While certain aeration equipment has proved to be effective in reducing moisture content of embankment material, the Owner makes no claim as to the efficiency of any particular piece of equipment that may be provided as a pay item on any given project.

The Contractor shall furnish and operate such of the following equipment as may appear in the bid items, and as the Engineer shall deem best suited for the conditions encountered, and at such locations as he may direct:

Heavy duty power grader, with moldboard 12 feet long by 24 inches in height and $\frac{3}{4}$ inch thick, excepting however, that a 10 percent tolerance will be allowed for each dimension. Graders shall be equipped with V type scarifier having not less than nine (9) insert teeth.

Tamping roller with at least two (2) individually suspended drums with metal studs. The load on each tamper foot shall be not less than 135 pounds per square inch of area. The tamping roller shall be drawn by a suitable tractor. The tractor and tamping roller shall be considered a tamping roller unit.

Heavy duty roofer, and tractor capable of propelling the roofer while turning material eighteen (18) inches deep at a speed of not less than one and one-half ($1\frac{1}{2}$) miles per hour of material requiring aeration. The roofer and tractor shall be considered as an aerating unit.

Heavy duty gang plow having not less than five 16-inch bottoms, and tractor capable of propelling the gang plow while turning excavation material at least 9 inches deep at the rate of not less than $1\frac{1}{2}$ miles per hour in fairly wet material.

Heavy duty tandem disk with 24-inch disks and cutting width of at least 7 feet, complete with tractor capable of propelling the assembly at not less than 2 miles per hour while turning fairly wet material to a depth of at least 6 inches.

Heavy duty, self-propelled rotary pulverizer employing a transverse shaft with paddles attached, capable of cutting and aerating wet material to a width of at least 6 feet and a depth of 6 inches while traveling not less than $1\frac{1}{2}$ miles per hour.

The listing of the equipment described in this section, while considered most likely to be adaptable for the purposes described, will not preclude the use of other kinds or type of equipment upon a mutually agreed price between the Contractor and the Owner if, in the opinion of the Engineer, other equipment will be either as effective or more effective than that listed for bids.

The use of any of the above aerating equipment in tandem operation will not be permitted. The aerating equipment shall not be used for performing other work while used in aerating operations.

Measurement and payment for aeration equipment as above described shall be as outlined in sections 13-4 and 13-5. Payment for aerating will be made only when bid items for aeration equipment are included in the proposal unless, in the judgment of the Engineer, the provisions of Section 4-1.05 for changed conditions will apply.

13-3.15 SNOW REMOVAL

Whenever the surface of a cut or the site of an embankment is covered with snow sufficiently deep to impair the utility of the work, the snow must be removed and deposited beyond the slope stakes at the Contractor's own expense. Work of this nature shall be at least one hundred (100) feet in advance of the excavation and placing of the embankment.

13-4 MEASUREMENT

Excavation will be measured by the cubic yard in its original position by cross sectioning. Pay quantities will be computed to the neat lines of the cross sections as staked.

Borrow will be measured by the ton at the point of delivery and will be classified same as the classification for roadway and drainage excavation.

Stripping of quarries and pits will be measured by the cubic yard in its original position by cross sectioning.

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, provided however, that moisture in excess of eight (8) percent will be deducted in ascertaining the pay quantities when measured by the ton.

Embankment compaction, except embankments constructed by Method A, will be measured by the cubic yard of compacted embankment material in place. Excavation material that is wasted, and excavation or borrow material placed under water by dredging operations, by end dumping, or by other methods in which the material is not compacted in layers in accordance with the provisions of sections 13-3.10D and 13-3.10E1, shall be excluded from measurement and payment for compaction.

Section 14—Haul

Pay quantities will be computed upon the compacted portion of the embankment to the neat lines of the staked cross sections, and no allowance will be made for subsidence or settlement.

Compacting cut sections as required in Section 13-3.13 will be measured by the cubic yard of compacted material in place.

Aerating equipment will be measured for each assembly of equipment, to the nearest one-half hour for the actual periods of operation in aerating material. No allowance will be made for time consumed in making repairs to the equipment, for moving equipment to or from areas on which aeration is required, or when the towing equipment is performing other work.

13-5 PAYMENT

Payment will be made for such of the following bid items as are included and shown in any particular contract:

1. "Common Excavation," per cubic yard.
2. "Solid Rock Excavation," or "Solid Rock Excavation Including Haul," per cubic yard.
3. "Common Borrow," per ton.
4. "Unsuitable Foundation Excavation," per cubic yard.
5. "Vertical Sand Drains," per vertical foot.
6. "Sand Borrow for Drainage Blanket," per ton or per cubic yard.
7. "Water," per M gallons.
8. "Embankment Compaction," per cubic yard.
9. "Heavy Duty Power Grader with Scarifier," per hour.
10. "Gang Plow and Traction," per hour.
11. "Tandem Disc and Tractor," per hour.
12. "Heavy Duty Roofer," per hour.
13. "Heavy Duty Pulverizing Mixer," per hour.

The unit contract prices for such types and classes of excavation and borrow listed above shall be full compensation for excavating, loading, placing or otherwise disposing of the material as shown on the plans, as specified herein or as directed by the Engineer, and shall include the removal and disposal, the wasting or stockpiling of forest debris or any top soil organic matter or other deleterious matter from the surface of a cut or fill, as specified or as may be directed by the Engineer.

Except where otherwise provided, the work prescribed under the heading of "Embankment" will not be paid for directly as a pay item but shall be considered as incidental work pertaining to the placement of the several classes of excavation and borrow.

The unit contract price per vertical foot for "Vertical Sand Drains" shall be full compensation for furnishing all labor, tools, equipment and materials necessary or incidental to excavating the drain holes and for selecting, loading, hauling and placing the sand backfill material as specified above.

The unit contract price per ton for "Sand Borrow for Drainage Blanket" shall be full compensation for selecting and/or processing of the material, and for hauling and placing the material as a blanket over the sand drains.

Water will be paid for as provided in Section 16.

Payment for "Embankment Compaction" per cubic yard shall be made at the unit contract price for all compacted embankment material placed up to finish subgrade elevation, excepting that excavated material that is wasted and excavation or borrow material placed under water, or placed by dredging operations, or by end dumping or by any other method where compaction in uniform layers is not practicable, shall be excluded from the pay quantity, and excepting further that payment for "Embankment Compaction" will not be made for embankments constructed by Method A.

The unit contract price per cubic yard for "Embankment Compaction" shall be full compensation for all materials, labor, tools, equipment and incidentals required to complete the compaction of embankments in accordance with the specifications.

The quantities for embankment compaction represent the best judgement of the Owner as to the quantities

that will be involved in compacting embankments and cut sections. The owner does not guarantee these estimated quantities, however, and the Engineer will be the sole judge as to the actual quantities required.

Where solid rock is encountered on a project not bid as "unclassified excavation" and for which there is no pay item for solid rock excavation included in the proposal, then in that event 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 9.03.

Compensation will be made for "Haul" in accordance with Section 14 at the unit price bid. If a bid item for "Haul" is not included in the project, the provisions for payment of "Solid Rock Excavation," as outlined above shall include haul.

Clearing and grubbing of borrow pits and channel excavation areas will be paid for as specified in Section 12. Clearing and grubbing of ditch excavation areas shall be considered as incidental to the construction, and the costs thereof shall be included in the pay item of ditch or channel excavation involved.

Section 14—Haul

14-1 DESCRIPTION

On much of the municipal work of excavation the method and details of haul and the payment therefor will be specified in the special provisions and the pay item, if any, will be shown in the proposal.

On projects involving large volumes of excavated materials requiring more or less balancing of quantities from cuts into fills, the plans may provide for measurement and payment of haul upon the "unit" basis. The specifications which follow are adaptable to such a method of measurement and payment for haul only when the unit contract price per "unit" for "Haul" is included in the proposal.

Under these specifications, the Contractor will not be allowed to waste and borrow in lieu of hauling the material as required. No allowance will be made for cross haul of material unless specifically ordered by the Engineer.

14-2 MEASUREMENT

14-2.01 HAUL QUANTITIES

Haul will be computed in "units" of 100 cubic yard stations for the transportation of excavated material. The quantity of cubic yard stations of haul is the product of the volume of the material measured in its original position in cubic yards by the distance transported, measured in stations of 100 feet. A cubic yard station of haul is, therefore, the equivalent of one cubic yard of material hauled one station. The measure of one "unit" of haul will represent 100 cubic yard stations.

The method of computing the haul shall be by the application of the mass diagram as shown on the Standard Mass Diagram, which is available for distribution upon request to the Director of Highways, Olympia, Washington.

Copies of the location mass diagram, when applicable for any particular project, will be made available to the Contractor upon request.

14-2.02 ROADWAY AND AUXILIARY LANES

Haul quantities will be computed on the basis of transporting the materials along the center line or base line of the highway or street without regard for any lateral distance from the outer limits of the right of way. Quantities thus computed will include the roadway prism or prisms, auxiliary lanes, borrow obtained by the widening of cuts, and waste deposited within the right of way and contiguous areas designated for wasting. Auxiliary lanes include frontage roads, speed change lanes, paralleling and loop ramps, cross roads and other lanes supplementary to through traffic movements.

Section 15—Subgrade

On multi-lane streets where more than one center line or base line along the through traffic lanes is shown on the plans, the line on which haul is to be computed will be indicated on the plans or described in the special provisions.

In the event haul is to be computed on any base line other than as hereinbefore specified, the lines will be described in the special provisions.

14-2.03 BORROW OR WASTE

Haul on borrow or waste other than as included above will be computed in the following manner:

Quantities of excavation or embankment, as the case may be, will be computed normal to the long axis of the borrow pit or waste site. The distance of haul will be computed along the long axis, thence by the shortest and most practicable route to the street center line from the end of the axis nearest to the street center line, unless a haul route is designated on the plans or in the special provisions in which case the haul distance will be measured along the designated route. If the Contractor elects to use a route shorter than the computed or designated route, payment will be made on the basis of the length of route actually used.

The haul on borrow materials from sources furnished by the Contractor will be paid for according to the actual amount of haul from the sources from which the borrow is taken, provided, however, that no allowance will be made for haul from such sources in excess of the quantity computed from the sources specified in the contract.

14-3 PAYMENT

The contract price per unit of "Haul" shall be full compensation for all costs and expenses involved in the transportation of the materials.

Section 15—Subgrade

15-1 DESCRIPTION

The subgrade will be considered as those areas and surfaces of new or existing streets, alleys, driveways, sidewalks or other public places upon which additional materials are to be placed under contract, or which are to be constructed or prepared for the future placement thereupon of other materials in accordance with these specifications, the plans, the special provisions, and which will be staked for lines and grades by the Engineer.

No additional compensation will be made for any work required to accomplish the intent of this section except for payment at the unit contract prices for furnishing and compacting such additional material of the type ordered by the Engineer that may be necessary to bring the subgrade to the required line, grade and cross section.

All underground work contemplated in the area of the subgrade shall be completed and properly backfilled before subgrade work is started. This is intended to include work on the contract, work to be performed by the Owner, or by others.

These specifications are to be used in conjunction with requirements in those sections of the specifications having to do with specific types of base materials and pavements.

15-2 CONSTRUCTION DETAILS

15-2.01 SUBGRADE FOR BASE MATERIALS

In advance of setting line and grade stakes, the subgrade area shall be cleared of brush, weeds, vegetation, grass and debris, all of which shall be satisfactorily disposed of. All depressions or ruts which contain water shall be drained. The subgrade shall then be bladed and dragged to remove inequalities and secure a uniform surface.

After the foregoing requirements have been complied with, the proper alignment and grades will be given by

the Engineer. Where normal crown sections are being constructed, stakes will be set at convenient offsets at intervals not to exceed fifty (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.

If ordered by the Engineer, an existing subgrade shall be compacted to 95% of maximum density measured in accordance with Section 13-3.10E5, or such other density as required by the Engineer, by use of such compaction equipment as called for in the special provisions or as ordered by the Engineer. The compaction equipment shall comply with the requirements of Section 15-2.01A. Payment for compaction of subgrade shall be as outlined in sections 15-3 and 15-4.

All soft, spongy, or yielding spots which may be ordered removed by the Engineer, shall be entirely removed and the space refilled with suitable material and thoroughly compacted. Removal of such unsuitable material will be paid for as Extra Work as provided in Section 9-1.04 unless the unsuitable area was caused by the negligence of the Contractor in his operations. In such case, the removal, replacement and compaction shall be done by the Contractor at his own expense.

The final finishing shall be to a height above the finished subgrade cross sections as may be determined, by trial and experience, to be proper to ensure thorough compaction to the grade as staked, by rolling.

When ordered by the Engineer, the Contractor shall sprinkle the subgrade with water in such quantities as directed, which will be paid for at the unit contract price for "Water".

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.

15-2.01A Compacting Equipment

When called for on the plans or in the special provisions, or when ordered by the Engineer, the Contractor shall furnish any one or more of the following compacting equipment as may be specified or required:

Variable Load Compactor: A variable load compactor shall consist of four (4) pneumatic-tired wheels in a single axial line but supported on one or more axles, together with a box or body which will permit loading within specified amounts. Each tire shall be not less than sixteen (16) inches in width and shall support air pressure up to ninety (90) pounds per square inch. All tires shall be of equal size and diameter, with treads satisfactory to the Engineer, and the pressure in the several tires shall not vary from each other more than five (5) pounds per square inch.

The wheels shall be so mounted that they will not make locking contact at any time, and will permit free rocking and wheel oscillation so that equal bearing pressure will be applied to the ground at all times. The wheels shall be so mounted that the total weight of the vehicle and contents will be distributed equally to all wheels. The box or boxes shall be of sufficient capacity that a total maximum weight of not less than thirty-five (35) tons nor more than fifty (50) tons can be attained in the compactor.

The weight of the compactor shall be as approved by the Engineer to obtain maximum compaction. The compactor shall be drawn by a vehicle of sufficient horsepower to enable the unit to travel through a loose layer eighteen (18) inches thick at a speed of at least four (4) miles per hour. The towing vehicle and the roller meeting the above requirements shall be considered a variable load compactor unit.

Grid Roller: A grid roller shall consist of two or more cylindrical drums independently mounted on a common shaft in a rigid frame. Each drum shall have a minimum outside diameter of five feet (5') and a minimum width of two feet six inches (2'6"). The overall width of the roller exclusive of frame shall be not less than five feet six inches (5'6") of which not more than

Section 15—Subgrade

six inches (6") shall be used for center spacing between two roller drums. The face of the drums shall have the appearance of woven open-mesh made by interlacing bars of not less than one and one-fourth inch (1¼") nor more than one and three-fourths inch (1¾") diameter spaced on four and one-half inch (4½") to five and one-half inch (5½") centers. Net opening between the bars shall be not less than three inches (3") nor more than four inches (4").

The roller shall be so constructed that counterweights can be used to adjust the gross weight of the roller to not less than 30,000 pounds. The grid roller shall be drawn by a power unit capable of propelling the fully loaded roller through six (6) inches of loose embankment material at a speed of at least four (4) miles per hour.

The power unit used to draw the grid roller shall be used exclusively for that purpose at all times when material is being compacted. The power unit and the grid roller including counterweights, all meeting the above specifications, shall be considered a grid roller unit.

Pneumatic Tired Roller: The pneumatic tired roller shall have a minimum gross weight of 8 tons and a minimum width of 5 feet. Wobble wheel rollers will not be permitted. The tires shall be of equal size, diameter and ply rating with smooth treads. The inflation pressures of the several tires shall not vary more than 5 pounds per square inch from the designated pressure. Tires shall be so spaced that the entire gap between adjacent tires will be covered by the tire which follows, at all operating tire pressures.

The relationship between tire sizes, tire characteristics, ply rating, tire inflation pressures and operating weights per tire shall be such that the roller is capable of developing tire contact pressures on the roadway through the entire range of 40 and 80 pounds per square inch. The exact contact pressure to be used within that range shall be as directed by the Engineer.

Smooth-wheeled Power Roller: A smooth-wheeled power roller shall be a modern, self-propelled, three-wheeled roller weighing not less than ten (10) tons and providing a compression on the rear wheels of not less than 325 pounds per linear inch of tire width.

Vibratory Compactor: The vibratory compacting unit shall be a self-propelled multiple shoe vibratory such as the Jackson Multiple Vibratory Compactor, the Lima Roadpacker Model C, or equal. The unit shall have an adjustable compactor width from a minimum of eight (8) feet to a maximum of approximately thirteen (13) feet. Within range of width, the greatest number of compactor shoes commensurate with the width of the area being compacted shall be used as directed by the Engineer.

Tamping Roller: The tamping roller shall have at least two (2) individually suspended drums with metal studs. The load on each tamping foot shall be not less than 135 pounds per square inch of area. The tamping roller shall be drawn by a suitable tractor, and the tractor and tamping roller shall be considered as a tamping roller unit for measurement and payment.

Mechanical Tamper: A mechanical tamper shall be air or gasoline driven. The air-driven mechanical tamping unit shall consist of an air-driven tamper together with all necessary incidental equipment. The tamper shall be operated at an air pressure of not less than seventy-five (75) pounds per square inch. The tamping foot shall have an area of not less than nineteen (19) square inches nor more than twenty-nine (29) square inches. If approved by the Engineer, tampers conforming to the above and assembled in groups may be used, provided that the total tamping area of the assembly is not less than fifty-nine (59) nor more than eighty-five (85) square inches.

The gasoline-driven mechanical tamping unit shall be equipped with a tamping foot of not less than fifty-nine (59) nor more than eighty-five (85) square inches in area. The gasoline-driven tamper shall operate by alternately rising and falling approximately fifteen (15) inches and delivering a blow of not less than 250 foot-pounds with each fall.

A basic mechanical tamping unit shall have a tamping foot area of not less than nineteen (19) nor more than twenty-nine (29) square inches. An increase of fifty percent (50%) in the quantity of hours for "Mechanical Tamper" will be paid for units having a total tamping area between fifty-nine (59) and eighty-five (85) square inches during the time that such units are used for compaction.

15-2.02 SUBGRADE FOR CEMENT CONCRETE PAVEMENT

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 one (1) foot outside the edge of the pavement with a compacting unit meeting the requirements of Section 15-2.01A. All portions of the surface on the subgrade which are inaccessible to the compactor shall be thoroughly compacted with a mechanical tamper.

All soft, spongy or yielding spots and all vegetable or other objectionable matter shall be entirely removed and the space refilled with suitable material and thoroughly compacted. The removal of such unsuitable material will be paid for as extra work as provided in Section 9.03, unless the unsuitable area is caused by negligent operations of the Contractor. In such case, the removal, replacement and compaction shall be done by the Contractor at his own expense.

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 saturated with water from twelve (12) to forty-eight (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 one and one-half (1½) feet inside of the edge of the proposed pavement or form to one (1) foot outside of the edge of the pavement or form shall be brought to an elevation that is not more than one (1) inch above or below the elevation for the finished subgrade over this area before stakes will be set for the forms.

15-2.03 PROTECTION OF SUBGRADE

After preparing the subgrade as above specified, all unnecessary traffic shall be kept off. Should it be found necessary to haul the aggregate and cement over the prepared subgrade, the Contractor shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped immediately preceding the placing of the concrete. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross section, will not be permitted. The Contractor shall protect the prepared subgrade from both his own and public traffic.

If, in the opinion of the Engineer, it should be necessary, the Contractor will be required, at his own expense,

to plank the subgrade before hauling materials or equipment over it.

15-3 MEASUREMENT

Compaction of subgrades, except as provided for under other sections of these specifications, will be measured to the nearest one-half (1/2) hour of actual time consumed in compacting for the various types of equipment used. No allowance will be made for time consumed in making repairs to the equipment, for moving equipment to or from areas on the work on which compaction is required, or when the towing equipment is performing other work.

15-4 PAYMENT

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

1. "Variable Load Compactor," per hour.
2. "Grid Roller," per hour.
3. "Pneumatic-tired Roller," per hour.
4. "Smooth-wheeled Power Roller," per hour.
5. "Vibratory Compactor," per hour.
6. "Tamping Roller," per hour.
7. "Mechanical Tamper," per hour.
8. "Water," per M gallons.

When any work described in this section is required but no item of payment is provided therefor in the proposal, the work required shall be considered as incidental to the construction and all costs thereof shall be included by the Contractor in other pay items of the contract.

All other costs for labor, materials, tools, and equipment required for, or incidental to, the preparation, shaping, maintaining, and protection of the subgrade, except as outlined in Section 15-1, shall be included in the unit contract price in place for the particular class of surfacing or paving involved. No additional payment will be made for the preparation, shaping, and protection of the subgrade.

Water, when required and used to secure adequate compaction of the subgrade, shall be measured and paid for in accordance with the provisions of Section 16. Water used in sprinkling the subgrade for maintenance purposes shall not be a pay item, unless ordered by the Engineer.

The compacting equipment described in Section 15-2.01A will be considered pay items when used for compacting subgrades as specified in Section 15-2.01. Compaction required in Section 39-3.14 will not be a pay item. The accepted hourly quantities for compacting at the contract price per hour for "Variable Load Compactor," "Grid Roller," "Pneumatic-tired Roller," "Smooth-wheeled Power Roller," "Vibratory Compactor," "Tamping Roller," and "Mechanical Tamper" shall be full compensation for all materials, labor, equipment, tools and incidentals necessary to complete the compaction of subgrades in accordance with these specifications.

The proposal quantities for any type of compacting equipment represent the best judgment of the Owner as to the amount of rolling and compacting that will be necessary to secure compaction of subgrades in accordance with these specifications. The Owner does not, however, guarantee these quantities, and the Engineer will be the sole judge as to the type of compacting equipment to be used and the number of hours required.

Towing different types of rollers in tandem will not be allowed; however, additional towed rollers of the same type for tandem use with fully powered units may be used when authorized in writing by the Engineer. Additional rollers, when so used, will be paid for by an increase of fifty percent (50%) in the number of hours for the type of roller and for the time each additional roller is used for subgrade compaction.

Section 16—Water**16-1 DESCRIPTION****16-1.01 WATER FOR STREETS**

Water for compacting embankment, constructing subgrade, placement of screened gravel and crushed surfacing, and for laying dust caused from grading operations or public travel, if ordered by the Engineer, shall be applied in the amounts and places designated by the Engineer and payment will be made therefor as described in Section 16-5. Water for sprinkling the subgrade between ribbons ahead of placing cement concrete pavement as required in sections 15 and 39 shall be considered as incidental to the construction of the pavement and the costs thereof shall be included by the Contractor in the unit contract price per square yard of "Cement Concrete Pavement", or other pay items of the contract.

16-1.02 WATER FOR TRENCHES

Where water settling is required for compaction of trench backfill, the jetting method or the sluicing method shall be used. The method of water settling will be determined in the field to best suit the local site conditions.

16-2 SOURCE OF WATER AND GENERAL REQUIREMENTS**16-2.01 WATER SUPPLY**

The Contractor shall make arrangements for and provide all necessary water at his own expense, unless otherwise provided in the special provisions.

If the Contractor purchases water from a water utility at a fire hydrant on or near the project, all arrangements shall be made by him at his own expense and payment be made the utility on basis of the actual quantity of water metered.

16-2.02 REQUIREMENTS AND RESPONSIBILITY

The Contractor shall use only those hydrants designated by the agency in charge of water distribution and in strict accordance with its requirements for hydrant use.

The Contractor shall secure permission from and comply with all requirements of the water utility before obtaining water from the fire hydrants. The Engineer shall also be notified by the Contractor of such permission as soon as granted.

The Contractor shall use hydrant wrenches only to open hydrants. He shall also make certain that the hydrant valve is open "full", since "cracking" the valve causes damage to the valve. An approved auxiliary valve shall be provided on the outlet line for control purposes. Fire hydrant valves must be closed slowly to avoid a surge in the system which creates undue pressure on the water lines. The Contractor shall carefully note the importance of following these directions.

If one of the Contractor's employees shall knowingly or unknowingly use the wrong wrench on a hydrant and thereby damage the hydrant valve stem, the Contractor will be responsible. He shall immediately notify the water utility so that the damage can be repaired as quickly as possible.

Upon completing the use of the hydrants, the Contractor shall notify the water distribution agency, so that the hydrants may be then inspected for possible damage. Any damage resulting from the use of the hydrants by the Contractor will be repaired by the water agency and the cost thereof shall, if necessary, be withheld from the final payment to the Contractor.

The Contractor shall furnish all connectors, wrenches, valves, and small tools that may be necessary to meet the requirements of the water distribution agency pertaining to hydrant use.

Violation of these requirements will result in fines and will lay the Contractor liable for damage suits because of malfunctioning of damaged fire hydrants, in the event of fire.

16-3 CONSTRUCTION DETAILS**16-3.01 GENERAL**

The Contractor shall furnish all hose and equipment necessary for sluicing or jetting. Minimum size of hose shall be such as will provide 35 pounds per square inch pressure at the discharge where jetting is being performed. The jet shall be a rigid iron pipe with a minimum diameter of one (1) inch, and of such length as may be directed by the Engineer.

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.

16-3.02 WATER FOR STREETS

Water upon streets shall be applied by sprinkling with tank trucks equipped with spray bars and suitable apparatus. When directed by the Engineer, sprinkling shall be done at night or in the early morning hours when evaporation loss is at a minimum.

16-3.03 WATER FOR SETTLING TRENCHES**-3.03A Jetting**

Jets shall be inserted at not more than four (4) foot intervals as measured in any direction through the entire width of the top of trench backfill. Penetration shall be to the crown of the pipe, to native ground on side slopes, and to the preceding lift. The jetting operations shall be completed as closely as is practicable to the pipe laying and backfilling operation. In excessively deep trenches and where the Engineer may direct, the backfill shall be placed in two or more lifts and each be jetted separately.

Where the backfill has been placed and traffic has compacted the surface, the Contractor shall loosen and shape the surface with a motor patrol, as directed, before water settling is begun. Ponding will be required after the jetting only if and whenever the Engineer deems it to be necessary.

Hydrant settling water shall be utilized when hydrants or other sources of water exist within seven hundred (700) feet of the operations.

Hauled settling water shall be utilized when the water settling operation is more than seven hundred (700) feet from a hydrant.

-3.03B Sluicing

The rate and manner of placing the backfill material shall be such as to provide for the sluicing of the entire depth of backfill into its final position.

Payment for sluicing will be made in the same manner as for jetting.

16-4 MEASUREMENT

Water will be measured by unit of one thousand (M) gallons in tanks or tank trucks of known capacity, or by means of meters of a type approved by the Engineer, which shall be furnished and installed by the Contractor at his own expense.

16-5 PAYMENT

Payment will be made for such of the following bid items as are included in any particular contract:

- "Water", per M gallons
- "Hydrant Settling Water", per M gallons
- "Hauled Settling Water", per M gallons

The unit contract price per one thousand (M) gallons of water shall be full compensation for furnishing all labor, materials, tools, equipment and doing all work incidental to furnishing, hauling and applying water as herein specified.

Section 17—Excavation for Structures**17-1 DESCRIPTION**

The provisions of this section of the specifications concern the removal or excavation of all materials of whatsoever nature that is necessary for the construction of footings, bases or any other foundation work required to support pump stations, headwalls, water tanks, transmission towers, and similar structures.

This section shall not apply to all bridges, retaining walls, concrete culverts, cribbing, and similar structures (See Division V.).

This section also contains the provisions which govern the construction and subsequent removal of all shoring, cribs, cofferdams or caissons; the pumping which may be necessary for the execution of the work, and the placement and compaction of all necessary backfill.

It is not intended that excavation for culverts, sewers and water mains and their appurtenances, manholes, inlets and catch basins, conduits and miscellaneous work covered elsewhere in these specifications or in the special provisions shall be considered as structure excavation.

Attention is called to the fact that the provisions of these specifications dealing with a separate payment for shoring and cribs apply only where an item for "Shoring and Cribs or Extra Excavation" appears on the plans and proposal for a specific structure. Where no such item is shown, the cost of any shoring and cribs that may be required shall be included in the unit contract price bid for structure excavation.

17-1.01 CLASSIFICATION

Structure excavation will not be further classified into solid rock excavation or common excavation, nor into wet or dry excavation. Structure excavation shall include the necessary grubbing of structure sites which otherwise would not be grubbed, the excavation of any and all formations encountered inside the limits which define structure excavation, and the removal and disposal of all debris, including submerged or buried timber, and all pumping that may be necessary for draining and dewatering the excavation. It shall also include the furnishing of all equipment necessary for the performance of this work, the placement of all necessary backfill inside the limits which define structure excavation, as hereinafter specified, and the disposal of excavated material that is not required for backfill.

For those structures for which a bid item of shoring and cribs or extra excavation is shown on the plans, all work involved in the construction, placing and subsequent removal of shoring, cribs, cofferdams or caissons shall be classified and paid for as "Shoring and Cribs or Extra Excavation," lump sum. If excavation by means of an open pit is allowed and no shoring or cribs are required, the bid item for shoring and cribs will then cover the excavation of any and all material outside the limits which define structure excavations, including the removal and disposal of all debris or buried timber encountered outside such limits, the furnishing of all the equipment required, and the placement and compaction of all necessary backfill in the areas outside the limits that define structure excavation.

17-3 CONSTRUCTION DETAILS**17-3.01 PRESERVATION OF CHANNEL**

When foundations or substructures are to be constructed in or adjacent to running streams, no excavation shall be done outside of cribs, cofferdams, caissons or sheet piling, nor shall the natural stream bed adjacent to the structure be disturbed without the written permission of the Engineer. If any open pit excavation or dredging is permitted at the site of the structure before the placement of cribs or cofferdams, the Contractor shall, after the foundations are in place, backfill such excavations to the original surface of the stream bed with material satisfactory to the Engineer. The backfilling material shall be of such quality and shall be placed in such a manner that it will offer the same resistance to scour as the material removed.

Section 17—Excavation for Structures

Materials deposited from foundation excavations within the stream area shall be removed and the stream bed freed from obstruction thereby. On navigable streams the Contractor shall at all times maintain the depth of water and horizontal clearances required for the passage of water traffic. He shall also furnish and maintain all necessary channel signals and lights during the construction period.

17-3.02 EXCAVATION IN OPEN PITS

When footings can be placed in the dry without the use of cofferdams and when cofferdams are not necessary for the preservation of conditions affecting the safety of the completed structure, the Engineer may permit the excavation of open pits without shoring, cofferdams or cribs. Such pits shall be constructed with side slopes sufficiently flat to prevent sliding or caving. The Contractor shall assume full responsibility for the prevention of slides adjacent to any such excavation, and in the event of any such slide the Contractor shall remove the additional material brought down by the slide at his own expense.

In case the material disturbed by a slide lies within an area upon which a portion of the structure is to be constructed, the Contractor shall excavate the disturbed material and backfill the excavated area to the original ground line with material satisfactory to the Engineer. This material shall be placed and compacted in the manner specified elsewhere herein. All costs in connection with excavating, backfilling, compacting and restoring such a slide area to its original position and condition shall be borne by the Contractor.

When water is encountered, ample provision shall be made for draining or pumping, and the excavation shall be accomplished by such means as will prevent stirring up or softening the bottom. Foundation material unduly disturbed or softened by the use of equipment in the bottom of the pit or by inadequate handling of water shall be removed by the Contractor at his own expense. Such material removed shall be replaced, at the Contractor's own expense, with material satisfactory to the Engineer. When the condition of the earth is such that the sides of the lower part of the excavation will stand vertically, back forms may be omitted with the approval of the Engineer, and the concrete for the footing may be deposited against the undisturbed earth. When back forms are omitted, the lower part of the excavation shall be made to the neat size of the footings, and if larger than neat dimensions, the cost of additional concrete shall be borne by the Contractor.

17-3.03 DEPTH OF FOOTINGS

Foundation for all structures shall be excavated to the depth and lines indicated on the plans or established by the Engineer. The Engineer may require the Contractor to excavate below the elevations shown on the plans, or may order him to stop above the elevations shown, depending upon where suitable foundation material is encountered.

17-3.04 PREPARATION FOR PLACING FOUNDATIONS

In solid rock or other hard material, the excavation shall be carried at least one foot into the rock or hard material to form a key for the concrete footing, or to such additional depth as shown on the plans. The bottom of the pit shall be cleaned of all loose material and cut to a firm surface, either level, stepped or serrated, as may be directed by the Engineer. The bottom of the foundation pit for an arch abutment shall be level or stepped as shown on the plans and the side of the pit back of the abutment shall be trimmed to true lines to permit placing of concrete against undisturbed material. When concrete is to rest on an excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation and the final removal of all loose or soft material shall be made just before the concrete is placed.

17-3.05 SHORING, CRIBS AND COFFERDAMS

Except as provided in Section 17-3.02, all excavations shall be shored, braced, or protected by cofferdams in accordance with approved methods. No excavation or dredging shall be done before shoring, crib or cofferdams are placed, 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 or cribs for foundation construction shall, in general, be carried well below the bottom of the footings and shall be well braced and as watertight as practicable. The interior dimensions of the cofferdams shall be such as to give sufficient clearance for the construction of the forms and the inspection of the concrete exteriors, and to permit pumping outside of the forms.

Where piles are required, the cofferdam shall be of sufficient size to permit the driving of the piles in the exact positions shown on the plans without interference from the wales or bracing. Cofferdams or cribs which are tilted or moved laterally during the process of sinking shall be righted or enlarged so as to provide the necessary clearance, and 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.

For substructure work, the Contractor shall submit four (4) sets of drawings showing his proposed method of cofferdam construction and other details left open to his choice or not fully shown on the Engineer's drawings. Such drawings shall be approved by the Engineer before construction is begun, but such approval shall not relieve the Contractor of responsibility for satisfactory results.

Upon completion of the work, all cofferdams and cribs shall be removed to the natural bed of the stream or channel, and on navigable streams they shall be removed to such elevations as required for depth of stream or channel to conform to the requirements of the regulations of the Corps of Engineers, U. S. Army. Removal shall be effected in such a manner as to not disturb or mar the finished concrete.

17-3.06 PUMPING

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 of such dimensions as may be necessary. The water shall then be pumped out and the rest of the concrete placed in the dry. When weighted cribs are used and the weight is utilized to partially overcome the hydrostatic pressure acting against the bottom of the foundation seal, special anchorage such as dowels or keys shall be provided to transfer the entire weight of the crib into the foundation seal.

During the placing of a foundation seal, the elevation of the water inside the cofferdam shall be controlled with respect to the water elevation outside in order to prevent any flow through the seal in either direction. The cofferdam shall also be vented at the elevation of the water on which the designed thickness of the seal is based.

Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of any portion of the concrete materials being carried away. No pumping will be permitted during the placing of the concrete or for a period of 24 hours thereafter, unless it be done from a suitable sump separated from the concrete work by a water-tight wall.

Pumping to dewater a sealed cofferdam shall not commence until the seal concrete has set sufficiently to withstand the hydrostatic pressure. In general, no seal of the gravity type shall be dewatered until the concrete has set for at least three (3) days, and no seal containing piling shall be dewatered until the concrete has set for at least ten (10) days. These periods may be extended if, in

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the opinion of the Engineer, it is necessary for the safety of the structure.

17-3.07 INSPECTION

The Contractor shall notify the Engineer before starting any excavation. From time to time during the progress of excavation, the Engineer will examine the character of material taken out. He shall have authority to stop the excavation at any time to make bearing tests and the Contractor shall give any assistance the Engineer may need in making such tests.

Single bearing test periods shall not exceed 72 hours. Material and labor furnished by the Contractor for such tests will be paid for on a force account basis except that the Contractor shall maintain the ordinary working conditions at the bottom of the excavation during test periods, at his own expense. 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.

17-3.08 DISPOSAL OF EXCAVATED MATERIAL

The material obtained from structure excavation shall be used as the Engineer may require, either in construction embankments, or for backfilling over and around the structures after they are complete, or in case it is unsuitable or not required for either of these purposes it shall be disposed of as directed by the Engineer.

17-3.09 BACKFILLING

All material used for backfill shall be of a quality acceptable to the Engineer and shall be free from large or frozen lumps, wood, or other extraneous matter. The backfilling of openings made for structures shall be considered as a necessary part of the excavation, although the Engineer may require that the material for use in making a backfill be obtained from a source entirely apart from the structure, in which case compensation will be on a force account or agreed price basis unless otherwise specified. Except as may be otherwise specified hereinafter, 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, in general, the top surface of the backfill shall be neatly graded.

Backfill in existing street areas or in areas that must support roadway embankment or which is a part of any roadway embankment, shall be placed in horizontal layers not more than six (6) inches thick, and each layer shall be tamped and compacted to 95% of the maximum density as determined by the "Compaction Control Test" in Section 13-3.10E5.

The use of mechanical tampers may be required for compacting backfill for certain items as shown in the individual specifications for such items, and as may be required in the special provisions or on the plans where greater density than that specified above is to be obtained. Mechanical tampers, when required, will be paid for as a separate bid item. Mechanical tampers shall comply with the provisions of Section 15-2.01A.

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

The Engineer may order the backfill around piers and in front of abutments and wings to be of stone or lean concrete if the excavation has been in hard material exposed to erosion. Backfill of this nature will be paid for by force account unless otherwise provided for in the proposal. If the material used in making the backfill is too dry to permit proper compaction, the Engineer may require the addition of sufficient water to allow satisfactory compaction. Compensation for the use of water for

this purpose shall be included in the contract prices for "Structure Excavation," and for "Shoring and Cribs or Extra Excavation."

No backfill shall be placed against any concrete structure until the concrete has set at least twenty-one (21) days.

17-4 MEASUREMENT

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 limits hereinafter defined, regardless of whether the excavation is made within a cofferdam enclosure or in an open pit. Any additional excavation outside of these limits shall be considered as having been made for the Contractor's benefit and all costs in connection with such excavation shall be at expense of the Contractor.

The horizontal limits for measuring the structure excavation for payment shall be for material removed up to but not beyond one foot outside the vertical planes of the footings, as shown on the plans.

The bottom limits for measuring the excavation for footings shall be the elevation of the bottom of the footing, as shown on the plans 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 upper limit for measuring excavation shall 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 the removal of certain materials in advance of excavation for structures and for which there is a designated pay item in the same contract, or in a separate contract, the upper limit shall be the completed subgrade of the designated grading section, as shown on the plans.

No measurement will be made of the materials involved in shoring, cribs, cofferdams and caissons.

The use of mechanical tampers will be measured only when compacting backfill within the limits which define structure excavation, and will be measured by the hour to the nearest one-half ($\frac{1}{2}$) hour of actual time consumed in compacting backfill. No allowance will be made for time consumed in making repairs to the equipment, or in moving the equipment to or from the work on which compaction is required.

17-5 PAYMENT

Excavation for structures will be paid for under such of the following bid items as are included and shown in any particular contract:

1. "Structure Excavation," per cubic yard.
2. "Shoring and Cribs or Extra Excavation," lump sum.
3. "Mechanical Tampers," per hour.

17-5.01 STRUCTURE EXCAVATION

Payment will be made at the unit contract price per cubic yard for "Structure Excavation" which price shall be full compensation for all necessary pumping, bailing, draining, the diversion of streams and all other work involved, including backfilling over and around structures to the original surface of the ground and disposing of all debris and surplus material, and for all necessary labor, materials, tools, and equipment. It shall also include the construction and subsequent removal of all cribs, cofferdams, caissons, and shoring, except where the construction of cribs, cofferdams, caissons and shoring is paid for under the bid item "Shoring and Cribs or Extra Excavation," per lump sum.

Payment for structure excavation carried below the elevations shown on the contract plans by order of the Engineer, will also be made at the unit contract price per cubic yard for structure excavations except as follows:

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Materials deposited from foundation excavations within the stream area shall be removed and the stream bed freed from obstruction thereby. On navigable streams the Contractor shall at all times maintain the depth of water and horizontal clearances required for the passage of water traffic. He shall also furnish and maintain all necessary channel signals and lights during the construction period.

17-3.02 EXCAVATION IN OPEN PITS

When footings can be placed in the dry without the use of cofferdams and when cofferdams are not necessary for the preservation of conditions affecting the safety of the completed structure, the Engineer may permit the excavation of open pits without shoring, cofferdams or cribs. Such pits shall be constructed with side slopes sufficiently flat to prevent sliding or caving. The Contractor shall assume full responsibility for the prevention of slides adjacent to any such excavation, and in the event of any such slide the Contractor shall remove the additional material brought down by the slide at his own expense.

In case the material disturbed by a slide lies within an area upon which a portion of the structure is to be constructed, the Contractor shall excavate the disturbed material and backfill the excavated area to the original ground line with material satisfactory to the Engineer. This material shall be placed and compacted in the manner specified elsewhere herein. All costs in connection with excavating, backfilling, compacting and restoring such a slide area to its original position and condition shall be borne by the Contractor.

When water is encountered, ample provision shall be made for draining or pumping, and the excavation shall be accomplished by such means as will prevent stirring up or softening the bottom. Foundation material unduly disturbed or softened by the use of equipment in the bottom of the pit or by inadequate handling of water shall be removed by the Contractor at his own expense. Such material removed shall be replaced, at the Contractor's own expense, with material satisfactory to the Engineer. When the condition of the earth is such that the sides of the lower part of the excavation will stand vertically, back forms may be omitted with the approval of the Engineer, and the concrete for the footing may be deposited against the undisturbed earth. When back forms are omitted, the lower part of the excavation shall be made to the neat size of the footings, and if larger than neat dimensions, the cost of additional concrete shall be borne by the Contractor.

17-3.03 DEPTH OF FOOTINGS

Foundation for all structures shall be excavated to the depth and lines indicated on the plans or established by the Engineer. The Engineer may require the Contractor to excavate below the elevations shown on the plans, or may order him to stop above the elevations shown, depending upon where suitable foundation material is encountered.

17-3.04 PREPARATION FOR PLACING FOUNDATIONS

In solid rock or other hard material, the excavation shall be carried at least one foot into the rock or hard material to form a key for the concrete footing, or to such additional depth as shown on the plans. The bottom of the pit shall be cleaned of all loose material and cut to a firm surface, either level, stepped or serrated, as may be directed by the Engineer. The bottom of the foundation pit for an arch abutment shall be level or stepped as shown on the plans and the side of the pit back of the abutment shall be trimmed to true lines to permit placing of concrete against undisturbed material. When concrete is to rest on an excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation and the final removal of all loose or soft material shall be made just before the concrete is placed.

17-3.05 SHORING, CRIBS AND COFFERDAMS

Except as provided in Section 17-3.02, all excavations shall be shored, braced, or protected by cofferdams in accordance with approved methods. No excavation or dredging shall be done before shoring, crib or cofferdams are placed, 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 or cribs for foundation construction shall, in general, be carried well below the bottom of the footings and shall be well braced and as watertight as practicable. The interior dimensions of the cofferdams shall be such as to give sufficient clearance for the construction of the forms and the inspection of the concrete exteriors, and to permit pumping outside of the forms.

Where piles are required, the cofferdam shall be of sufficient size to permit the driving of the piles in the exact positions shown on the plans without interference from the wales or bracing. Cofferdams or cribs which are tilted or moved laterally during the process of sinking shall be righted or enlarged so as to provide the necessary clearance, and 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.

For substructure work, the Contractor shall submit four (4) sets of drawings showing his proposed method of cofferdam construction and other details left open to his choice or not fully shown on the Engineer's drawings. Such drawings shall be approved by the Engineer before construction is begun, but such approval shall not relieve the Contractor of responsibility for satisfactory results.

Upon completion of the work, all cofferdams and cribs shall be removed to the natural bed of the stream or channel, and on navigable streams they shall be removed to such elevations as required for depth of stream or channel to conform to the requirements of the regulations of the Corps of Engineers, U. S. Army. Removal shall be effected in such a manner as to not disturb or mar the finished concrete.

17-3.06 PUMPING

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 of such dimensions as may be necessary. The water shall then be pumped out and the rest of the concrete placed in the dry. When weighted cribs are used and the weight is utilized to partially overcome the hydrostatic pressure acting against the bottom of the foundation seal, special anchorage such as dowels or keys shall be provided to transfer the entire weight of the crib into the foundation seal.

During the placing of a foundation seal, the elevation of the water inside the cofferdam shall be controlled with respect to the water elevation outside in order to prevent any flow through the seal in either direction. The cofferdam shall also be vented at the elevation of the water on which the designed thickness of the seal is based.

Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of any portion of the concrete materials being carried away. No pumping will be permitted during the placing of the concrete or for a period of 24 hours thereafter, unless it be done from a suitable sump separated from the concrete work by a water-tight wall.

Pumping to dewater a sealed cofferdam shall not commence until the seal concrete has set sufficiently to withstand the hydrostatic pressure. In general, no seal of the gravity type shall be dewatered until the concrete has set for at least three (3) days, and no seal containing piling shall be dewatered until the concrete has set for at least ten (10) days. These periods may be extended if, in

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the opinion of the Engineer, it is necessary for the safety of the structure.

17-3.07 INSPECTION

The Contractor shall notify the Engineer before starting any excavation. From time to time during the progress of excavation, the Engineer will examine the character of material taken out. He shall have authority to stop the excavation at any time to make bearing tests and the Contractor shall give any assistance the Engineer may need in making such tests.

Single bearing test periods shall not exceed 72 hours. Material and labor furnished by the Contractor for such tests will be paid for on a force account basis except that the Contractor shall maintain the ordinary working conditions at the bottom of the excavation during test periods, at his own expense. 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.

17-3.08 DISPOSAL OF EXCAVATED MATERIAL

The material obtained from structure excavation shall be used as the Engineer may require, either in construction embankments, or for backfilling over and around the structures after they are complete, or in case it is unsuitable or not required for either of these purposes it shall be disposed of as directed by the Engineer.

17-3.09 BACKFILLING

All material used for backfill shall be of a quality acceptable to the Engineer and shall be free from large or frozen lumps, wood, or other extraneous matter. The backfilling of openings made for structures shall be considered as a necessary part of the excavation, although the Engineer may require that the material for use in making a backfill be obtained from a source entirely apart from the structure, in which case compensation will be on a force account or agreed price basis unless otherwise specified. Except as may be otherwise specified hereinafter, 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, in general, the top surface of the backfill shall be neatly graded.

Backfill in existing street areas or in areas that must support roadway embankment or which is a part of any roadway embankment, shall be placed in horizontal layers not more than six (6) inches thick, and each layer shall be tamped and compacted to 95% of the maximum density as determined by the "Compaction Control Test" in Section 13-3.10E5.

The use of mechanical tampers may be required for compacting backfill for certain items as shown in the individual specifications for such items, and as may be required in the special provisions or on the plans where greater density than that specified above is to be obtained. Mechanical tampers, when required, will be paid for as a separate bid item. Mechanical tampers shall comply with the provisions of Section 15-2.01A.

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

The Engineer may order the backfill around piers and in front of abutments and wings to be of stone or lean concrete if the excavation has been in hard material exposed to erosion. Backfill of this nature will be paid for by force account unless otherwise provided for in the proposal. If the material used in making the backfill is too dry to permit proper compaction, the Engineer may require the addition of sufficient water to allow satisfactory compaction. Compensation for the use of water for

this purpose shall be included in the contract prices for "Structure Excavation," and for "Shoring and Cribs or Extra Excavation."

No backfill shall be placed against any concrete structure until the concrete has set at least twenty-one (21) days.

17-4 MEASUREMENT

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 limits hereinafter defined, regardless of whether the excavation is made within a cofferdam enclosure or in an open pit. Any additional excavation outside of these limits shall be considered as having been made for the Contractor's benefit and all costs in connection with such excavation shall be at expense of the Contractor.

The horizontal limits for measuring the structure excavation for payment shall be for material removed up to but not beyond one foot outside the vertical planes of the footings, as shown on the plans.

The bottom limits for measuring the excavation for footings shall be the elevation of the bottom of the footing, as shown on the plans 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 upper limit for measuring excavation shall 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 the removal of certain materials in advance of excavation for structures and for which there is a designated pay item in the same contract, or in a separate contract, the upper limit shall be the completed subgrade of the designated grading section, as shown on the plans.

No measurement will be made of the materials involved in shoring, cribs, cofferdams and caissons.

The use of mechanical tampers will be measured only when compacting backfill within the limits which define structure excavation, and will be measured by the hour to the nearest one-half (1/2) hour of actual time consumed in compacting backfill. No allowance will be made for time consumed in making repairs to the equipment, or in moving the equipment to or from the work on which compaction is required.

17-5 PAYMENT

Excavation for structures will be paid for under such of the following bid items as are included and shown in any particular contract:

1. "Structure Excavation," per cubic yard.
2. "Shoring and Cribs or Extra Excavation," lump sum.
3. "Mechanical Tampers," per hour.

17-5.01 STRUCTURE EXCAVATION

Payment will be made at the unit contract price per cubic yard for "Structure Excavation" which price shall be full compensation for all necessary pumping, bailing, draining, the diversion of streams and all other work involved, including backfilling over and around structures to the original surface of the ground and disposing of all debris and surplus material, and for all necessary labor, materials, tools, and equipment. It shall also include the construction and subsequent removal of all cribs, cofferdams, caissons, and shoring, except where the construction of cribs, cofferdams, caissons and shoring is paid for under the bid item "Shoring and Cribs or Extra Excavation," per lump sum.

Payment for structure excavation carried below the elevations shown on the contract plans by order of the Engineer, will also be made at the unit contract price per cubic yard for structure excavations except as follows:

Section 21—Weighing

If there is no bid item of shoring and cribs for the structure and an increased depth greater than three (3) feet below the elevation shown on the contract plans is required, an allowance for extra cost may be made, based upon the actual cost to the Contractor of constructing, extending or reconstructing any shoring or cribbing that may be necessary to carry the excavation to the required depth below that shown on the plans. This extra cost to the Contractor will be paid for on the basis of "Force Account Work" as covered under Section 9-1.04.

No payment will be made for any material removed from below the elevations shown on the plans, or established by the Engineer, for the bottoms of the excavations. Any such material excavated below the established elevations shall be replaced by the Contractor at his own expense. Replacement shall be made with concrete or other material acceptable to the Engineer.

17-5.02 SHORING AND CRIBS

Payment for shoring and cribs will be made at the lump sum contract price, which shall be full compensation for the construction and subsequent removal of all shoring, cribs, cofferdams, and caissons, and for all necessary labor, materials, tools and equipment for performing such work.

No additional compensation over the contract price for shoring and cribs or extra excavation will be made for increased depth, to and including a depth of three (3) feet below the elevations shown on the contract plans; excepting, however, that if a depth greater than three (3) feet below the elevations shown is required, allowance for extra cost may be made, based upon the actual cost to the Contractor of constructing, extending or reconstructing any shoring or cribbing that may be necessary to carry the excavation to the required depth below that shown on the plans. This extra cost to the Contractor will be paid for on the basis of "Force Account Work" as covered in Section 9-1.04.

When the item "Shoring and Cribs or Extra Excavation," lump sum, is shown on the plans and proposal, and when with the written approval of the Engineer the actual installation of shoring, crib, cofferdam or caisson is not made, the Contractor will be paid in full for the bid item "Shoring and Cribs or Extra Excavation," lump sum, which price shall be full compensation for all excavation, backfill, backfill compaction, or other incidental work performed by him in lieu of constructing the shoring, crib, cofferdam or caisson.

17-5.03 MECHANICAL TAMPERS

Payment for mechanical tampers will be made at the unit contract price per hour for "Mechanical Tamper," which price shall be full compensation for all materials, labor, equipment, tools and incidentals required to compact backfill materials (within the limits which define structure excavation) to the density required by the Engineer. (See Section 15.)

Section 21—Weighing

21-1 DESCRIPTION

Scales for the weighing of crushed surfacing materials, mineral aggregates for bituminous construction, concrete aggregates, and other road materials which are to be obtained from bunkers, stockpiles and local deposits and which are required to be measured and paid for on a weight basis as specified in the standard specifications or in the special provisions, shall be furnished by and at the expense of the Contractor.

The Contractor shall be responsible for maintaining the scales in accurate condition at all times.

21-1.01 WEIGHING EQUIPMENT FOR AGGREGATES AND ROAD MATERIALS FROM BUNKERS

Aggregates and road materials proportioned or measured by the ton shall be weighed on beam or springless dial scales conforming to the following requirements:

1. At least that part of the total load weighed which is in fraction of one hundred pounds shall be indicated on a graduated dial.

2. The weighing equipment must be so arranged that the operator stands, when operating the bin gates, at such a position that he can conveniently shovel material from the weighing hopper. The weighing dial shall be in full view of the operator when he is in position to operate the gate which delivers material to the weighing hopper.

3. Clearances shall be provided between the scale parts and the hopper or bin structure to prevent displacement of the scale parts due to vibration or any other cause. There must be sufficient clearance between the top of the weighing hopper and any other part of the bin structure so that the scale operator can conveniently shovel material from the weighing hopper.

4. In the case of weighing hoppers mounted on platform scales, the arrangement shall be such that the center of gravity of the total load on the scale is in the same vertical line as the center of the scale platform.

5. Scales shall be of a type well suited for supporting a weighing hopper under an overhead bin or structure and shall be of a simple rugged design with the minimum number of parts and adjustments for maintaining an accuracy within the limits hereinafter specified.

6. The use of springs to carry part or all of the load in the weighing mechanism will not be permitted.

Equipment for weighing shall be accurate within one-half percent through the range of use. Each scale installation shall be provided with at least eight standard fifty-pound weights for calibrating and testing weighing equipment.

All working parts of scales, particularly knife edges, shall be protected to prevent any material except wind borne material from falling upon or against them.

21-1.02 UNDERWEIGHTS

If an inspection of the scales discloses them to be underweighing, they shall be properly adjusted, and no additional payment will be allowed for tonnage previously weighed and recorded.

21-1.03 WEIGHING EQUIPMENT FOR AGGREGATES AND ROAD MATERIALS FROM LOCAL DEPOSITS AND STOCKPILES

When crushed surfacing and mineral aggregates are manufactured from local deposits or taken from stockpiles, or when other road materials are taken direct from local deposits, they shall be weighed, when so provided in the specifications, on platform scales of sufficient capacity to weigh the gross weight of the maximum loads hauled with type registering beams to record each weighing in duplicate, and to be furnished by and at the expense of the Contractor. If material is shipped by rail, the car weights will be accepted, provided however, that the actual weight of the material only will be paid for and not the minimum car weights used for assessing freight tariffs.

The Owner will furnish a man, at no cost to the Contractor, who will operate the scales while the loading and hauling of materials is in progress. This provision shall not relieve the Contractor from the responsibility of installing and maintaining the scales and equipment at his expense.

The Contractor shall provide for use of the scaleman a wind proof and weather-tight scale house of 6' x 10' minimum size, having a door for access and provisions for securely locking. It shall have suitable windows for light and ventilation, electric light, space heater, table and chair, all furnished by the Contractor. Sanitary facilities shall be nearby or furnished by the Contractor.

Section 22—Production From Quarry and Pit Sites

21-1.04 WEIGHING EQUIPMENT FOR BULK PORTLAND CEMENT

If portland cement is handled in bulk, it shall be weighed on scales meeting the requirements specified for the weighing of concrete aggregates. The scales used for weighing cement shall be separate from those used for weighing other material. The cutoff gate from the storage bin shall be of a design permitting positive shut off of the flow of cement. The weighing hopper shall be designed to assure complete discharge readily. Adequate provision shall be made to prevent loss of cement between the weighing hopper and the batch box.

21-2 PAYMENT

All costs in connection with the weighing of crushed stone surfacing, portland cement, aggregates, and road materials shall be included in the unit contract prices for the various pay items of the project.

Section 22—Production From Quarry and Pit Sites

22-1 DESCRIPTION

In many instances, with availability of commercial plants nearby, the awarding agencies do not always provide the Contractor with quarry and pit sites for production, but require him to provide such materials from sources of his selection that will meet the specifications herein. If the site is provided by the Owner, the plans and special provisions will so state and describe.

The requirements set forth in this section shall apply to the manufacturing and producing of crushed stone and screened materials of the kind, quality and grading specified for use in the construction of portland cement and asphalt concrete, cement treated base, asphalt treated base, crushed stone and screened gravel surfacing courses, ballast and bank run gravel, gravel backfill, riprap, and bituminous surface courses of all descriptions.

22-2 MATERIALS

The raw materials in the quarry or pit shall be of a quality such that, after being subjected to the manufacturing processes specified, the products will comply with the specifications for the particular class of material to be produced or manufactured.

22-3 CONSTRUCTION DETAILS

22-3.01 ACQUISITION OF SITES

The Owner will not provide quarry or pit sites unless specifically stated in the Special Provisions.

The Contractor, if he so desires, may obtain the specified materials from other sources than those acquired by the Owner if they are approved by the Engineer, provided the material is of a quality equal to that in the source specified, in which event the Contractor, at his own expense, shall make all necessary arrangements for obtaining the materials and he shall satisfy himself as to the quantity of suitable material available.

If the Contractor elects to substitute a gravel deposit of an approved source for the manufacture of ballast, crushed surfacing or mineral aggregate in lieu of a ledge rock or talus source provided by the Owner in the contract plans, all pit-run material passing a one-half (½) inch square sieve, or larger if ordered by the Engineer, shall be removed prior to crushing so that the finished product will have approximately the same degree of fracture and stability as that which would have been obtained from the specified source.

Whenever the Contractor elects to obtain material from an approved source other than that provided him by the Owner, or whenever the Contractor is required by the special provisions to provide his own source of mate-

rials, the clearing, grubbing and stripping therefrom shall be performed as directed by the Engineer and all costs incurred therefor shall be considered as incidental to the project and shall be included by the Contractor in his unit contract prices of borrow or processed materials to be removed.

22-3.02 PREPARATION OF SITE

Before blasting or crushing operations are commenced, the portion of the quarry or pit site from which the materials are to be taken shall be cleared, grubbed, and stripped free of vegetable growth, earth, sand, soft and unsound rock, and any material that will not make satisfactory surfacing. All combustible debris resulting from these operations shall be burned, and all other unsuitable materials and debris shall be removed and disposed of as directed by the Engineer. All overburden and unsuitable materials shall be conveyed to some point which will insure against the probability of any part of them becoming mixed with the stone which is to be crushed or produced. For the final stripping of a ledge quarry, the use of sluicing is recommended, and this method will be required unless the stone is satisfactorily cleaned by some other method.

The requirements for "Preparation of Site" as outlined above, insofar as they are applicable, shall obtain in the preparation of ledge rock, talus, gravel and sand, quarry or pit sites for all classes of materials which are required by the standard specifications to be produced in accordance with this Section 22. The quarry or pit site shall be cleared, grubbed and stripped free of all materials that will adversely affect the quality specified for the classes of products to be manufactured or produced.

22-3.03 PRODUCTION

In the event that the grading or quality of the raw material in sources used for the manufacture of products covered by this Section 22 is such that the fracture, grading, or quality of the product specified cannot be obtained by utilizing the natural material, fine portions of the raw material shall be rejected to the extent necessary to produce finished products meeting all requirements of these specifications. All oversize gravel occurring in gravel pits up to and including boulders of ten inches in the greatest dimension shall be utilized in the manufacture of crushed materials. Failure of the Owner to include a scalping requirement in the special provisions shall not relieve the Contractor of the responsibility for rejecting fine portions of the raw material if such becomes necessary to produce finished products meeting all requirements of the specifications.

When scalping over a screen of a specified size is required in the special provisions, the scalping screen shall be of such size and capacity that substantially all of the material smaller than the specified scalping screen size will be removed by the scalping operation.

Washing and reclaiming of the reject material and subsequent addition of this material to any finished products will not be allowed unless specifically authorized in writing by the Engineer.

If necessary to secure a product of the required quality, grading, and fracture, the materials shall be washed before and/or during crushing or screening. Washing will be required in the preparation of concrete aggregates. When specifically provided by the special provisions, the use of water will not be required in the production of mineral aggregates for the various types of bituminous surfaces. In such cases the mineral aggregate shall be cleaned by blowing with air until the resulting product meets the requirements for cleanliness and freedom from dust. If mineral aggregate is cleaned with air, it shall be produced only from such sources as will permit of ready removal of dust and coatings by this method.

When produced from a source provided by the Owner, all scalplings of material that is unsatisfactory under the specifications or special provisions shall be considered as reject material, subject to disposal as directed by the Engineer. Reject material shall be so placed that it will not foul the pit or quarry for any future operation.

Section 22—Production From Quarry and Pit Sites

Surplus screenings accumulated during the crushing and screening of specified roadway materials will be considered separate and distinct from reject material scalped ahead of the crushing operation. If the Contractor produces materials from a source provided by the Owner, the surplus screenings accumulated during the production of the specified materials shall be stockpiled at a location within the site provided and become the property of the Owner. The stockpiling shall be performed in an orderly and recoverable manner satisfactory to the Engineer. All costs incurred in producing, hauling and stockpiling the surplus screenings from a source provided by the Owner, except as provided for payment hereinafter, shall be considered as incidental to the production of the specified materials and shall be included by the Contractor in the pay items of the contract.

Surplus screenings accumulated during the manufacture of specified materials from a site provided by the Contractor shall become his own property, unless an item for surplus screenings has been included in the pay items of the contract.

If the special provisions and proposal include an item of surplus screenings, the Contractor will be paid therefor to the extent of the quantity set out in the proposal and no more, and the screenings shall be stockpiled either in a separate pile or with other surplus screenings as the Engineer may direct.

In the event the Contractor provides his own source for the production of the materials, surplus screenings, when included as a bid item, shall be furnished and stockpiled at the site specified, the same as provided above. It is not the intent to require the Contractor to produce "Surplus Screenings" in an amount greater than they will be accumulated during the normal production of other materials from the pit.

The stockpile sites for the surplus screenings shall be prepared and constructed by the Contractor as outlined in Section 23-3.01.

In event the Contractor shall elect to stockpile surfacing material or concrete aggregate from a source owned or controlled by the Owner ahead of its placement upon the roadway, he may do so if the stockpiling is within the area of the site provided by the Owner, and done in a manner approved by the Engineer. If he shall elect to stockpile such materials upon land leased by himself, he may do so upon approval of the Engineer and upon proof that the lease will extend for a period not less than one year beyond the completion date of his contract. All materials remaining after placing the amount required for the contract, whether upon the site provided or upon land leased by the Contractor, shall become the property of the Owner and all costs resulting from the production of such excess materials shall be considered as incidental to the production of the processed materials produced and placed on the roadway.

When more than one quarry or pit site is provided in the special provisions, the Contractor may obtain material from any one of the sources, and the Owner will specify the quantity of raw material which has been determined by tests to be available at each quarry or pit site. In the event that a Contractor sets up in a pit made available by the Owner and if the quantity from that site, when the pit is exhausted, is less than that stated by the Owner, then the provisions of Section 22-4 shall apply.

When the special provisions require material in a source provided by the Owner to be washed and/or scalped over a screen of a specified size, the scalping shall be performed after the pit or quarry-run material has passed through the primary crusher. If the native material in the source proves to be of better quality than anticipated by the Owner, or if the Contractor provides a more efficient processing operation than was anticipated by the Owner, he will be allowed to change the size of the scalping screen or make such other changes in the operation as he may elect, provided that the finished product has value of sand equivalent equal to or better than those obtained on the same product produced in the specified manner; and provided further, that the finished product meets all other requirements of the specifications.

tions. The requirement for washing concrete aggregate will not be relaxed under any conditions.

For the allowable moisture content for payment in manufactured materials see Section 22-4.

22-3.04 FINAL CLEANUP

The quarry or pit site, upon completion of the Contractor's operations, shall be cleared of all rubbish, temporary structures and equipment, and shall be left in a neat and presentable condition at the expense of the Contractor.

22-4 PAYMENT

All costs in connection with the production of the materials to meet the requirements specified shall be considered as incidental to the production of the required pay quantities of materials and shall be included in the unit contract prices for the pay items of materials involved. Clearing and grubbing will be measured and paid in accordance with the provisions of Section 12. Stripping will be measured and paid for in accordance with the provisions of Section 13. "Surplus Screenings" will be considered as a pay item only when it is included in the bid proposal of any particular contract.

For payment purposes, bank run gravel and crushed or screened materials, depending upon their grading, shall be limited to the following water contents:

% By Weight Passing 1/4-inch Sieve	Maximum Water Content % By Weight
Less than 20%	4%
More than 20%	8%

The maximum allowable water content in the manufactured aggregates shall be as specified above, and the addition of water by the Contractor to the screened or crushed product for the purpose of increasing the water content to the allowable maximum will not be permitted. Water content in excess of permissible amount, as determined by the Engineer, will be deducted from the tonnage of material to be paid for.

If, in the opinion of the Engineer, there should be insufficient suitable material in any quarry or pit site made available by the Owner, the Owner will acquire at its own expense an additional source, in which event the Contractor will be required to move his crushing plant to the new quarry or pit. Under such conditions the following schedule of allowances, insofar as they may be applicable, shall govern the compensation to be made by reason of the move:

1. Crushing plants with two (2) crushing units \$2,000.00
2. Crushing plants with three (3) crushing units 2,500.00
3. Crushing plants with four (4) or more crushing units 3,000.00
4. The clearing, grubbing and preparing of the new quarries or pit sites as specified under the heading "Preparation of Site" will be paid for in the manner provided in these specifications for "Clearing," "Grubbing," and "Excavation."

In the event there is no bid item applicable, the payment for the preparation of the new site shall be on a "Force Account" basis.

In the event the moving of the plant due to shortage of the supply of material necessitates a longer haul on materials than required from the original quarry, the Owner will reimburse the Contractor for the additional haul at the rate of \$0.14 per ton-mile of haul. The unit ton-mile, shall be considered to be the equivalent of one ton of material hauled a distance of one mile. The haul distance will be measured in one-half (1/2) mile units, fractional half miles being allowed as full half miles. For material hauled within one-half (1/2) mile, the haul will be one-half (1/2) ton-mile of haul. For material hauled beyond the first one-half (1/2) mile and within the first mile, the haul will be one (1) ton-mile of haul, and so on. Payment for haul computed on this basis shall be

Section 23—Crushed Surfacing, Ballasting, and Stockpiling

made at the unit contract price per ton-mile of haul, which price shall be full compensation for hauling the materials one (1) mile or fraction thereof as stated above, to any distance that may be required.

The above allowances, insofar as they may be applicable, shall be full compensation for all claims of any kind or description by reason of the necessity of changing from one site to another due to shortage of the supply from sources made available by the Owner. No additional compensation or allowance whatsoever will be made by the Owner on account of such moves. In advance of moving any crushing plant as outlined above, the Contractor shall first secure from the Engineer an order in writing to do so. The order shall set forth in detail the allowance based upon the above schedule. Should the Contractor fail to secure such aforementioned order, it shall be considered sufficient proof that the move was immaterial insofar as to costs, and no allowance or compensation will be made by reason of such move.

Section 23—Crushed Surfacing, Ballasting, and Stockpiling

23-1 DESCRIPTION

Surfacing and ballasting, unless otherwise specified, shall consist of the construction of one or more courses of crushed stone upon an existing roadway surface, or upon a subgrade properly prepared under the provisions of these standard specifications.

Surfacing materials and ballast may also be specified to be stored in stockpiles for future use on anticipated future projects.

The aggregate shall be graded in such a manner that, with the incorporation of a minimum amount of "filler" or "keystone" material, it will compact into a dense and unyielding mass which will be true to the line, grade and cross section shown on the plans. The Contractor shall furnish all materials unless otherwise specified in the special provisions.

23-2 MATERIALS

23-2.01 CRUSHED SURFACING

Crushed surfacing shall be manufactured from ledge rock, talus or gravel in accordance with the provisions of Section 22. The materials shall be uniform in quality and substantially free from wood, roots, bark and other extraneous material, and shall meet the following test requirements:

Los Angeles Wear, 500 Rev. (ASTM Designation C 131) 35% maximum.

Crushing surfacing of the various classes shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the roadway, or during manufacture and placement into temporary stockpile.

	Top Base Course and Course Keystone		
% Passing 1 1/4" square sieve...	100		
% Passing 3/4" square sieve....	50 to 80		100
% Passing 1/2" square sieve....	30 to 50		55 to 75
% Passing U. S. No. 40 sieve....	3 to 18		8 to 24
% Passing U. S. No. 200 sieve (wet sieving)	7.5 max.		10 max.
All percentages are by weight.			
Sand equivalent (Section 6)....	40 min.		40 min.

When separated on 1/4 inch, 3/8 inch, 1-inch, and 1 1/4 inch sieves, the crushed surfacing shall contain in each size, including material retained on the No. 10 Sieve, not less than seventy-five (75) percent by weight of particles with at least one fractured face produced by mechanical crushing.

The portion of crushed surfacing retained on a 1/4-inch square sieve shall not contain more than 0.15% wood

waste. Wood waste shall be defined as all material which has a specific gravity less than 1.0 after drying to constant weight.

The portion of crushed surfacing 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 in accordance with Section 37-2.02B1 except that the color shall be measured after the sample has been in the test solution for one hour.

23-2.02 BALLAST

Ballast shall consist of crushed, partially crushed or naturally occurring granular material from approved sources manufactured in accordance with the provisions of Section 22. In the manufacture of ballast all oversize material up to and including boulders of ten inches in the greatest dimension shall be utilized in the manufacture of the finished product.

The material from which ballast is to be manufactured shall meet the following test requirement:

Los Angeles Wear, 500 Rev. (ASTM Designation C 131) 40% maximum.

Ballast shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the roadway, or during manufacture and placement into temporary stockpile:

% Passing 2 1/2" square sieve	100
% Passing 2" square sieve	65 to 100
% Passing 1" square sieve	50 to 80
% Passing 3/4" square sieve	30 to 50
% Passing U. S. No. 40 sieve	16 max.
% Passing U. S. No. 200 sieve (wet sieving) ..	9 max.
All percentages by weight.	

Dust ratio:

% Passing #200 (wet sieving)	3/4 max.
% Passing #40	

Sand equivalent (Section 6)

The portion of ballast retained on a 1/4-inch square sieve shall not contain more than 0.2% wood waste. Wood waste shall be defined as all material which has a specific gravity less than 1.0 after drying to constant weight.

The portion of ballast 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 test when tested in accordance with Section 37-2.02B1 except that the color shall be measured after the sample has been in the test solution for one hour.

23-3 CONSTRUCTION DETAILS

23-3.01 STOCKPILING SURFACING MATERIAL

When specified, "Crushed Surfacing" and "Ballast" complying with these specifications, shall be placed in stockpiles at the points shown on the plans or as may be ordered by the Engineer. This work shall be designated and paid for as "Crushed Surfacing in Stockpile," per ton, and as "Ballast in Stockpile," per ton.

The stockpile sites shall be cleared of all vegetation, trees, brush, rocks or other debris, and a uniform ground surface made before the stockpile material is deposited upon the stockpile site.

Stockpiles shall be constructed on the previously prepared sites in accordance with the cross section stakes set by the Engineer, and when completed they shall be neat and regular in shape, occupying as small an area as is practicable, accessible for loading on a truck without obstructing the highway or street. Stockpiles shall be built up in layers not to exceed four (4) feet in thickness and the stockpile shall have a minimum height of eight (8) feet. The quantity of surfacing material to be piled at each site shall be the amount indicated on the plans or ordered by the Engineer.

Plank runways will be required for operating trucks on stockpiles when it is deemed necessary by the Engineer in order to avoid tracking dirt and other foreign matter on the crushed rock.

Section 23—Crushed Surfacing, Ballasting, and Stockpiling

All costs in connection with the preparation of the stockpile sites and the construction of the stockpiles shall be included in the unit contract prices for the various types of material being stockpiled, except that "Clearing" and "Grubbing" of the site will be measured and paid for in accordance with Section 12 when such bid items are carried in and made a part of the particular project.

23-3.02 SUBGRADE

The subgrade shall be constructed in the manner specified under Section 15.

23-3.03 SHOULDERS

Shoulders shall be constructed in the manner shown on the cross section, made a part of the plans, and the material used shall conform to the same specifications and method for payment as like materials used and processed in the roadway itself.

23-3.04 DEPTH OF LAYERS

Crushed surfacing, base course and top course, shall be constructed in layers not to exceed four (4) inches in depth. The methods employed for each layer shall be the same as specified elsewhere for that particular course. Ballast shall be constructed in layers as described in Section 23-3.16A.

23-3.05 SPREADING MATERIALS

Spreading of the first course of surfacing shall begin at points nearest from the point of loading and each 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. If the Engineer shall deem it necessary for further stability or other reason, he may require a succeeding course to be placed over any section of a previously placed course before the final completion of that course.

Unless otherwise provided in the special provisions, the surfacing, keystone and ballast may be spread by any method that will result in an even distribution of the material upon the roadway without perceptible separation in gradation. The method of spreading and the field operation shall be satisfactory to the Engineer at all times.

Should there occur during any stage of the surfacing or stockpiling a separation of the coarser from the finer materials causing serious lack of uniformity in the grading, the Contractor shall immediately make changes in the method of handling such as will prevent separation and meet approval of the Engineer.

Equipment such as scrapers and others essentially used for earth excavation will not be permitted.

23-3.06 ROLLING

Rolling shall be accomplished by means of such of the equipment described in Section 15-2.01A as may appear in the various bid items of the contract.

Each course of surfacing shall be rolled until the material does not creep under the roller before a succeeding course of surfacing material is applied. For each surfacing operation the Contractor shall provide sufficient rolling equipment to fully comply with these specifications.

All rolling shall commence at the outer edges of the surfacing and continue toward the center. Under no circumstances shall the center of the road be rolled first.

23-3.07 LOADING AGGREGATE FROM STOCKPILE

The use of dragline equipment to transport the aggregate from stockpiles to elevators or other loading devices will not be permitted.

23-3.08 HAULING

Hauling shall be distributed over the roadway in such a manner as to be most effective in the compacting of

the surfacing. Hauling over any of the surfacing in process of construction will not be permitted when, in the opinion of the Engineer, the effect will be detrimental. The Contractor shall not haul loads in excess of the legal load or speed limit. All loads shall be of uniform capacity when it is practicable.

In hauling any material upon which the measure of quantity is to be determined by vehicle load, the loads shall be the water measure capacity of the body.

23-3.09 CORRECTION OF SURFACE DEFECTS

Should irregularities develop in any surface during or after rolling, they shall be remedied by loosening the surface and correcting the defects, after which the entire area, including the surrounding surface, shall be re-rolled until thoroughly compacted. The finished surface shall be true to the proper grade and crown before proceeding with the surfacing.

23-3.10 FLOATING OR LOOSE STONE

Before placing the "Top Course" the preceding one shall be properly bound up and all floating or loose stone shall be removed from the surface.

23-3.11 HOURS OF WORK

Normally, the Contractor shall so arrange his surfacing operations that the work will be carried on during the hours of daylight. However, when necessary to complete the project within the time specified, work may be undertaken during the hours of darkness provided the Contractor obtains approval of the Owner for work conducted between the hours of 7:00 p.m. and 6:00 a.m. and furnishes and operates during such period, an adequate and effective artificial lighting apparatus to ensure that all work undertaken can be carried on satisfactorily in the manner contemplated by the specifications.

23-3.12 UNFAVORABLE WEATHER

When, in the opinion of the Engineer, the weather is such that satisfactory results cannot be secured, the Contractor shall suspend operations until the weather is favorable. No surfacing materials shall be placed in the snow or on a soft, muddy or frozen subgrade. The Owner shall not be liable for damages or claims of any kind or description by reason of suspending operations under directions of the Engineer.

23-3.13 PATROLLING

All surfacing in progress of construction shall be bladed and otherwise worked as may be necessary to maintain the proper grade and cross section at all times, and to keep the surface smooth and thoroughly compacted. The cost of any or all of the above work shall be included in the prices bid for the surfacing materials involved.

23-3.14 EQUIPMENT

The minimum amount of heavy equipment that will be considered necessary, in addition to crushing and hauling equipment, for the proper execution of these specifications shall be as follows:

1 Heavy duty self-propelled grader, of an approved type, equipped with scarifier, broom and not less than an 8-foot blade.

1 10-ton self-propelled three-wheel roller, or one (1) pneumatic-tired roller. Roller wheels may be weighted if necessary to secure specified weight per linear inch of tire width.

Other combinations and types of equipment may be substituted for the above if approved by the Engineer.

Additional equipment shall be supplied by the Contractor if required to properly care for the work. All equipment shall be kept in good repair at all times. The cost of furnishing and keeping all equipment in good

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repair shall be considered incidental to the performance of the contract and the cost shall be included in the unit contract prices for pay items of work involved.

Where the plans provide for the measurement and payment of surfacing material by the ton, the equipment for weighing the materials shall conform to the requirements of the specifications for "Weighing Equipment" in Section 21.

23-3.15 WATER

Where specified on the plans or ordered by the Engineer, the Contractor shall apply water to any course or courses in accordance with Section 16.

23-3.16 CONSTRUCTION OF COURSES

Whenever practicable any one course shall be completed in advance of laying the succeeding one. Any one course shall be completed as much in advance of the succeeding course as is practicable for good results and adequate inspection. The spread of any one course before another course is added shall be as much distance as is practicable under the circumstances, not less than one (1) block nor more than one-half (1/2) mile, and shall be subject to the direction of the Engineer.

Each layer shall be spread and compacted in accordance with sections 23-3.05 and 23-3.06. The completed layer shall have a smooth, tight and uniform surface reasonably true to the line, grade and cross section shown on the plans.

-3.16A Ballast

Ballast shall be spread upon the prepared subgrade by the methods specified in Section 23-3.05, and to the depth, width and cross section shown on the plans, or as directed by the Engineer. The maximum depth of any course shall not exceed six (6) inches.

The surface of the course shall be lightly bladed and then rolled until thoroughly compacted. When the aggregate does not compact readily, due to lack of fines or natural cementing properties, keystone and water shall be added in such amounts as the Engineer may direct, and in the manner specified below.

Top course surfacing material to be used as keystone shall be spread evenly on top of the ballast, using spreader boxes or chip spreaders. Thereafter the surface shall be rolled, wetted and, if necessary, broomed lightly until the keystone is worked into the interstices of the ballast stone without excessive displacement. The operations of adding keystone, rolling, wetting and brooming shall be continued until the course has become thoroughly keyed and compacted, and will not creep or move under the roller.

Ballast shall not be placed on the roadway in loads of widely varying gradations.

The surface of the stone at all times shall be kept to the true line, grade and cross section by blading or brooming.

-3.16B Base Course

Crushed surfacing for the base course shall be spread upon the roadway or upon the preceding course in layers not exceeding four (4) inches in thickness, to the amount and in accordance with the cross section shown on the plans. After each layer has been spread by the methods specified under Section 23-3.05, and has been lightly bladed, if necessary, the surface shall be rolled until the material is thoroughly compacted. The completed course shall have uniform distribution as to gradation.

When the depth of the base course is greater than four (4) inches, the next layer shall be constructed in the same manner as has been outlined above. The final result shall be an unyielding course, free from inequalities, with a smooth, tight, even surface, true to the grade, line and cross section shown on the plans.

-3.16C Top Course

Crushed surfacing for the top course shall be spread upon the roadway or upon the preceding course to the

depth, grade and cross section shown on the plans, and by methods specified in Section 23-3.05. After spreading, the surface shall be lightly bladed and then rolled until the material is thoroughly compacted to line and grade shown on the plans, or as directed by the Engineer. Water shall be placed during the blading and rolling operations in the quantity directed by the Engineer.

The completed course shall have uniform distribution as to gradation, and all areas in which there is an excess of coarse or fine aggregate shall be removed and replaced with suitable material.

-3.16D Maintenance Rock

Maintenance rock, 1/2-inch minus, shall meet all requirements of Section 23-2.01 for crushed surfacing except that it shall meet the following specifications for grading:

% Passing 1/2" square sieve	100
% Passing 3/4" square sieve	55 to 70
% Passing U. S. No. 40 sieve	10 to 30
% Passing U. S. No. 200 sieve (wet sieving)	10 max.

All percentages are by weight.

23-3.17 RESURFACING

The existing surface shall be scarified and then bladed until it has the uniform grade and cross section shown on the plans. 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. The cost of scarifying and shaping existing surfacing shall be considered as incidental to the construction and shall be included in the unit contract price for "Crushed Surfacing."

Crushed surfacing as called for on the plans shall be uniformly spread upon the existing surfacing at such points as may be necessary to secure the required depth and to remove irregularities which could not be accomplished with the existing surfacing. Both old and new surfacing, in advance of incorporating "Filler," shall be bladed until the two have been thoroughly mixed. The cost of mixing old and new surfacing shall be included in the unit contract price bid for the new material. Should there not be sufficient "Filler" in the existing road, "Filler" of the kind and in such quantities as the Engineer may direct, shall be incorporated in the manner hereinbefore described. The surface shall then be rolled as described under the heading of "Base Course" in Section 23-3.16B.

In event no new surfacing material is required in advance of placing the "Top Course," the surface of the existing road which has been scarified and bladed shall be rolled in the same manner as though new surfacing material had been added. The cost of such rolling shall be included in the unit contract price for the succeeding course of surfacing material.

23-3.18 REMOVING AND REPLACING SURFACING MATERIAL

Whenever the special provisions require such work, the Contractor shall salvage as much as practicable of the existing surfacing and utilize it in the construction, as directed by the Engineer.

At such points as are indicated on the plans and at any other points where necessary, in order to secure satisfactory results, the existing surfacing shall be removed from the roadway and deposited in conveniently located piles. After the completion of the construction which necessitated such removal, the surfacing shall be uniformly spread upon the roadway and then shall be completed as provided for base course construction. Extreme care shall be taken to avoid an injurious amount of foreign material becoming mixed with the surfacing material. The moving of surfacing into piles and then back on the roadway will be measured and paid for as provided in the special provisions of the project involved.

23-3.19 FINAL CLEANING UP

After the surfacing is completed and before final acceptance of the work, the entire roadway shall be

Section 24—Filler

neatly finished and trimmed to the lines, grades and cross section as shown on the plans.

After all required material has been removed from any stockpile site during contract operations and if there should be a surplus remaining in the stockpile, the Contractor shall clean up the stockpile site, leaving the surplus material in neat and compact piles. Care shall be taken to keep the aggregate free from dirt and foreign matter. All cost and expense in connection with this operation shall be included in the unit contract prices for the various pay items of work involved in the contract.

23-3.20 MAINTENANCE DURING SUSPENSION OF WORK PERIOD

The provisions of Section 8-1.04 shall apply to maintenance during suspension of work.

23-3.21 APPLICATION OF DUST PALLIATIVE

When required by the plans, 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 P.S. 300 oil and shall be uniformly applied by an approved pressure-type distributor at the rate of three-tenths (0.3) gallons of oil 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.

23-4 MEASUREMENT

Crushed surfacing materials will be measured by the ton in trucks at the point of loading, unless shown by the cubic yard in the proposal, in which case measurement will be made in trucks at the point of delivery in accordance with special provisions therefor. The provisions of Section 21 shall apply when measurement is by the ton.

Crushed surfacing materials for placement in stockpile will likewise be measured by the ton, unless the special provisions and proposal show measurement by the cubic yard, in which case the volume of pay material will be determined by cross sectioning the stockpile.

Top course surfacing material when used as keystone will be measured in the same manner as top course surfacing material, regardless of the classification of the course in which it is used.

Ballast consisting of crushed stone or naturally occurring granular material shall be measured in the same manner as crushed surfacing materials.

"Water" shall be measured as provided for in Section 16.

"Filler" will be measured in accordance with the provisions of Section 24.

Maintenance rock will be measured by the ton or by the cubic yard in trucks at the point of delivery.

Rolling equipment shall be measured as provided in Section 15.

Dust palliative oil shall be measured in barrels used. One barrel is equal to 42 gallons.

23-5 PAYMENT

Payment will be made for such of the following bid items as are included and shown in any particular contract:

1. "Crushed Surfacing, Top Course (or Base Course)," per ton, or cubic yard.
2. "Crushed Surfacing, Top Course (or Base Course) in Stockpile," per ton, or cubic yard.
3. "Crushed Surfacing, Top Course (or Base Course) from Stockpile," per ton, or cubic yard.

4. "Ballast," per ton, or per cubic yard.
5. "Ballast in Stockpile," per ton, or per cubic yard.
6. "Ballast from Stockpile," per ton, or per cubic yard.
7. "Water," per M gallons.
8. "(Kind) Filler," per ton, or per cubic yard.
9. "Maintenance Rock (size) in Stockpile," per ton, or per cubic yard.
10. "Smooth-wheeled Power Roller," per hour.
11. "Pneumatic-tired Roller," per hour.
12. "Dust Palliative," per barrel.

Crushed surfacing materials shall be paid for at the unit contract price per ton of 2,000 pounds, or per cubic yard when so shown in the proposal.

Top course surfacing material when used as keystone shall be paid for as top course surfacing material, regardless of the classification of the course in which it is used.

Ballast consisting of crushed or naturally occurring granular material shall be paid for in the same manner as crushed surfacing materials.

Removing and replacing surfacing material shall be paid for at the unit contract price per cubic yard, when shown in the proposal.

"Water" shall be paid for at the unit contract price per thousand (1,000) U. S. gallons at the point of delivery on the road.

"Filler" will be paid for in accordance with the provisions of Section 24.

The unit contract price per ton or per cubic yard for "Maintenance Rock ½" Minus in Stockpile," shall be full compensation for furnishing all labor, materials, tools and equipment required to manufacture the material in accordance with these specifications, and to haul and place it in stockpiles at designated sites.

All costs involved in preparing stockpile sites shall be included in the unit contract price for maintenance rock, excepting however, that clearing and grubbing of the designated sites will be measured and paid for in accordance with Section 12 when such bid items are shown in the proposal of any particular project, and not otherwise.

All items of work and materials required by these specifications for which no payment is specified or provided, shall be considered incidental to and a part of the items for which payment is specified and the cost of such work and materials shall be included in the unit contract prices for the pay items shown on the plans.

The unit contract prices for the pay items enumerated shall be full compensation for furnishing all materials, labor, tools, and equipment necessary for the fulfillment of all the requirements of these specifications and those of any other pertinent specifications, in the execution of the work shown on the plans, or as ordered by the Engineer.

Section 24—Filler

24-1 DESCRIPTION

The term "Filler" as used in connection with the construction of gravel base, crushed stone surfacing courses and courses of naturally occurring granular material shall be classified into two classes, viz: (1) Crushed Stone Filler, and (2) Sand Filler. Where the term "Filler" is used in Section 23 of these specifications, it shall be construed to mean the class of filler specified in these specifications or the special provisions for the construction of various surfacing courses, or as called for on the plans.

Filler shall be obtained from approved sources. When sources of sand filler are designated in the special provisions, the Contractor may, after properly stripping the pit, place the naturally occurring material directly on the roadway without further treatment other than the removal of oversize particles. The Contractor shall, how-

Section 25—Screened Gravel Surfacing—One Course

ever, conduct his operations so as to avoid the inclusion of unsatisfactory material that may be present within the bounds of the pit site.

24-2 MATERIALS

The Owner will, when provided in the special provisions, acquire and make available to the Contractor without charge, the right to take "Filler" materials from the sources designated by the Engineer, and the right to use such sources as may be necessary for his operations.

Filler shall consist of naturally occurring sand or granular material manufactured from rock, gravel, or talus. Filler shall meet the requirements which follow for the two classes.

24-2.01 SAND FILLER

Sand filler shall consist of sand screened from natural deposits and shall be composed of naturally occurring grains, preferably angular.

Sand filler shall meet the following requirements for grading and quality:

Passing ¾" square sieve.....	100%
Passing ½" square sieve.....	90% to 100%
Passing U. S. No. 10 sieve.....	40% to 75%
Passing U. S. No. 40 sieve.....	15% to 40%
Passing U. S. No. 200 sieve (wet sieving).....	0% to 15%
Sand Equivalent (see Section 6).....	40 Minimum

All percentages are by weight.

24-2.02 CRUSHED FILLER

Crushed filler shall consist of the fine product resulting from crushing stone, and shall meet the following grading and quality requirements:

Passing ¾" square sieve.....	100%
Passing ½" square sieve.....	90% to 100%
Passing U. S. No. 10 sieve.....	40% to 75%
Passing U. S. No. 40 sieve.....	15% to 40%
Passing U. S. No. 200 sieve (wet sieving).....	0% to 15%
Sand Equivalent (see Section 6).....	40 Minimum

All percentages are by weight.

24-3 CONSTRUCTION DETAILS

Before commencing excavation in the filler pit, the Contractor shall remove all trees, brush, stumps, stripping and overburden as may be necessary to give access to the filler materials desired. The removal and disposal of overburden and debris shall be done in accordance with the instructions of the Engineer.

Stones, boulders, clods, and other unsuitable materials shall be left in the pit, and will not be included in the pay quantities.

Filler shall be spread uniformly on the road at the rate ordered. Unless this can be accomplished satisfactorily by other means, the Contractor shall use an approved adjustable mechanical spreader.

24-4 MEASUREMENT

Filler will be measured by weighing in trucks or by the cubic yard in trucks at the point of delivery. The proposal will indicate the measure of payment—by the ton, or by the cubic yard.

24-5 PAYMENT

Payment will be made for such of the following bid items as are included and shown in any particular contract.

1. "Sand Filler," per (ton, cubic yard).
2. "Crushed Filler," per (ton, cubic yard).
3. "Clearing and Grubbing," per acre, or lump sum.
4. "Stripping Quarries and Pits," per cubic yard.

Clearing and grubbing shall be measured and paid for in accordance with the provisions of Section 12. Stripping will be measured and paid for in accordance with the provisions of Section 13.

Payment for filler of the kind shown in the proposal shall be made at the unit contract price per ton or per cubic yard, whichever is designated in the proposal, for "(kind) Filler," which price shall be full compensation for furnishing all materials, labor, tools, and equipment, and for all other costs and expense necessary or incidental to excavating, loading, hauling the full distance and spreading on the roadbed as specified above, and for final cleaning up of the filler pit. No additional compensation will be made for haul.

Section 25—Screened Gravel Surfacing—One Course

25-1 DESCRIPTION

Screened gravel surfacing shall consist of screened gravel constructed on the properly prepared subgrade to the lines, grade and cross section shown on the plans or as directed by the Engineer. The screened gravel surfacing shall be so graded that it will readily compact into a dense unyielding mass.

25-2 MATERIALS

Screened gravel surfacing shall consist of crushed, partially crushed, or naturally occurring granular materials from approved sources, processed in accordance with the provisions of Section 22. It shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the roadway, or during manufacture and placement into a temporary stockpile. The exact point of acceptance will be determined by the Engineer.

	CLASS A	CLASS B
% Passing 1-inch square opening.....	100	
% Passing ¾-inch square opening.....	100	
% Passing ½-inch square opening.....	50 to 65	25 to 75
% Passing U. S. No. 200 sieve (wet sieving).....	5 max.	10 max.

All percentages are by weight.

Dust Ratio:	
% Passing U. S. No. 200 sieve (wet sieving)	¾ max.
% Passing U. S. No. 40 sieve	
Sand Equivalent (Section 6).....	45 min. 40 min.

Screened gravel surfacing material retained on a ¼ inch square sieve shall not contain more than 0.15% by weight of wood waste. Wood waste is defined as all material which, after drying to constant weight, has a specific gravity of less than 1.0.

When tested for organic matter, that portion of screened gravel surfacing passing a U. S. No. 10 sieve shall not have wood waste that results in a darker color than that specified in Section 37-2.02B1, except that the color will be measured after the sample has been in the test solution for one hour.

25-3 CONSTRUCTION DETAILS

Immediately in advance of depositing the surfacing materials, the subgrade shall be prepared as specified in the specifications for subgrade for crushed surfacing in Section 23. Screened gravel surfacing shall be uniformly spread upon the prepared subgrade in amount, width and cross section shown on the plans or as directed by the Engineer, and shall then be bladed until the material shows a uniform grading.

If ordered by the Engineer, "filler" of the kind specified and conforming to the requirements of Section 24, shall be spread uniformly over the surfacing material in

Section 26—Bank Run Gravel for Streets

such quantities as the Engineer may direct. The filler shall then be mixed with the surfacing material by blading until a uniform product is obtained. The surfacing shall then be spread in such a manner that it will have a uniform depth, true to line and grade as staked by the Engineer. It shall then be rolled by either a smooth-wheeled power roller or by a pneumatic-tired roller.

The type of roller shall conform to the requirements set forth in Section 15-2.01A.

The type of roller to be used for any particular project shall be as set forth in the special provisions.

25-4 MEASUREMENT

Screened gravel surfacing will be measured by the ton at the point of loading if the quantity is enough to justify the use of scales, or it may be measured by the cubic yard in trucks at the point of delivery, in accordance with whichever unit of measure is shown on the plans and proposal.

25-5 PAYMENT

The unit contract price per ton or per cubic yard for "Screened Gravel Surfacing" shall be full compensation for all costs and expense necessary for preparing the subgrade, furnishing, screening, loading, hauling, spreading, blading and compacting of the surfacing material, and for incorporating filler and for all other costs and expense necessary or incidental to the completion of the work as specified above.

Filler will be measured and paid for as provided in Section 24.

Compaction and water shall be incidental to the contract unless payment is specifically provided for in the Special Provisions.

Section 26—Bank Run Gravel for Streets

26-1 DESCRIPTION

Where shown on the plans or where designated by the Engineer, embankments, shoulders and/or the top of embankments and the subgrade of cuts to a depth as shown on the plans or as designated by the Engineer, shall be composed of bank run gravel from approved sources prepared in accordance with Section 22. Bank run gravel is defined as naturally occurring material having characteristics such that when compacted in place on the roadway it will provide a course having greater supporting value than the subgrade on which it is placed.

26-2 MATERIAL

26-2.01 CLASSES AND GRADING OF BANK RUN GRAVEL

Bank run gravel shall be substantially free from wood, roots, bark or other extraneous material. It shall have such characteristics of particle size and shape that it will compact readily to a firm, stable course.

The maximum size of stone shall not exceed the depth of the course being applied less one (1) inch, except that in no case shall the maximum size exceed eight (8) inches.

Bank run gravel shall be termed Bank Run Gravel Class A, or Bank Run Gravel Class B. The following requirements shall govern for the separate classes:

	Bank Run Gravel Class A	Bank Run Gravel Class B
Passing 1/4" sieve.....	25% min. 75% max.	25% min. 75% max.
Passing U. S. No. 200 sieve (wet sieving)	5% max.	10% max.
Dust Ratio: % Passing #200 (wet sieving) ..	2% max.	3% max.
% Passing #40		
Sand Equivalent	50 min.	30 min.

26-2.02 BANK RUN GRAVEL FROM SPECIFIED SOURCES

When sources of bank run gravel are designated in the special provisions the Contractor may, after stripping a sufficient area to yield the required quantity as provided in Section 22, place the naturally occurring material directly on the roadbed without further treatment except removal of oversize stone. He shall, however, work the pit in such a way that individual loads do not vary greatly from the average grading available in the deposit, and he shall avoid or waste material that is designated by the Engineer as unsuitable for the specified class of bank run gravel. The Contractor shall make as many moves of loading equipment within the specified pit area as may be necessary to fulfill the above requirement.

26-2.03 BANK RUN GRAVEL FROM SOURCES PROVIDED BY THE CONTRACTOR

When bank run gravel is furnished from sources provided by the Contractor, the material shall be produced from approved sources in accordance with Section 22. The grading and quality shall be as specified in Section 26-2.01.

Bank run gravel for uses other than the support of portland cement concrete pavement shall meet the requirements of Section 26-2.01 and shall meet the following additional requirements thereto:

Stabilometer resistance value (Section 6) 68 minimum
Swell pressure (Section 6) 0.3 psi maximum

If bank run gravel from sources furnished by the Contractor has lower resistance value or higher swell pressure it may be used if approved by the Engineer, provided that the thickness of crushed surfacing is increased over that shown on the plans by such an amount as the Engineer determines necessary to compensate for the lower values. The bank run gravel shall be decreased in thickness by an amount equal to the required increased thickness of crushed surfacing. The volume of crushed surfacing required to compensate for resistance value lower than, or swell pressure higher than that specified above, shall be measured for payment as "Bank Run Gravel, Class A or Class B" and not as crushed surfacing. All costs incurred therefor shall be included by the Contractor in his unit contract price for "Bank Run Gravel, Class A or Class B".

If, as an alternate to sources provided in the special provisions, the Contractor shall elect to furnish bank run gravel from another source in which the material has a lower resistance value or higher swell pressure than that in the designated source, the thickness of crushed surfacing and bank run gravel shall be adjusted to compensate the lower values as outlined in the preceding paragraph.

When the Contractor furnishes the source, he shall remove the materials in such manner that all parts of the pit will be drained to a natural drainage course at its normal water level.

26-3 CONSTRUCTION DETAILS

26-3.01 REMOVAL OF OVERBURDEN

Before any of the bank run gravel material is removed, the site shall be cleared and grubbed and all debris shall be disposed of by the Contractor. The entire area from which bank run gravel is to be taken shall be stripped of earth and other material unsuitable as bank run gravel. All overburden materials shall be conveyed by the Contractor at a location which will ensure against its becoming mixed with the selected material.

26-3.02 PREPARATION OF ROADBED

The surface of the roadbed upon which bank run gravel is to be placed shall be compacted as specified in Section 15-2.01, Subgrade for Base Materials. All loose stones shall be removed from the surface of the roadbed.

26-3.03 CONSTRUCTION OF COURSES

The bank run gravel material shall be uniformly

Section 27—Asphalt Materials

spread upon the prepared subgrade to the depth, width and cross section shown on the plans.

The maximum depth of any course shall not exceed eight (8) inches unless otherwise specified in the special provisions.

Each course shall be bladed and rolled until it is thoroughly compacted and true to line, grade and cross section before the material for the succeeding course is spread. Rolling shall be done by means of the equipment described in Section 15-2.01A.

26-3.04 PIT OPERATIONS

Bank run gravel material shall be taken to the lines and grades staked by the Engineer from the portions of the pit which will furnish the most suitable material. Upon completion of the operation, the side slopes and floor of the pit shall be dressed to a uniform slope as directed by the Engineer. All debris and refuse shall be removed by the Contractor and the site left in a neat and presentable condition.

26-4 MEASUREMENT

Bank run gravel Class A or Class B will be measured by the ton in trucks at the point of loading if the quantity is enough to justify the use of scales, or by the cubic yard measured in trucks at the point of delivery, in accordance with whichever unit is shown on the plans and proposal.

The pay quantity for bank run gravel produced from a source provided by the Owner shall be the actual quantity delivered and used on the roadway except that water content in excess of eight (8) percent by weight, including water absorbed by the material, shall be deducted from the tonnage to be paid for if payment by the ton is specified. Crushed surfacing used for compensating lower resistance value or higher swell pressure than bank run gravel produced from a source provided by the Owner, shall be measured and paid for as "Bank Run Gravel, Class A or Class B".

If bank run gravel from a source provided by the Contractor has lower resistance value or higher swell pressure than that specified, the pay quantity of "Bank Run Gravel, Class A or Class B" shall be the quantity of bank run gravel actually delivered and used on the roadway, less water in excess of eight (8) percent by weight, plus the quantity of crushed surfacing, if any, used to compensate for lower resistance value or higher swell pressure, as described in Section 26-2.03. In no such case shall the crushed surfacing used to compensate for lower values than that specified, be included in any pay item for crushed surfacing.

The quantity for bank run gravel shall not include waste material or any material not suitable for the purpose intended.

26-5 PAYMENT

Payment will be made for such of the following bid items as are included and shown in any particular contract:

1. "Bank Run Gravel (Class A or Class B)," per ton, or cubic yard.
2. "Clearing" and "Grubbing," per acre (or lump sum).
3. "Stripping Quarries and Pits," per cubic yard.
4. "Water," per M gallons.
5. "Smooth-wheeled Power Roller," per hour.
6. "Pneumatic-tired Roller," per hour.
7. "Grid Roller," per hour.

The unit contract price per ton or per cubic yard for "Bank Run Gravel (Class A or Class B)," shall be full compensation for furnishing all material, labor, tools, equipment and all other costs and expense necessary or incidental to the preparation of the roadbed, excavating, loading, hauling the full distance, placing and blading the bank run gravel and for which no other specific bid item is provided.

Clearing and grubbing for borrow pits will be measured and paid for in accordance with the provisions of Section 12.

"Stripping Quarries and Pits," will be measured and paid for in accordance with the provisions of Section 13.

"Water" will be measured and paid for in accordance with the provisions of Section 16.

Rolling equipment will be measured and paid for in accordance with the provisions of Section 15.

Water and compaction of subgrade and gravel shall be considered as incidental to the construction whenever the items of water and compaction equipment are not included in the bid proposal and the special provisions so provide, and all costs incurred in complying with the specifications shall be included by the Contractor in his unit contract price per ton or per cubic yard for "Bank Run Gravel (Class A or Class B)."

Section 27—Asphalt Materials

27-1 DESCRIPTION

27-1.01 ASPHALT MATERIAL

Asphalt furnished under these specifications shall not have been distilled at a temperature high enough to injure by burning or to produce flecks of carbonaceous matter, and upon arrival at the work shall show no signs of separation into lighter and heavier components. Lots placed in storage for subsequent shipment shall be thoroughly mixed so there will be no appreciable difference in properties between individual shipments.

Asphalt of the grade specified shall fully comply with all of the requirements hereinafter set forth for each respective grade.

The particular grade or grades of asphalt to be used on any project will be those called for in the special provisions, on the plans, or in these specifications.

Section 27—Asphalt Materials

-1.01A Slow-Curing (SC) Liquid Asphalts

CHARACTERISTICS	WSHD Test Method	SC-70 SC-250 SC-800 SC-3000			
		Flash Point (Cleveland Open Cup)..... Min. °F	206A	150	175	200	225
Kinematic Viscosity at 140° F Cs.....	202A	70-140	250-500	800-1600	3000-6000
Distillation:					
Total Distillate to 680° F % by volume.....	211A	10-30	4-20	2-12	5 Max.
Kinematic Viscosity of Distillation Residue at 140° F, Stokes.....	202A	4-70	8-85	20-140	40-350
Asphalt Residue of 100 Penetration..... Min. %	221A	50	60	70	80
Ductility of 100 Penetration Asphalt Residue at 77° F, Cm..... Min.	213A	100	100	100	100
Solubility in Carbon TetrachlorideⓄ..... Min. %	214A	99.5	99.5	99.5	99.5
Water..... Max. %	217A	0.5	0.5	0.5	0.5

ⓄTrichloroethylene (not trichloroethane) may be used as the solvent for determining solubility. In case of dispute, however, carbon tetrachloride will be used as the reference solvent.

-1.01B Medium-Curing (MC) Liquid Asphalt

CHARACTERISTICS	WSHD Test Method	MC-70 MC-250 MC-800 MC-3000			
		Flash Point—Tag Open Cup, Viscosity at 140° F, Kinematic cs..... Min. °F	207A	100	150
Water Content..... Max. %	202A	70-140	250-500	800-1600	3000-6000
Distillation, % by volume of total distillate to 680°F:					
To 437°F.....	217A	0.2	0.2	0.2	0.2
To 500°F.....	211A	0-20	0-10	.....	.....
To 600°F.....		20-60	15-55	0-35	0-15
Residue to 680°F..... Min. %		65-90	60-87	45-80	15-75
Properties of residue from distillation to 680°F:		55	67	75	86
Penetration at 77°F, 100 g., 5 sec.....	201A	120-250	120-250	120-250	120-250
Ductility at 77°F, Cm..... Min.	213A	100	100	100	100
Solubility in Carbon TetrachlorideⓄ..... Min. %	214A	99.5	99.5	99.5	99.5

ⓄFlash point by Cleveland Open Cup may be used for products having a flash point greater than 175°F.
 ⓄIf penetration of residue is more than 200 and its ductility at 77°F is less than 100, the material will be acceptable if its ductility at 60°F is not less than 100.

ⓄTrichloroethylene (not trichloroethane) may be used as the solvent for determining solubility. In case of dispute, however, carbon tetrachloride will be used as the reference solvent.

-1.01C Rapid-Curing (RC) Liquid Asphalt

CHARACTERISTICS	WSHD Test Method	RC-70 RC-250 RC-800 RC-3000			
		Flash Point—Tag Open Cup..... Min. °F	207A	80
Viscosity at 140° F., Kinematic, cs.....	202A	70-140	250-500	800-1600	3000-6000
Water Content..... Max. %	217A	0.2	0.2	0.2	0.2
Distillation, % by volume of total distillate to 680°F:					
To 374°F..... Min.	211A	.....	.....	.....	.....
To 437°F..... Min.		10	.....	.....	.....
To 500°F..... Min.		50	35	15	.....
To 600°F..... Min.		70	60	45	25
Residue to 680°F..... Min. %		85	80	75	70
Properties of residue from distillation to 680°F:		55	65	75	80
Penetration at 77°F, 100 g., 5 sec.....	201A	80-120	80-120	80-120	80-120
Ductility at 77°F, Cm..... Min.	213A	100	100	100	100
Solubility in Carbon TetrachlorideⓄ..... Min. %	214A	99.5	99.5	99.5	99.5

ⓄTrichloroethylene (not trichloroethane) may be used as the solvent for determining solubility. In case of dispute, however, carbon tetrachloride will be used as the reference solvent.

The material shall not foam when heated to application temperature recommended by these specifications.

Section 27—Asphalt Materials

-1.01D Paving Asphalts

Paving asphalts shall be free from water and shall not foam when heated to 350° F. They shall conform to the following table:

CHARACTERISTICS	WSHD Test Method	Viscosity Graded at 140° F. (60C) on RTFC Residue		
		AR-2000	AR-4000	AR-4000W
Tests on Residue from RTFC Procedure—Calif. Method 346EⓄ				
Absolute Viscosity at 140° F., poise.....	203A	1500-2500	3000-5000	2500-5000
Kinematic Viscosity at 275° F., cs, min.....	202A	200	275	275
Penetration at 77° F., 100g/5 sec., min.....	201A	40	25	40
Percent of original penetration at 77° F., min.....	Ⓞ	40	45	45
Ductility at 77° F., cm., min.....	213A	100Ⓞ	75	.....
Ductility at 45° F., (1 cm/min.) cm., min.....		.....	.....	10
Test on Original Asphalt				
Flashpoint, Pensky-Martens, ° F., min.....	205A	425	440	440
Solubility in Trichloroethylene percent, min.....	214A	99	99	99

ⓄTFO may be used but RTFC shall be the referee method.

ⓄOriginal penetration as well as penetration after RTFC loss will be determined by AASHTO Test Method T-49.

ⓄIf the ductility at 77° F. is less than 100 cm., the material will be acceptable if its ductility at 60° is more than 100 cm.

Paving asphalts shall be free from water and shall not foam when heated to 350° F.

-1.01E Asphalt for Sub-Sealing

CHARACTERISTICS	WSHD Test Method	
Softening Point (Ring and Ball), F°.....	216A	160°-180F°
Penetration of Original Sample		
At 32°F, 200 g., 60 sec..... Min.	201A	15
At 77°F, 100g, 5 sec.....	201A	25-40
At 115°F, 50 g., 5 sec..... Max.	201A	90
Ductility at 77°F, Cm..... Min.	213A	3
Flash Point (Cleveland Open Cup) °F..... Min.	206A	425
Solubility in Carbon Tetrachloride..... Min. %	214A	99.0
Loss on Heating, 325°F, 5 hrs..... Max. %	209A	1.0
Penetration 77°F after loss on heating, % of original..... Min.	201A	70

Asphalt for sub-sealing under pavements shall be free from water and shall not foam when heated to 350°F.

-1.01F Asphalt for Crack Pouring

CHARACTERISTICS	WSHD Test Method	
Softening Point (Ring and Ball), F°..... Min.	216A	150°F
Penetration of Original Sample		
At 32°F, 200g., 60 sec..... Min.	201A	30
At 77°F, 100g, 5 sec.....	201A	50-65
Ductility at 77°F, Cm..... Min.	213A	3
Solubility in Carbon Tetrachloride..... Min. %	214A	99.0
Loss on Heating, 325°F, 5 hrs..... Max. %	209A	0.5
Penetration 77°F after loss on heating, % of original..... Min.	201A	60

Asphalt for Crack Pouring shall be free from water and shall not foam when heated to 350°F.

Section 27—Asphalt Materials

-1.01G Cationic Emulsified Asphalt

CHARACTERISTICS	WSHD Test Method	Medium Setting				
		Rapid CRS-1	Setting CRS-2	CMS-2S [ⓐ]	Slow CSS-1	Setting CSS-1h
Tests on Emulsion [ⓐ]						
Furol Viscosity at 77°F, Sec.	212A	20-100	100-400	50-500	20-100	20-100
Furol Viscosity at 122°F, Sec.	212A	60	65	60	57	57
Residue from Distillation, % by weight.	212A	3	3	3	3	3
Settlement, 5 days Min. [ⓑ]	212A	0.10	0.10	0.10	0.10	0.10
Sieve Test (Retained on No. 20) [ⓐ] Max. %	212A					
Aggregate Coating-Water Resistance Test [ⓐ] Min.						
Dry Aggregate (Job) % Coated Min.				80		
Wet Aggregate (Job) % Coated Min.				60		
Cement Mixing Test Max. %	212A				2	2
Particle Charge Test Positive		Positive	Positive	Positive		
pH Max.	212A				6.7	6.7
Oil Distillate, % by volume Max. [ⓐ]	212A	5	5	20		

CHARACTERISTICS	WSHD Test Method	Medium Setting				
		Rapid CRS-1	Setting CRS-2	CMS-2S [ⓐ]	Slow CSS-1	Setting CSS-1h
Tests on Residue:						
Penetration, 77°F, 100g 5 sec.	212A	100-250	100-250	100-250	100-200	40-90
Solubility in Carbon Tetrachloride [ⓐ] Min. %	212A	97.0	97.0	97.0	97.0	97.0
Ductility, 77°F, cm Min.	212A	40	40	40	40	40

- [ⓐ]C in grade designations signifies cationic type, S indicates sand mixing grade.
- [ⓑ]All tests shall be performed within 30 days from the date of emulsion shipment.
- [ⓐ]The test requirement for settlement may be waived when the emulsified asphalt is used in less than 5 days; or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.
- [ⓐ]Except that distilled water is used instead of sodium oleate solution.
- [ⓐ]Calcium carbonate shall not be added to the job aggregate when making the aggregate coating-water resistance test.
- [ⓐ]Volume of oil distillate may be determined by reading on the graduated cylinder which is used to collect total distillate.
- [ⓐ]Trichloroethylene (not trichloroethane) may be used as the solvent for determining solubility. In case of dispute, however, carbon tetrachloride will be used as the reference solvent.

Section 27—Asphalt Materials

-1.01H Test Methods

The properties enumerated above shall be determined in accordance with the following methods of test:

Test	Designation
1. Penetration	ASTM D-5
2. Penetration Ratio	Section 6
3. Residue of Specified Penetration	ASTM D-243
4. Viscosity, Saybolt Furol	ASTM D-88 E-102
5. Viscosity, Kinematic, Ziefuchs Cross Arm	ASTM D-445
6. Flash, Cleveland Open Cup	ASTM D-92
7. Flash, Tag Open Cup	ASTM D-1310
8. Flash, Pensky Martens Closed	ASTM D-93
9. Thin Film Oven Test	ASTM D-1754
10. Loss on Heating	ASTM D-6
11. Ductility	ASTM D-113
12. Bitumen Soluble in Carbon Disulphide	ASTM D-4
13. Proportion of Bitumen Soluble in Carbon Tetrachloride	ASTM D-165
14. Float Test	ASTM D-139
15. Water	ASTM D-95
16. Distillation	ASTM D-402
17. Spot Test	AASHTO T-102
18. Softening Point	ASTM D-36
19. Emulsified Asphalt	ASTM D-244

-1.01I Change in Grades

At any time during the progress of the work, the Engineer may order the use of other grades of asphalt materials in substitution of the grades specified in the special provisions if, in his judgment, the results contemplated by the specifications will be better attained thereby.

If the market price of the grade substituted is higher than that of the grade specified, the difference will be added to the unit contract price for asphalt, or if lower, it will be deducted from the unit contract price. Furthermore in case any substitution so ordered makes it necessary to use a retort or superheater, where same is not required by the grade specified, the Contractor will be allowed \$2.00 per ton (2,000 lbs.) in addition to the revised unit price for asphalt. No additional compensation will be made. If the contract is awarded for the use of asphalt that requires the use of a retort or superheater and substitution is made to a grade not requiring the use of such equipment, a deduction of two dollars (\$2.00) per ton (2,000 lbs.) will be made from the revised unit price.

If the Engineer orders a change of paving asphalt, additional compensation, if any, 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 its cost and that of the original material specified, based on invoices from the supplier, shall be deducted from monies due the Contractor.

-1.01J Notice of Shipment

The producer shall furnish a notice of shipment in triplicate at the time of shipment of each car load or other lot of asphalt cement. The original copy shall be mailed to the Engineer, the duplicate to the consignee and the triplicate with the shipment. The asphalt shall not be unloaded at the point of delivery until the Engineer has checked the notice of shipment. The notice shall contain the following information:

1. Name of shipper.
2. Date of shipment.
3. Car initial and number or suitable identification if shipped by other carrier.
4. Name of commodity.
5. Consignee and delivery point.
6. The contract number or Owner's purchase order number.
7. Point from which shipped.

8. Quantity contained. (When weighed on approved scales show gross, tare and net weights; otherwise show volume as loaded, temperature of loading, gallons at 60° F., and net tons.)
9. Certificate of grade. (Statement that material conforms to the specifications.)
10. Signature of shipper by authorized representative.

-1.01K Samples

The producer shall ship by prepaid express a sample of asphalt taken from each load or other lot that is shipped for use on work under the jurisdiction of the Owner. The sample shall consist of one quart, taken directly from the material after loading, properly labeled, which shall be forwarded promptly to the Engineer, or to a laboratory designated by him.

-1.01L Basis of Measurement

The quantity of asphalt to be paid for shall be the net amount determined by actual weight or by volume measurement. The method of measurement to be used in each instance shall be subject to determination by the Engineer. The apparatus used and the procedure employed in obtaining weight or volume measurements shall meet the approval of and shall be subject to inspection by the Engineer.

Deductions shall be made for any asphalt material included in the measurement that does not actually become incorporated in the work.

The unit of measurement for asphalt shall be a ton of two thousand (2,000) pounds. When measurement is made by volume, computations of weight shall be made in accordance with the following schedule:

Material	Gal. per ton at 60° F.	Material	Gal. per ton at 60° F.	Material	Gal. per ton at 60° F.
SC-70	255	MC-70	255	RC-70	255
SC-250	247	MC-250	247	RC-250	247
SC-800	244	MC-800	244	RC-800	244
SC-3000	241	MC-3000	241	RC-3000	241

The volume of asphalt, with the exception of emulsified asphalt, shall be converted from any temperature to the volume at 60° F., in accordance with the standard ASTM -IP Petroleum Measurement Tables specified in ASTM Designation D 1250.

For the purposes of payment the unit of measurement of emulsified asphalt shall be a ton of two thousand (2,000) pounds. When measurement is made by volume, two hundred forty (240) U. S. gallons of emulsified asphalt at a temperature of sixty degrees (60°) F. shall be considered as equivalent to a ton of two thousand (2,000) pounds. The volume of emulsified asphalt at any temperature shall be converted to the volume at 60° F., using the coefficient of cubical expansion of 0.00025 per degree F.

-1.01M Temperature of Application

Asphalt materials shall be heated to the temperature directed by the Engineer, but within the limits, shown in the accompanying table, before they are applied to the roadway:

Type and Grade of Asphalt	Distributor Spraying Temperature Min. °F.	Max. °F.
LIQUID ASPHALTS		
SC, MC, RC 70 Viscosity	120	180
SC, MC, RC 250 Viscosity	165	220
SC, MC, RC 800 Viscosity	200	255
SC, MC, RC 3000 Viscosity	235	290
ASPHALT EMULSIONS		
RS-1, CRS-1, SS-1, CSS-1, SS-1h & CSS-1h	75	130
RS-2, CRS-2, & CMS-2S	110	160

Section 32—Bituminous Surface Treatment

Paving Asphalts
AR-2000 Minimum 300° F. Maximum 400° F.
AR-4000 Minimum 350° F. Maximum 400° F.
Asphalt for Subsealing and Crack
Pouring Minimum 350° F. Maximum 425° F.
Paving Asphalt for Use in Asphalt
Plants Minimum 250° F. Maximum 350° F.

The temperature of paving asphalts when loaded for transporting to destination shall not be greater than 400° F.

-1.01N Unauthorized Grades

The use of grades of asphalt other than those called for on the plans or in the special provisions, except as provided in Section 27-1.01H, will not be allowed. Any work which proves to be defective because of the use of unauthorized grades of asphalt shall be repaired or removed at the expense of the Contractor, if ordered by the Engineer.

-1.01O Anti-Stripping Additive

When called for on the plans or in the special provisions asphalt material shall be treated with an approved heat-stable anti-stripping additive before use.

Anti-stripping additive in the amount of 1% by weight of the asphalt, or less if ordered by the Engineer, shall be added to the asphalt at the point of shipment.

The anti-stripping additive shall be approved by the Engineer or laboratory prior to use.

Payment for the anti-stripping additive shall be incidental to the unit contract prices for the various items involved. No additional compensation shall be made.

Section 32—Bituminous Surface Treatment

32-1 DESCRIPTION

This specification shall apply to surfaces constructed by treating an existing crushed rock, screened gravel or bituminous roadway surface with asphalt and covering with mineral aggregate to obtain a surface thoroughly cemented to the roadway, having the contour and section shown on the plans and ensuring good riding and non-skid qualities.

Section 32—Bituminous Surface Treatment

32-2 MATERIALS

32-2.01 ASPHALT

The particular asphalt to be used on any project will be those which are called for in the proposal or shown on the plans. Asphalt of the grade or grades specified shall comply with all the requirements set forth in Section 27, Asphalt Materials.

32-2.02 MINERAL AGGREGATE

-2.02A General Requirements

Mineral aggregate to be used for bituminous surface treatment shall be of the type and size called for on the plans or in the proposal. Mineral aggregate may be obtained from Owner-owned stockpiles, produced from Owner-owned sources, or furnished by the Contractor, as may be called for on the plans or in the special provisions.

Any method of handling mineral aggregate which, in the opinion of the Engineer, causes segregation shall be corrected by the Contractor so that a uniform product will be incorporated in the work.

Mineral aggregate shall be manufactured in accordance with Section 22. It shall be manufactured from ledge rock, talus or gravel which meets the following test requirements:

Los Angeles wear, 500 Rev., ASTM Designation C 131 35% Max.

The finished product shall be clean, uniform in quality, and free from wood, bark, roots, and other deleterious materials.

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 fifty percent of the surface area of any size between successive laboratory sieves.

The portion of mineral aggregate for bituminous surface treatment retained on a ¼-inch sieve shall not contain more than 0.1% wood waste by weight. Wood waste is defined as material with a specific gravity less than 1.0 after drying to constant weight.

The portion of mineral aggregate for bituminous surface treatment 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 in accordance with Section 37-2.02B1, except that the color shall be measured after the sample has been in the test solution one hour.

-2.02B Test Requirements

Mineral aggregate for bituminous surface treatment shall conform to the requirements in the table below. The particular grading to be used shall be as shown on the plans. All percentages are by weight.

The requirements for grading shall apply at the time the aggregate is placed in the hauling vehicle for delivery to the project.

The crushed and screened cover stone and crushed screenings shall be damp when applied to the roadway. If the aggregates are dry and dusty in stockpile, the Contractor will be required to wet the stockpiles by spraying.

PASSING SIEVE	Crushed Cover Stone % Passing	Screened Cover Stone % Passing	CRUSHED SCREENINGS		
			5/8"-1/4"	1/2"-1/4"	1/4"-0
3/4" Square	100	100	100	.....	.....
3/8" Square	95-100	95-100	95-100	100	.....
1/2" Square	.....	.....	.....	95-100	.....
3/4" Square	.....	.....	.....	.....	100
1/4" Square	30-50	30-50	0-10	0-15	90-100
U. S. No. 10	.....	.....	0-3	0-3	30-60
U. S. No. 100	.....	.....	0-1	0-1	0-10
U. S. No. 200 (wet sieving)	0-7.5	0-2	.....	.....	.....
Fracture size, including material passing 1/4", minimum %	75	.....	75	75	75
Sand Equivalent (section 6) Min.	40	40	.....	.....	.....
Modified immersion compression test, section 6, minimum % retained strength	70	70	70	70	70

32-3 CONSTRUCTION DETAILS

32-3.01 PREPARATION OF UNTREATED ROADWAY

The existing roadway surface, including intersections and side street approaches, shall be shaped to a uniform grade and section shown on the plans or as directed by the Engineer, by using motor patrol graders equipped with scarifiers and weighing not less than ten tons, by applying water in the amount directed by the Engineer with approved types of distributors, compacting the surface with pneumatic-tired and smooth-wheeled, three-wheel, or tandem rollers, one of which shall weigh not less than eight tons. All equipment shall meet requirements outlined in Section 32-3.11.

The material on the existing street shall be loosened to a depth of approximately one inch, scarifying if necessary. The material shall be drifted back and forth across the street, evenly distributed and compacted into an unyielding mass by blading, rolling, and watering. 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 one-half to one inch above the finished surface. Where existing oil mats are to be met, they shall be thoroughly swept and cleaned to provide proper connections, as the Engineer may direct.

Private driveways entering the street, if shown on the construction plans or indicated in the special provisions, shall be prepared in the same manner except that shaping shall be performed by hand methods to the extent that it is deemed necessary by the Engineer. The depth to which driveways shall be prepared from the street gutter line toward private property shall be as shown on the construction plans or as required in the special provisions.

Where intersections are so flat as to present potential drainage problems, and where street grades are one and one-half (1½) percent or less, the gutter grades will be staked by the Engineer, as required, at intersections, and at 50-foot intervals elsewhere. The roadway shall be graded and compacted to the exact grades as set by the Engineer. Where earth curbs are encountered, the curb shall be shaped in accordance with the section shown on the plans. Where concrete curbs or concrete curb and gutter are in place, grading shall be performed to meet the existing curbs and gutters. Any excess material encountered which cannot be incorporated into the roadway surface shall be removed and disposed of and will be paid for at the unit contract price per cubic yard for "Removal of Excess Surfacing Material."

Preleveling and patching shall be performed only when specified in the special provisions and in accordance with requirements specified therein.

Section 32—Bituminous Surface Treatment

32-3.02 FIRST APPLICATION OF ASPHALT

Before the first application of asphalt is applied, the entire roadway, all side street approaches at intersections, alley approaches, and driveways shall be stable and unyielding, be of medium damp condition, be free from irregularities and material segregation, and be true to line, grade, and cross section. All castings shall be covered with heavy building paper and weighted down with sand or crushed material.

Where concrete curb or curb and gutter exist, the distributor shall be equipped with a splash board of such design as to prevent spraying thereon.

Asphalt shall be applied at the rate of 0.25 to 0.50 gallon per square yard as directed by the Engineer, at temperatures set forth in Section 27-1.01L. 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 times specified herein, provide proper widths to such dimensions as to facilitate the most satisfactory coverage with crushed cover stone, lapping of subsequent adjacent applications, and in such a manner as the Engineer deems most satisfactory for the particular project. Asphalt shall be applied to spandrels of intersections and driveways immediately ahead of, or behind the adjacent longitudinal street application.

Where earth curbs exist, the application of asphalt shall extend four inches beyond the gutter line. On projects that have concrete curb and gutter existing, the application shall lap onto the gutter section, but not to exceed two inches. In the case of vertical concrete curb, the application shall be placed as closely as possible without excessive splash onto the curb.

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

After applying the first shot of asphalt and at such time as the Engineer may direct, crushed cover stone shall be evenly applied to the roadway surface at a rate of 25 to 33 pounds per square yard. The quantity of cover stone to be applied shall be just enough so the asphalt will be uniformly covered and will not pick up under traffic. Where the Contractor places cover stone in excess of the amount directed by the Engineer, he shall remove the excess material before application of the second shot at his own expense. The cover stone shall be applied over the freshly spread asphalt by trailer-type or self-propelled spreader boxes of an approved design. The cover stone 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 back of the spreader box application. Cover stone shall be spread in such a manner as to provide a 4- to 8-inch strip of asphalt exposed to provide a lap with the next application of asphalt cement. Successive spreads of asphalt will then be applied and covered as described above.

As soon as the crushed cover stone has been applied to the first half of the street, the cover stone 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 weighing not less than eight tons.

Where excess rock has been applied, it shall either be removed as previously specified or be drifted uniformly over the adjacent roadway by using an approved 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 cover stone 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 cover stone is well compacted and "set" into the asphalt. This operation will 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 weighing not less than eight tons.

To avoid laps and joints at transverse junctions of separate applications of asphalt, the Contractor shall spread sufficient building paper over the treated surface to assure proper functioning of spray jets when untreated surface is reached.

During that period following the first application of the bituminous surface treatment and prior to the second, the Contractor shall perform brooming, spotting, and rolling as may be necessary to prevent "pick up" or other damage to the surface.

32-3.03 SECOND APPLICATION OF ASPHALT

The final application shall not be applied sooner than five days from the date of completion of the first application of bituminous surface treatment, and the time may be extended for a period in excess of five days if so directed by the Engineer. The roadway surface, including intersections and side street approaches, shall be prepared by use of an approved type of motor patrol grader, equipped with a wire broom mold board. All loose material shall be distributed over the entire roadway so as to provide a uniform thickness of material consisting primarily of coarse material not in excess of one rock thickness. Rotary brooms will not be permitted unless specifically called for in the special provisions. Castings and curbs shall again be protected as described in Section 32-3.02.

As directed by the Engineer, asphalt shall be applied at the rate of 0.2 to 0.35 gallon per square yard and crushed cover stone at the rate of 25 to 33 pounds per square yard. The manner of applying both materials, and the procedure of rolling and brooming shall be the same as for the first application described in Section 32-3.02.

32-3.04 ADDITIONAL ASPHALT AND MINERAL AGGREGATE

If the application of asphalt or cover stone, or both, shall indicate the quantities placed on any particular portions of roadway to be too little or too much for the required results, the Engineer may direct the Contractor to make an additional application of one or both materials in accordance with these specifications, or his directions. Additional asphalt or mineral aggregate thus used will be paid for at the unit contract price for each of the materials used, and no further compensation will be allowed.

32-3.05 PATCHING

Omissions by the distributor or damage to the treated surface of any coat shall be immediately covered by hand patching with asphalt in adequate quantities. Holes which develop in the surface shall be patched. All costs incurred in coating omissions and patching shall be included by the Contractor in his unit contract prices for the materials used and no additional compensation will be made for such work.

32-3.06 CORRECTION OF DEFECTS

Defects such as raveling, low centers, lack of uniformity, or other imperfections caused by faulty workmanship shall be corrected as directed by the Engineer, and new work shall not be opened to traffic until such defects have been remedied.

All improper workmanship and defective materials resulting from overheating, improper handling or application shall be removed from the roadway by the Contractor and be replaced with approved materials and workmanship at his own expense.

32-3.07 PROTECTION OF STRUCTURES

All curbs, curb and gutters, castings, guard rails, road signs, and other facilities shall be protected from splashing of the asphalt. All costs incurred by the Contractor in necessary protective measures shall be included by the Contractor in his unit contract prices for various pay items of the contract.

Section 32—Bituminous Surface Treatment

32-3.08 UNFAVORABLE WEATHER

Asphalt may be applied to damp but not wet material. Subject to the determination of the Engineer, asphalt shall not be applied during rainfall or any imminent storms that might damage the construction. The Engineer shall determine whether the surface and materials are dry enough to proceed with construction.

In general, it is the policy of the Owner to prohibit the application of any asphalt when the ground temperature is lower than fifty degrees F. The Engineer may require the Contractor to delay the application of asphalt until the atmospheric and roadway conditions are satisfactory. No asphalt shall be placed which cannot be covered before darkness.

32-3.09 MAINTENANCE

Unless otherwise provided in the special provisions, the Contractor shall, at his own expense, maintain the completed roadway for a period of five days after the completion of all work on any one continuous section adding screenings when surplus asphalt cement appears on the surface due to action of traffic or climatic conditions.

In the event of the Contractor's failure or neglect to faithfully perform this maintenance, resulting in injury to the surface, the Contractor shall make the necessary repairs at his own expense, to the satisfaction of the Engineer.

32-3.10 PROGRESS OF WORK

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

32-3.11 ORGANIZATION AND EQUIPMENT

Personnel: The Contractor shall have on hand sufficient personnel and required equipment before commencing any stage of construction. Each stage of the construction shall be supervised by competent personnel, thoroughly experienced in the particular type of work. All operators of graders, distributors and trucks shall be experienced in the equipment they operate. Anyone of the Contractor personnel found to be incompetent in execution of his work by the Engineer, shall be replaced by the Contractor upon request of the Engineer.

Equipment: The equipment listed below will be the minimum required for this type of construction, and additional units must be secured if, in the opinion of the Engineer, it becomes necessary to fulfill the conditions of these specifications, or to complete the improvement within the time specified.

1 Asphalt cement heater capable of heating the asphalt cement to the required temperature.

1 Asphalt distributor of at least 1,000 gallon capacity which will distribute the asphalt cement uniformly at the required rate of application. It shall be insulated and equipped with an adequate heating device. It shall be equipped with a ten-foot spray bar with extensions, pressure pump and gauge, volume gauge so located as to be observed easily by the inspector from the ground, a tachometer to control accurately the speed and spread of asphalt cement, and two thermometers, one to be installed permanently in the tank to indicate temperatures of the cement at all times. The power for operating the pressure pump shall be supplied by an independent power unit which will develop a minimum of twenty-five pounds per square inch pressure at the spray bars.

Necessary asphalt patching equipment.

2 Asphalt thermometers.

Necessary insulated transfer supply tanks with a minimum capacity of 1,000 gallons.

Motor patrol graders as required, each equipped with 10-foot blades and wire broom moldboards, weighing not less than ten tons for use on bituminous surface treatment.

1 Spreader box which may be self-propelled or be attached to the rear of the hauling truck. The spreader box must be supported on at least four pneumatic-tired wheels, and equipped with a satisfactory device for metering and distributing the aggregate evenly over the roadway surface.

1 Multiple wheel pneumatic-tired 2-axle roller, having a width of not less than five feet and not more than seven and five-tenths feet, equipped with pneumatic tires of equal size and diameter with smooth or "Highway" treads, satisfactory to Engineer. The tires on the front and rear axles shall be staggered and the angle between the center line of the wheel and tire assembly and the center line of the axle shall be ninety degrees throughout the complete revolution of the wheel on the axle. The air pressure in the several tires shall not vary from each other more than five pounds per square inch.

The gross weight of each roller shall be not less than eight tons nor more than eleven tons. The weight of the rollers shall be as ordered by the Engineer within the above limits, to obtain maximum compaction. The rollers shall be towed by a rubber tired tractor or light truck. The above described roller may be towed or self-propelled if it meets all other requirements of these specifications.

1 Smooth wheeled power roller weighing not less than eight tons.

1 Two-axle power patching roller.

Trucks of uniform capacity equipped with power hoists.

1 Loading device of adequate capacity to load trucks with mineral aggregate.

Hand push brooms.

1 Water tank truck of 1,000-gallon minimum capacity with 10-foot spray bar or splash plates.

All of the mobile equipment listed above except smooth-wheeled power rollers shall be equipped with pneumatic tires. All equipment shall be maintained in good working order to ensure the progress and quality of work.

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

32-3.12 TRAFFIC AND DETOURS

Unless otherwise provided in the special provisions, the Contractor shall plan his operations on the basis that the project will be closed to all traffic during working hours except emergency vehicles such as fire and police departments and ambulance service. The project shall be opened to local traffic after working hours. The project will be opened to all traffic during the time between the first and second applications of light bituminous surface treatment and immediately after completing the last application.

Unless otherwise stated in the special provisions, the Contractor shall furnish and place all necessary detour signs. These shall be placed as directed each day at commencement of work and be removed at completion of the work each day. "Slow" signs and other necessary signs shall be furnished and placed on the project as directed. The cost of this work shall be considered as incidental to the construction and shall be included by the Contractor in the unit pay items of the contract. Further requirements shall be as outlined elsewhere in these general specifications, or in the special provisions.

32-3.13 FINISHING AND CLEANUP

Finishing and cleanup shall be performed as specified in Sections 4-1.08 and 57.

32-4 MEASUREMENT AND PAYMENT

Payment will be made for such of the following bid items as appear on the contract bid proposal and in accordance with requirements described hereinafter:

1. "Preparation of Untreated Roadway," per square yard.
2. "Asphalt (grade)," per ton.
3. "Crushed Stone Surfacing Top Course," per cubic yard, or per ton.
4. "Crushed Cover Stone," per cubic yard, or per ton.
5. "Water," per M gallons.
6. "Removal of Excess Surfacing Material," per cubic yard.
7. "Finishing and Cleanup," per lump sum, or per station (100').

Section 32A—Slurry Seal Coat

32-4.01 PREPARATION OF UNTREATED ROADWAY
Preparation of untreated roadway shall be a pay item on the bid proposal in all cases where bituminous surface treatment is a part of the contract.

The unit contract price per square yard for "Preparation of Untreated Roadway" shall be full compensation for all labor, equipment, and material necessary to perform the required blading, scarifying, processing, leveling, rolling, and all other work incidental to fulfilling the requirements of the specifications not otherwise covered by other pay items.

32-4.02 ASPHALT

The unit contract price per ton for "Asphalt (particular type required)" shall be full compensation for furnishing, heating, hauling, and spreading. The quantity of asphalt shall be upon measurement described in Section 27-1.01K.

32-4.03 CRUSHED STONE SURFACING AND CRUSHED COVER STONE

The measurement of aggregates to be furnished by the Contractor shall be by the cubic yard based on net volume at point of delivery, or by the ton in truck, whichever is shown on the bid proposal.

The unit contract price for these items shall be full compensation for furnishing the material, hauling, and placing in accordance with the specifications.

32-4.04 WATER

Water shall be paid for in accordance with the unit contract price per M gallons for "Water," which shall be full compensation for hauling, placing, and also the furnishing of water unless the special provisions provide otherwise.

32-4.05 REMOVAL OF EXCESS SURFACING MATERIAL

Where excess material is encountered on the roadway at any stage of the work and where, in the opinion of the Engineer it must be removed, it shall be paid for at the unit contract price per cubic yard for "Removal of Excess Surfacing Material," as measured in trucks at point of loading. Where excess material has been placed through carelessness or poor workmanship of the Contractor, no payment will be made for such removal.

32-4.06 FINISHING AND CLEANUP

Whenever any contract has for its major purpose the construction of bituminous surface treatment, the payment for cleanup as described in the specifications shall be by a lump sum or per station (100') in accordance with the bid item for "Finishing and Cleanup," provided, however, that if the proposal does not contain a bid item for "Finishing and Cleanup," then in that event all cleanup work specified in the contract shall be considered as incidental to the construction and all costs thereof shall be included by the Contractor in his various unit contract prices of other items.

Whenever the light bituminous surface treatment is only a minor part of a contract which includes other types of work, the cleanup required for the light bituminous surface treatment part of the contract shall be considered as incidental to the general cleanup of the entire project and the cost thereof to meet the requirements of the specifications shall be included in the various unit contract prices of other items by the Contractor.

32-4.07 INCIDENTAL WORK

Any incidental work required to complete the bituminous surface treatment as specified herein, but which is not specifically mentioned in the foregoing specifications, shall be performed by the Contractor and shall be considered as incidental to the construction, and all costs therefor shall be included in the unit contract prices of the bid items.

Section 32A—Slurry Seal Coat

32A-1 DESCRIPTION

The work covered by this specification consists of furnishing all labor, equipment and materials used in performing all operations necessary in connection with the application of a slurry seal upon the designated surface.

The slurry seal shall consist of a mixture of emulsified asphalt, mineral aggregate and water which has been properly proportioned, mixed and spread evenly on the designated surface and as directed by the Engineer. The cured slurry seal shall have a homogeneous appearance, fill all cracks, adhere firmly to the surface and have a skid resistant texture.

32A-2 MATERIALS

32A-2.01 Asphalt

The asphalt shall be an Anionic Quick-Setting type QS-h emulsified asphalt and shall conform to the following requirements:

Properties	Limits
Viscosity at 77° F., Saybolt-Furol, sec. (undiluted)	100 max.
Residue by Distillation, %	57 min.
Sieve Test, Retained on 20 Mesh, %	0.10 max.
Particle Charge, Electroplate	Negative
Tests on Residue from Distillation:	
Penetration at 77° F., 100 g., 5 sec.	40-100
Solubility in Trichloroethylene, wt. %	97 min.
Ductility at 77° F., cm.	40 min.

32A-2.02 Mineral Aggregate

Mineral aggregate to be used for slurry seal coat shall be manufactured from ledge rock, talus or gravel in accordance with the provisions of Section 22. The material from which the aggregates are produced shall meet the following test requirements:

Los Angeles Wear, 500 Rev. (ASTM Designation C131)	30% max.
Degradation Factor (WSHD Test Method No. 113A)	50 min.

The finished product shall be clean, uniform in quality and free from wood, bark, roots and other deleterious materials.

It may be necessary during stockpiling to add blending sand or filler to improve the grading of the mineral aggregate. For this purpose only, crushed fines from the aggregate source may be used but only in the minimum amount needed for optimum mix design and workability.

When tested in accordance with ASTM Designation D2419, the total aggregate blend shall have a sand equivalent of not less than 45. The fracture of each size above the No. 8 sieve shall be a minimum of 75%. The combined mineral aggregate including blending sand and fillers, but not portland cement, shall conform to one of the following grading limits as noted in the bid items.

Sieve Size	Per Cent Passing	
	Type I	Type II
No. 4	100	100
No. 8	100	90-100
No. 16	90-100	65-90
No. 30	65-90	45-70
No. 50	40-60	30-50
No. 100	25-42	18-30
No. 200	15-30	10-21
No. 200	10-20	5-15
Asphalt Content (total emulsion), % by Weight of Dry Aggregate	10-16	7.5-13.5

32A-2.03 Setting Agent

The setting of the OS-h emulsified asphalt-aggregate system is initiated and controlled by the addition of small quantities of portland cement. Addition of portland cement up to 2% by weight of dry aggregate may be required, and the Contractor may at his option add portland

Section 32A—Slurry Seal Coat

cement up to an additional 1% by weight of dry aggregate in order to accelerate setting. The portland cement shall conform to the requirements of AASHO Designation M85 for Type I or Type II cement.

32A-2.04 Water

All water used with the slurry mixture shall be potable, reasonably free from oil, dirt, silt and harmful salts and conform to the requirements for Mixing Water, Portland Cement Concrete, Section 37-2.03.

32-2.05 Additives

Any material added to the slurry mixture or any of the component materials shall be approved by the Engineer prior to use, and the Contractor shall furnish a statement describing the additive, its purpose and quantity to be used.

32A-3 EQUIPMENT

32A-3.01 General Requirements

All equipment and associated tools used in the placement of slurry seal shall be maintained in satisfactory working condition at all times. Descriptive information on the slurry mixing and applying equipment to be used shall be submitted by the Contractor to the Engineer not less than 7 days before the work starts for the purpose of approval of the equipment.

32A-3.02 Slurry Mixing Equipment

The slurry mixing machine shall be a continuous flow mixing unit, either truck or trailer mounted, and be capable of delivering accurately to the mixing chamber a predetermined proportion of aggregate, water and emulsified asphalt, and discharging the thoroughly mixed product on a continuous basis. The aggregate shall be prewetted immediately prior to mixing with emulsified asphalt. The mixer-blender of the mixing machine shall be capable of thoroughly blending all ingredients together with no violent mixing occurring.

The mixing machine shall be equipped with an approved fines feeder that provides an accurate metering device or method of introducing a predetermined amount of portland cement into the mixer-blender at the same time and location that the aggregate is fed. This fines feeder shall be used to add portland cement to initiate and control setting of the slurry mixture. The slurry machine shall have a struck-off aggregate storage bin capacity of not less than 7 cubic yards.

The mixing machine shall be equipped with a water pressure system and fog type spray bar adequate for uniform fogging of the surface immediately ahead of the slurry spreading equipment.

The aggregate feed to the mixer shall be equipped with a revolution counter so that the amount of aggregate used may be determined at any time. The emulsified asphalt pump shall be of the positive displacement type and shall be equipped with a revolution counter or meter so that the amount of asphalt used may be determined at any time. The water pump for dispensing water into the mixer-blender shall be equipped with a meter which will read-out in total gallons. The water line into the mixer-blender shall be equipped with a minimum of two valves. One valve shall establish the required water flow and the other valve shall be a quick acting valve to start and stop water flow. The controls for proportioning each material to be added to the mix shall be calibrated and properly marked. They shall be accessible for ready calibration and so placed that the Engineer may determine the amount of each material used at any time.

The slurry mixing machine shall be equipped with a "fifth wheel" type odometer that will measure the total feet traveled.

32A-3.03 Slurry Spreading Equipment

Attached to the mixing machine shall be a mechanical

type spreader box capable of applying slurry mixture evenly over the surface. The box shall be equipped with flexible material in contact with the surface on the front, middle and sides to prevent loss of slurry and on a back as a squeegee to strike-off the slurry. It shall be maintained and adjusted so as to prevent the loss of slurry on varying grades and crowns and to assure uniform spread. The box shall be equipped with a steering device and shall have an adjustable width up to at least 12 feet. The box shall be kept clean, and build-up of asphalt and aggregate of the box shall not be permitted. The use of a burlap or other acceptable drag may be required by the Engineer to obtain the desired texture. If a drag is used, it shall be washed or replaced as necessary to insure that slurry mix accumulations do not cause scores or streaks.

32A-3.04 Cleaning Equipment

Power brooms, power blowers, air compressors, water flushing equipment, and hand brooms shall be provided for cleaning the surface and cracks of the existing pavement as needed or required by the Engineer.

32A-3.05 Auxiliary Equipment

Hand squeegees, hand drags, shovels, an asphalt distributor and other equipment shall be provided as necessary to perform the work. Containers shall be required for disposal of waste slurry.

32A-4 CONSTRUCTION REQUIREMENTS

32A-4.01 Stockpiling of Aggregate

Precautions shall be taken to insure that a stockpile does not become contaminated with oversized rock clay, or silt, or collect excessive amounts of moisture. The stockpile shall be placed in an area that drains readily. Segregation of the aggregate will not be permitted.

32A-4.02 Asphalt Storage

Any emulsified asphalt storage used by the Contractor shall be suitable with the storage container constructed so as to prevent water from entering the asphalt. An acceptable heating system shall be provided if necessary to prevent the emulsified asphalt from freezing, but the asphalt shall not be heated to a temperature greater than 130° F.

32A-4.03 Weather Limitations

Slurry seal shall be placed only when the air and pavement surface temperatures are 55° F. or above and the weather is not foggy or rainy.

32A-4.04 Surface Preparation

Immediately prior to applying the slurry, the surface shall be cleaned thoroughly of all loose material, silt spots, vegetation, and other objectionable matter. Any standard method used to clean pavements will be acceptable, except water flushing will not be permitted in areas where extensive cracking exists in the pavement surface. The Engineer shall give the final approval of the surface.

If the slurry is to be placed over a brick or portland cement concrete surface, a highly absorbent asphalt surface, or over an asphalt surface where the exposed aggregate has become polished and slick, a tack coat of emulsified asphalt of the same type and grade specified for the slurry and diluted with water (1 part water to 1 part asphalt by volume) shall be applied. The tack coat shall be applied with an asphalt distributor with the normal application rate being from 0.05 to 0.10 gallons per square yard of diluted emulsion. The Engineer shall give final approval to the rate of application.

32A-4.05 Composition of Slurry Mixture

The amount of emulsified asphalt to be blended with the aggregate shall be that as recommended by a labora-

Section 32B—Coal Tar Pitch Emulsion Seal Coats

tory analysis and subject to final adjustment in the field on the basis of a test section on a nearby surface off the pavement to be covered. The minimum amount of water shall be added as necessary to obtain a fluid and homogeneous mixture.

32A-4.06 Application of Slurry Mixture

Immediately prior to application of the slurry, the existing surface shall be prewetted with a water fog spray at such a rate that the entire surface shall be damp. The slurry mixture shall be placed upon the damp surface and shall have a thick, creamy consistency and shall be relatively free-flowing. Once the proper consistency is obtained, changes in proportioning of the various component materials of the mixture shall be held to a minimum.

The slurry mixture shall be spread to fill cracks and minor depressions and will have a uniform non-skid surface. The slurry shall be placed with a spreader box except in those inaccessible areas where hand spreading may be required. A hand drag may be required in areas of hand spreading to give the same texture as the machine spread surface.

The total time of mixing in the mixer-blender shall not exceed 4 minutes. A sufficient amount of slurry shall be carried in all parts of the spreader box at all times so that complete coverage is obtained. No lumping, balling, or unmixed aggregate shall be permitted. No segregation of the emulsion and aggregate fines from the coarse aggregate will be permitted. If oversized aggregate or foreign matter appears in the slurry mixture, slurry placement shall be discontinued and the aggregate rescreened to remove these materials. Streaks such as those caused by oversized aggregate shall be corrected and not left in the finished slurry surface. Excessive breaking of the emulsified asphalt in the spreader box will not be allowed and adjustments in the amount of setting agent shall be made to correct this problem.

No excessive build-up nor unsightly appearance shall be permitted on longitudinal or transverse joints. All transverse joints shall be squared-off and the slurry mix removed deposited in a container suitable to the Engineer, or placed outside the pavement surface for removal prior to project completion. The Contractor shall use building paper at each transverse joint to avoid sags or ridges on the previous application of slurry. The Contractor may employ an alternate method to achieve smooth joint construction subject to approval by the Engineer. In general, longitudinal or transverse joints shall be made with the slurry substantially cured, or fresh and still workable.

On steep grades, those in excess of 8%, the slurry seal shall be placed uphill unless otherwise authorized by the Engineer. On projects have major intersections and braking areas, rolling of the slurry mixture with a pneumatic-tired roller may be required to reduce the scuffing action of vehicles.

Slurry treated areas shall be allowed to cure until such time as the Engineer permits their opening to traffic.

32A-4.07 Traffic Control

Unless otherwise provided in the Special Provisions, the Contractor shall plan his operations on the basis that the project will be closed to all traffic during working hours except emergency vehicles, such as ambulance, fire and police. It shall be the responsibility of the Contractor to provide suitable methods such as barricades, signs, flagmen, etc., to protect the uncured slurry. If damage occurs in spite of adequate precautions to protect the uncured slurry, the Contractor will be reimbursed for repair of the damage.

The cost of traffic control shall be considered as incidental to the construction and shall be included by the Contractor in the unit price items of the contract.

32A-4.08 Finishing and Cleanup

Finishing and cleanup shall be performed as specified in Sections 4.08 and 57.

32A-5 Measurement and Payment

Payment will be made for such of the following bid items as are included and shown in any particular contract.

1. "Preparation of Existing Surface", per square yard.
2. "Asphalt for Tack Coat Applied on Surface", per ton.
3. "Furnish and Apply Emulsified Asphalt Slurry Mixture", per square yard.
4. "Pneumatic-tired Rolling of Slurry Mixture", per square yard.

Section 32B—Coal Tar Pitch Emulsion Seal Coats

32B-1 Description

This work shall consist of the construction of a single or multiple course coal tar pitch emulsion seal in accordance with these specifications.

32B-2 Materials

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

Coal tar pitch emulsion shall conform to all requirements of Federal Specification R-P-355. The emulsion shall be prepared from straight run, high temperature, coke oven tar conforming to the requirements of Federal Specification RC 1424. The emulsion shall be homogeneous and shall show no separation or coagulation of components that cannot be overcome by moderate stirring. It shall be capable of application and complete coverage by surface of bituminous pavements when spread at the specified rates.

Aggregates:

Mineral aggregate for coal tar pitch seal shall be either a natural sand or manufactured product composed of clean, hard, durable, uncoated particles free from dirt, organic matter and other objectionable substances. The aggregate shall meet the following requirements:

% Passing U.S. No. 16 sieve.....	100
% Passing U.S. No. 30 sieve.....	15-85
% Passing U.S. No. 50 sieve.....	2-10
% Passing U.S. No. 100 sieve.....	0-2

All percentages are by weight.

Sand Equivalent30 min.
Water used for mixing and for surface dampening shall be clear, fresh and potable.

32B-3 Construction Requirements

32B-3.01 Equipment

All equipment, tools, and machines used in the performance of the work shall be subject to the approval of the Engineer and shall be maintained in satisfactory working condition at all times.

Equipment for surface cleaning shall be capable of effectively removing oil, grease, dust, dirt or other objectionable materials from the pavement surface prior to seal coat application.

The mixer for combining the coal tar pitch emulsion and sand for Type 1 seal shall be of the blade or paddle type (Plaster Mixer or Pug-Mill). For larger operations, a concrete transit mixer or a conventional slurry machine may be used with the approval of the Engineer. The mixer shall be of sufficient size and power to obtain thorough and uniform mixing at the rated capacity.

Application equipment shall consist of suitable brooms, squeegees, slurry seal and spreader box and distributor as required. The selection of the application equipment is dependent upon type of seal, project size and job conditions. The equipment shall be approved by the Engineer.

The distributor shall include a mixing tank with agitator, water tank, pressure pumps and regulators, hydraulic or pneumatic controls and spray-bar nozzles

Section 32B—Coal Tar Pitch Emulsion Seal Coats

capable of applying the emulsion at a uniform rate. It shall also have suitable metering devices for gauging the rate of application. The distributor equipment may be provided with a separate water spray-bar located ahead of the product spray-bar, or a separate water truck may be used in place of the extra spray-bar. Hand spray equipment or nylon brushes shall be available for application where mechanical equipment cannot be used.

Where a slurry box spreader is used for Type 1 seal, it shall be attached to the mixer. It shall be of a mechanical type squeegee box equipped with flexible material in contact with the surface to prevent loss of slurry from the box. It shall have adjustments to assure uniform spread and an adjustable width up to 12 feet. The box shall be kept clean, and build up of bitumen and aggregate on the box shall not be permitted. The use of burlap drags or other acceptable drags may be required by the Engineer.

32B-3.02 Surface Preparation

All pavement surfaces shall be thoroughly clean before application of the seal coat regardless of type.

On newly constructed asphalt concrete, the surface shall be allowed to age for at least two weeks. The surface shall then be washed with a strong detergent such as trisodium phosphate, and thoroughly rinsed with water. The cleaned pavement shall be allowed to dry completely before application of the coal tar pitch emulsion seal coat.

Old pavement surfaces shall be free of oil and grease spots, paint, clay, dust and other objectionable materials which might adversely affect bonding of the emulsion. Cleaning equipment shall be capable of effectively removing oil, grease, paint, clay, dust and other objectionable materials. Solvents shall not be used for cleaning.

Where indicated in the special provision, or ordered by the Engineer, pavement surfaces that have been softened and cut back by petroleum derivatives, or have failed from other causes, shall be removed and replaced by a hot plant mix asphalt concrete and compacted to match existing pavement in order to provide a surface texture comparable to that of the surrounding area. Such replacement areas shall be prepared as new pavement surfaces before application of the coal tar pitch emulsion seal coat.

32B-3.03 Coal Tar Pitch Emulsion Seal Type 1

This method of seal requires an application of coal tar pitch emulsion prime coat and two applications of coal tar pitch emulsion sand slurry.

32B-3.03A Preparation of Emulsion

The coal tar pitch emulsion shall be thoroughly stirred in its container as received, preferably by power mixer, so that a creamy homogeneous consistency of all material in the container is assured for ready application.

32B-3.03B Proportioning Sand Slurry

Aggregate shall be mixed with the emulsion at the rate listed below based on the oven dry weight of the aggregate.

Water blended into the mix for workability shall include the surface moisture content of the aggregate and shall not exceed 20 percent, by volume, of emulsion used. The amount of water to be added to the emulsion shall be the minimum necessary to secure a workable mixture as determined by the Engineer.

32B-3.03C Mixing Sand Slurry

Emulsion shall be charged into the mixer first, and if necessary, water shall be added in minimal amounts as the mixer operates, allowing not less than 5 minutes for thorough blending of the liquids. Dampened aggregate shall be introduced slowly during mixing to prevent segregation or lumping of the materials, and mixing shall be continued for a minimum of 5 minutes after all aggregate has been added. The mixture shall be uniform and homo-

geneous and no slurry shall be accepted in which the emulsion has broken prior to spreading operations.

32B-3.03D Application

After completion of surface preparation and immediately prior to application of the emulsion, the pavement surface shall be dampened with a fog spray of water as directed by the Engineer. A distributor truck or other method approved by the Engineer shall be used to apply the water.

Emulsion and slurry shall be applied by the combined or individual use of a distributor, spreader box, brushes, nylon or plastic bristled brooms, squeegees and related hand tools.

The first application shall consist of coal tar pitch emulsion (prime coat) spread at a rate of 0.075 to 0.10 gallon per square yard.

The second application shall consist of coal tar pitch emulsion sand slurry containing 3 to 5 pounds of aggregate per gallon of undiluted emulsion, spread at a rate of 0.10 to 0.15 gallon per square yard.

The third application shall consist of slurry containing 4 to 6 pounds of aggregate per gallon of undiluted emulsion, spread at a rate of 0.10 to 0.15 gallon per square yard.

If required by the Engineer, the surface shall be dampened with water prior to application of each coat. Each application shall be cured sufficiently so that the material will not adhere to and be picked up by the tires of vehicles before the next coat is applied. The curing period between applications shall be designated by the Engineer, but in no case shall be less than 4 hours.

Each coat shall be so applied that coverage is uniform, and any pinholes or unsealed areas shall be repaired prior to each subsequent operation.

Upon completion of the slurry seal construction, all traffic shall be excluded from the area for not less than 24 hours, or longer, if directed by the Engineer.

32B-3.04 Coal Tar Pitch Emulsion Seal Type 2

This method of seal requires two applications of coal tar pitch emulsion and applications of aggregate if ordered by the Engineer.

32B-3.04A Preparation of Emulsion

The coal tar pitch emulsion shall be thoroughly stirred in its container as received, preferably by power mixer, so that a creamy homogeneous consistency of all material in the container is assured for ready application.

32B-3.04B Application

After completion of surface preparation and immediately before application of any coal tar pitch emulsion, the pavement surface shall be fog-spray dampened with clean water as directed by the Engineer.

Coal tar pitch emulsion shall then be uniformly applied over the prepared surface at a rate of 0.05 to 0.10 per square yard. This application shall be allowed to cure sufficiently so that material will not adhere to or be picked up by vehicle tires before the next coat is applied. The curing period between applications shall be as designated by the Engineer, but in no case shall be less than 4 hours.

Following cure of the first coat, a second application of coal tar pitch emulsion shall be made at a rate of 0.10 to 0.15 gallon per square yard as ordered by the Engineer. After completion of the second application, all traffic shall be excluded from the area covered for 24 hours, or longer, if directed by the Engineer.

Each coat shall be so applied that coverage is uniform, and any pinholes or unsealed areas shall be repaired prior to each subsequent operation.

If ordered by the Engineer, sand in the approximate amount of 3 to 5 lbs. per square yard shall be applied to either of the above coats before final cure. The sand used shall be approved by the Engineer and meet the requirements set forth in Section 32B-2.

Section 33—Asphalt Treated Base

32B-3.05 Weather Limitations

Coal tar pitch emulsion seal coats shall be constructed in dry weather and only when the ambient temperature is 45° F. or above.

32B-4 Measurement

Preparation of surface shall be measured by the square yard of surface prepared in accordance with these specifications.

Coal tar pitch emulsion shall be measured by the gallon of undiluted emulsion used in the work.

Mineral aggregate shall be measured by the cubic yard in trucks at the point of delivery on the roadway.

Coal tar pitch emulsion seal coat shall be measured by the square yard of seal completed in place and accepted by the Engineer.

32B-5 Payment

Payment will be made for such of the following bid items as are included in the proposal and payment will be made under:

1. "Preparation of Surface," per square yard.
2. "Coal Tar Pitch Emulsion," per gallon.
3. "Mineral Aggregate," per cubic yard.
4. "Coal Tar Pitch Emulsion Seal Coat, Type, " per square yard.

The unit contract price per square yard for "Preparation of Surface" shall be full compensation for all labor, tools, equipment materials and water required to complete the work of preparing the surface, including patching, in accordance with these specifications.

The unit contract price per gallon for "Coal Tar Pitch Emulsion" and per cubic yard for "Mineral Aggregate" shall be full compensation for furnishing these materials at the job site.

The unit contract price per square yard for "Coal Tar Pitch Emulsion Seal Coat, Type" shall be full compensation for all costs of labor, equipment and other materials including water required in the transportation, mixing, placing of the material and all other work required to complete the construction as specified.

Section 33—Asphalt Treated Base

33-1 DESCRIPTIONS

Asphalt Treated Base, ATB, consists of an aggregate base material which has been waterproofed and stabilized by plant mixing with an asphalt binder.

This work shall consist of one or more courses of ATB placed directly on the subgrade or an untreated aggregate base in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer.

33-2 MATERIALS

33-2.01 Asphalt

The asphalt binder shall be AR-2000 or AR-4000 paving asphalt as designated on the plans, in the special provisions or ordered by the Engineer. The asphalt used shall comply with the requirements of Section 27-1.01D.

33-2.02 Mineral Aggregate

Aggregates for ATB shall be manufactured from ledge rock, talus, or gravel in accordance with the provisions of Section 22, and shall meet the following test requirements.

Los Angeles Wear, 500 Rev.	30% max.
(ASTM Designation C131)	
Degradation Factor	
(WSHD Test Method No. 113A)	15% min.

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Aggregates for ATB shall meet the following requirements for grading:

Pass 2" Sieve (Square opening)	100%
Pass 1½" Sieve (Square opening)	56-100
Pass ¾" Sieve (Square opening)	40-78
Pass U.S. No. 10 Sieve	22-57
Pass U.S. No. 40 Sieve	8-32
Pass U.S. No. 200 Sieve	2-9
Paving Asphalt, % of total mixture	3.0-5.0
(Exact percentage of paving asphalt to be determined by the Engineer)	

When tested in accordance with ASTM Designation D2419, the mineral aggregate shall have a sand equivalent of not less than 35.

33-2.03 Test Requirements

When the aggregates are combined within the limits set forth above, and mixed in the laboratory with the designated grade of asphalt, the mixture shall be capable of meeting the following test values:

Stabilometer Value	20 min.
Cohesimeter Value	50 min.
Modified Immersion Compression (M.I.C.) Test, % Retained Strength	70 min.

33.3 CONSTRUCTION REQUIREMENTS

33-3.01 Asphalt Mixing Plant

Asphalt mixing plants used to produce ATB shall be capable of meeting the following requirements:

33-3.01A Dryer

The dryer shall be capable of drying the aggregates and heating them to the required temperature.

33-3.01B Proportioning

The mixing plant shall be capable of proportioning the aggregates and asphalt within the range and at the rate specified by the Engineer. If the mineral aggregate is furnished in a single stockpile, the mixing shall be accomplished in a continuous mix or batch type plant meeting the requirements set forth in Section 34. With either plant type, provisions shall be made to separate the aggregate into at least two different sizes immediately after heating in the dryer.

If the Contractor furnishes the aggregate in two separate stockpiles and feeds each size separately onto the cold belt or elevator in the proportion required to provide a completed mixture meeting all requirements of these specifications, and if the size separation of the stockpiles is such that neither pile contains more than 75% of the total aggregate, the requirements for a screening or gradation unit immediately ahead of the pugmill mixer will not be required.

If the Contractor elects the separate stockpile alternative, he may provide either a batch type or continuous mixer. If a continuous mixer is used, the requirements for calibrated gates and sampling devices for each bin or size of aggregate will not be required provided that the asphalt pump and the aggregate feeder are so synchronized that the quantity of asphalt delivered to the mixer and incorporated into the mix can be controlled accurately.

33-3.01C Mixer

The mixer shall be capable of producing a uniform mixture of uniformly coated aggregate particles meeting the requirements of these specifications.

33-3.02 Preparation of Aggregate

Aggregates for ATB shall be stockpiled before use in the event they do not meet the specifications in their natural state. The aggregates shall be heated to a temperature directed by the Engineer but within the limits of 375° and 350° F.

Section 34—Asphalt Concrete Pavement

33-3.03 Heating of Asphalt Material

The heating of the asphalt material shall conform to the requirements of Section 34-3.04.

33-3.04 Mixing

The ATB shall be mixed in accordance with the requirements of Section 34-3.06.

33-3.05 Hauling Equipment

Trucks used for hauling ATB shall have tight, clean, smooth metal beds which have been thinly coated with a minimum amount of mixture of water and light oil or diesel oil before receiving a load of mixture. Excess water and oil shall not be left in the bottom of the trucks. Each truck shall have a cover of canvas or other suitable material of such size as to protect the mixture from the weather.

33-3.06 Spreading and Finishing

ATB shall be spread with a spreading machine equipped with a stationary, vibratory or oscillating screed or cutoff device subject to the approval of the Engineer. Final approval of the equipment shall be based on a job demonstration that the finished base will meet all the requirements of these specifications. Automatic screed controls may be employed but will not be required.

33-3.06A Subgrade Protection

Unless otherwise directed by the Engineer, the Contractor shall place ATB as a protection for a prepared subgrade on sections which are to receive ATB, as soon as 10,000 square yards of the subgrade have been completed. This requirement shall not necessarily be limited to contiguous areas on the project.

33-3.06B Final ATB Course

The final surface course of the ATB section, whether constructed in one or more lifts, shall not deviate at any point more than ¼" from the bottom of a 10 ft. straight-edge laid in any direction on the surface on either side of the roadway crown. Failure to meet the above requirement will necessitate sufficient surface correction as to satisfy the requirement and this shall be done at the Contractor's expense.

33-3.07 Compacting

The Contractor will place on each project a sufficient number and type of rollers with competent and experienced operators to efficiently compact the ATB mixture while it is still in a workable condition. The normally required minimum rolling equipment for each project will be two (2) saatic steel-wheeled rollers with at least one (1) of these rollers being of the tandem type. If the Contractor can obtain the required smoothness and density with fewer, or other types of compacting units, the Engineer may permit this.

33-3.08 Density

The ATB shall be compacted to a density of not less than 80% of the maximum theoretical density established by the Rice Vacuum Pycnometer method. The density of the ATB shall be determined by means of tests on pavement cores. The frequency of such cores shall be at the discretion of the Engineer, but in no case shall it be less than one (1) core for each normal day's production.

33-4 MEASUREMENT

Asphalt treated base will be measured by the ton.

33-5 PAYMENT

Payment will be made for asphalt treated base on a per ton basis. The unit contract price per ton for ATB

shall be considered full compensation for furnishing all labor, equipment, materials, tools and supplies and for all other costs including producing, screening, loading, hauling, and stockpiling the asphalt treated base aggregate, furnishing the asphalt cement, mixing, hauling, spreading, compacting the asphalt treated base, and all other work not set forth as bid items in this contract incidental to fulfilling the requirements of these specifications.

Section 34—Asphalt Concrete Pavement

34-1 DESCRIPTION

These specifications apply to pavements constructed of asphalt concrete in one or more courses and include bases, leveling courses and wearing surfaces. The number of courses in the pavement cross section shall be as shown on the plans or designated in the special provisions.

Unless otherwise specified in the special provisions, the Contractor shall furnish all asphalt and mineral aggregates, mineral filler and blending sand as may be required and perform all mixing, hauling, spreading, compacting and other work necessary to complete an asphalt concrete pavement in accordance with these specifications.

34-2 MATERIALS

34-2.01 ASPHALT

The grade of paving asphalt shall be AR-2000 or AR-4000 as specified in the special provisions, designated on the plans or ordered by the Engineer. Any grade of asphalt used shall comply with the requirements of Section 27, ASPHALT MATERIALS, of these specifications and the special provisions.

34-2.02 MINERAL AGGREGATE

-2.02A General Requirements

The material from which mineral aggregate for asphalt concrete is manufactured shall meet the following test requirements:

Los Angeles Wear (ASTM Designation C 131) 500 Rev. 30% Max.

Mineral aggregate for asphalt concrete shall be manufactured from ledge rock, talus, or gravel in accordance with the provisions of Section 22. It shall be uniform in quality, substantially free from wood, roots, bark, or other extraneous materials, and free from adherent coatings. The presence of a thin, firmly adhering film of weathered rock will not be considered as coating unless it exists on more than fifty (50) percent of the surface area of any size between consecutive laboratory sieves.

Mineral aggregate removed from deposits contaminated with various types of wood waste shall be washed, processed, selected or otherwise treated to remove as much of the wood waste as possible from the finished product. The Engineer may require the material to be washed if, in his judgment, an undue amount of wood contamination will otherwise be present in the finished product.

Mineral aggregate retained on a ¼-inch square sieve will be considered free from wood waste if the oven-dried aggregate does not contain more than 0.1% by weight of material with a specific gravity less than 1.0.

That portion of the mineral aggregate passing the U.S. No. 10 sieve, when tested for organic matter, shall not have wood waste that results in a darker color than that specified in Section 37-2.02B1 except that the color shall be measured after the sample has been in the test solution for one hour.

-2.02B Test Requirements

Mineral aggregate for asphalt concrete shall meet the following test requirements:

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CLASS OF ASPHALT CONCRETE	B	G	D	E	F
% Fracture, size above U.S. No. 10	75	75	75	50	50
% Minimum sand equivalent	45	45	45	45	35

The properties of the mineral aggregate for asphalt concrete shall be such that when it is combined within the limits set forth under Section 34-2.03 and mixed in the laboratory with the designated grade of asphalt, the mixtures can be produced with the minimum value shown below.

CLASS OF ASPHALT CONCRETE	B	G	D	E	F
Minimum Stabilometer	30	30	..	25	25
Minimum Cohesimeter	100	100	..	100	50
% Air Voids	2-4.5	2-4.5	..	2-4.5	2-4.5
Modified Immersion, Compression, retained strength % min.	70	70	70	70	70

Stockpiling

Preparation of stockpile site, the stockpiling of mineral aggregates and the removal of the materials from stockpiles shall conform to the requirements of the specifications for stockpiling surfacing materials in Section 23-3.01. The method of producing and stockpiling mineral aggregates selected by the Contractor shall be approved by the Engineer. Approval will be contingent upon proof submitted by the Contractor that a completed mix can be produced satisfactorily.

In taking mineral aggregates from stockpiles, the Contractor shall use only the amount of material required by these specifications and shall load it in a manner to avoid separation of sizes or the admixture of any dirt or foreign material. The Contractor shall clean up the remainder of the stockpile and leave it in a uniform and compact pile with a minimum waste.

-2.02C Grading of Mineral Aggregates

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: 1 1/4" to 1/4", 3/8" to 1/4", and 1/4" to 0. Each size shall be stockpiled separately regardless of whether it is being produced for future work on other contracts or for immediate use, with the exception that, if the Contractor proportions the asphalt concrete in a batch type plant with approved automatic controls or with a continuous mix plant, he may then use one or more stockpiles provided that the stockpiled aggregate with blending sand, if necessary, shall meet the grading requirements determined by the Engineer to be within the specifications for the class of asphalt concrete to be produced. Mineral aggregate for classes G and D shall be produced or furnished in one size designation, as specified hereinafter.

The gradation of all stockpiles shall be such that when recombined with an approved blending sand—if that becomes necessary—an aggregate is produced which will result in a completed mix in compliance with all requirements.

When the grading is determined before the aggregate is introduced into the pug mill, the amount of material passing the U.S. No. 200 sieve shall be determined by "wet sieving".

Stockpiles for Immediate Use

The Contractor shall furnish representative samples of the mineral aggregates being produced and stockpiled and of the available blending sand to the Engineer as soon as stockpiling begins to permit a preliminary mix design to be prepared.

The sizes of coarse aggregate stockpiled for classes B and E shall meet the following requirements for grading:

COARSE AGGREGATE

CLASS OF ASPHALT CONCRETE	B	E
Size Designation	5/8" to 1/4"	1 1/4" to 1/4"
% Passing 1 1/4" sieve	100	100
% Passing 1" sieve	100	85-100
% Passing 3/8" sieve	100	45-70
% Passing 1/2" sieve	75-100	..
% Passing 1/4" sieve	0-25	0-25

All percentages by weight.
If a suitable source of blending sand is available and has been approved by the Engineer or laboratory as a source of supplemental fines, the fine aggregate may be graded as follows:

FINE AGGREGATE

CLASS OF ASPHALT CONCRETE	B	G	D	E
Size Designation	1/4" to 0	3/8" to 0	3/8" to 0	1/4" to 0
% Passing 1/2" sieve	100	100	100	100
% Passing 1/4" sieve	70-100	62-82	50-72	70-100
% Passing No. 10 sieve	35-75	32-48	10-28	35-75
% Passing No. 200 sieve	2-12	3-7	0-3	2-12

All percentages by weight.
In those classes of asphalt concrete where separation into two sizes is required, the Contractor shall so control the separation and stockpiling of coarse and fine mineral aggregate that the quantity of material passing the 1/4-inch sieve in the coarse aggregate shall not vary more than 10% throughout the entire stockpile.

The material in each separate stockpile, including mineral aggregate 1/4"-0 (but not including blending sand), shall meet the test requirements in Section 34-2.02B.

The stockpiled materials shall meet the grading requirements for stockpiles for immediate use and in addition thereto, the grading of the stockpiled materials shall be such that when they are recombined in appropriate ratios, together with blending sand if necessary, the completed mixture will meet all pertinent requirements of Section 34-2.03. It shall be the responsibility of the Contractor to furnish such blending sand as may be required to bring the completed mix within the above prescribed gradation limits.

Mineral aggregate for asphalt concrete Class F need not be separated into two sizes provided that the stockpiled aggregate, when supplemented by an approved blending sand if required, will produce a completed mixture complying with all pertinent requirements of Section 34-2.03. If blending sand is required to bring the completed mix within the prescribed gradation limits, it shall be the responsibility of the Contractor to furnish it in the quantity required. If blending sand is required for the production of asphalt concrete Class F, it shall be fed onto the cold stone belt or elevator by a separate mechanical feeder.

-2.02D Mineral Filler

Mineral filler shall be portland cement or commercially ground stone dust, and shall be approved by the Engineer. It shall be free of lumps and extraneous material and shall meet the following requirements:

Passing U. S. No. 10 sieve	100%
Passing U. S. No. 200 sieve, not less than	75%
Particles smaller than .025 mm., not less than	50%
Particles smaller than .005 mm., not more than	35%
Plasticity index, ASTM Designation D 424, not more than	2
Specific gravity, not less than	2.50

The determination of percentage of particles smaller than .025 mm. and .005 mm. shall be by means of the hydrometer method, ASTM Designation D 422.

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-2.02E Blending Sand

Blending sand shall be clean, hard, sound naturally occurring sand or crushed fines which will readily accept asphalt coating and have a minimum Sand Equivalent of 30. The total aggregate mixture, when blending sand is used, shall meet the fracture and grading requirements of these specifications.

Blending sand, when used, shall be introduced into the mineral aggregate by means of a fully controlled adjustable feeder which can be synchronized with the aggregate feeder(s).

Blending sand shall be approved by the Engineer prior to using the blending sand concrete.

34-2.03 PROPORTIONS OF MATERIALS

The materials of which asphalt concrete is composed shall be of such sizes and grading that, when proportioned and mixed together, they will produce a uniformly graded mixture which will conform to the requirements given in the table which follows.

The percentages of aggregate include mineral filler, when used, and refer to the complete dry mix. The percentages of asphalt refer to the complete asphalt concrete mixture. All percentages are by weight.

GRADING AND ASPHALT REQUIREMENTS

ASPHALT CONCRETE CLASS	Percentages by Weight Passing Sieves				
	B	G	D	E	F
Pavement Type	ACP	ACP	ACP	ACB	ACP
Normal Use	Wearing	Pre/leveling Wearing	Open Seal Wearing	Base/leveling	Pre/leveling Wearing
Nominal Compacted Depth Limits for Each Course	0.10-.25'	.04'-0.10'	.04'-0.08'	.15'-.45'	0.10'-.25'

COMPOSITION AND GRADING OF ASPHALT MIXTURES

Sieve Size	% by Weight Passing	Square Opening Sieves
1 1/4"	100	100
1"	90-100	90-100
3/4"	100	67-86
3/8"	100	60-80
1/2"	75-90	90-100
3/8"	55-75	54-72
1/4"	32-48	32-48
US # 40	11-24	11-24
US # 60	6-15	6-15
US # 200	3-7	3-7
% Mineral Filler	0-2	0-2
Asphalt % of Total Mixture	4-7.5	4-6
	4-7.5	3.5-7
		4-7

The percentage of aggregate include mineral filler, when used, and refer to complete dry mix. Percentages of asphalt refer to the complete asphalt concrete mixture. All percentages are by weight.

-2.03A Mix Design

The actual proportions of the several constituents to be used in the production of the asphalt mixture shall be determined by the Engineer within the foregoing table limits, so as to provide a pavement having air voids, stabilometer, cohesimeter values and surface texture satisfactory to the Engineer. The fixed proportions shall be changed only by order of the Engineer.

-2.03B Aggregates in Mixture

Aggregate gradings within the ranges in the table shall be such that there will be a minimum of 2% of the total aggregate retained between any successive pair of sieves finer than the U. S. #10 for classes B and G, and 2% for Class E.

For asphalt concrete Class B and Class F the Engineer may at his discretion approve an aggregate grading with up to 9.5% maximum passing the U. S. #200 sieve, but with the further provisions that the gradation of the materials retained on all sieves larger than U. S. #200 are within the above prescribed ranges.

The gradings shall be of such uniformity that the fractions of aggregate passing the 1/4" and #10 sieves during the run of any day will conform to the following limitations:

Maximum variation in percentage of material passing 1/4" sieve	10
Maximum variation in percentage of material passing U.S. No. 10 sieve	8

The ratio of percentage of material passing a U.S. #10 sieve to percentage of material passing a #200 sieve, determined by "wet sieving", shall be 6.0 or greater and not more than 10.0 for classes B and G asphalt concrete.

-2.03C Asphalt in Mixture

When mineral aggregates or a source for the production of mineral aggregates is provided by the Owner, the approximate percentage of asphalt required in the mixture for the particular class of pavement will be set forth in the special provisions under the heading "Asphalt Concrete Pavement Asphalt Content". The percentage set under this heading shall be considered as informational and tentative only and the actual quantity of asphalt used shall be such a percentage as will meet the requirements for the mixture as set forth in these specifications.

No additional compensation will be allowed in event the percentage of asphalt required in the mixture is greater than that indicated under the special provisions heading of "Asphalt Concrete Pavement Asphalt Content".

If the total amount of asphalt used on the entire project, exclusive of waste, is greater than the amount computed from the maximum percentage in the foregoing table, the Owner will reimburse the Contractor for the cost of the extra asphalt, based on invoices by the supplier.

34-3 CONSTRUCTION DETAILS

34-3.01 PREPARATION OF ROADWAY

-3.01A Preparation of Asphalt, Concrete or Brick Surfaces

Before construction of an asphalt concrete pavement on an existing surface, all fatty asphalt patches, grease drippings, and other objectionable matter shall be entirely removed from the existing pavement. All excess asphalt joint filler shall be completely removed and all premoded joint filler shall be removed to at least one-half inch (1/2") below the surface of the existing pavement. All types of existing pavement or bituminous surfaces shall be thoroughly cleaned by sweeping to remove dust and other foreign matter.

A tack coat of asphalt applied at the rate of .02 to .05 gallon per square yard of retained asphalt shall be applied uniformly to all surfaces on which any course of asphalt concrete is to be placed, unless its omission is specifically directed by the Resident Engineer in charge of construction.

The tack coat shall be an emulsified asphalt, cationic grade CRS-1, CSS-1 or CSS-1h, or Anionic grade RS-1, SS-1 or SS-1h. The CRS and RS grades emulsified asphalt shall not be diluted with water. The CSS or SS grades emulsified asphalt may be diluted with 1 to 2 parts water as approved by the Engineer. Asphalt used for tack coat shall conform to the requirements of Section 27.

When asphalt concrete pavement is to be constructed over an existing paved or oiled surface, in addition to the preparation as outlined hereinbefore, all holes and small depressions shall be filled with an appropriate class of asphalt concrete mix by hand shoveling. The surface of the patched area shall be leveled and compacted thoroughly, as directed by the Engineer.

-3.01B Preparation of Untreated Roadway

The existing roadway shall be prepared and the roadway primed as provided under "Bituminous Surface Treatment Class A" in Section 32, except that only one application of asphalt and one application of cover stone will be required. All other provisions of Section 32 pertaining to bituminous surface treatment Class A shall apply, except as hereinafter modified.

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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 the full 5 days, as specified, unless otherwise directed by the Engineer.

Should any holes, breaks, or irregularities develop in the roadway surface after the prime coat has been applied, they shall be patched with asphalt concrete, as described in Section 34-3.01A immediately in advance of placing the asphalt concrete. The Contractor shall maintain the completed prime coat by blading or brooming with motor patrol graders, as directed by the Engineer, until the asphalt concrete is placed.

After the maintenance, patching or repair work has been completed and immediately prior to placing the asphalt concrete pavement, the surface of the prime coat shall be swept clean of all dirt, dust, or other foreign matter.

When the prime coat application is not specified in the special provisions or shown on the plans, the Contractor shall prepare the untreated roadway as described above and shall omit the prime coat treatment. The asphalt concrete pavement shall be constructed on the prepared subgrade.

-3.01C Removing Existing Pavement

Where shown on the plans or where designated by the Engineer, the existing pavement of the type shown on the plans shall be broken up, loaded, hauled, and disposed of in accordance with requirements outlined in Section 52, "Removal of Existing Street Improvements."

34-3.02 CONNECTIONS WITH EXISTING FACILITIES

Where the bituminous pavement is to be connected with an existing roadway surface, bridge, railway crossing or other facility, the Contractor will be required, under direction of the Engineer, to modify the existing roadway profile in such a manner as to produce a smooth riding connection to the existing facility.

Where it is necessary to remove existing asphalt surfaces or oil mat surfaces to provide proper meet lines and riding surfaces, the Contractor shall burn or chip the existing surface so that there will be sufficient depth to provide a minimum of one (1) inch of asphalt concrete, and the waste material shall be disposed of to the satisfaction of the Engineer. Prior to placing the asphalt concrete, these areas shall be tacked in accordance with requirements previously described in Section 34-3.01A. Meet lines shall be straight and the edges be vertical. The edges of meet line cuts shall be painted with diluted cutback asphalt or SS-1 emulsion prior to placing asphalt concrete. After placing the asphalt concrete, the meet line shall be sealed by painting with a cutback asphalt or SS-1 emulsion and immediately covered with clean dry sand. Chipping or burning will be paid for at the unit contract price per square yard for "Chipping Existing Asphalt Surface."

Where it is required to remove sections of existing pavements such as portland cement concrete, cobblestone, brick and other rigid type, the removal shall be performed and paid for as described in Section 52, "Removal of Existing Street Improvements."

34-3.03 PREPARATION AND HEATING AGGREGATES

For control of the cold aggregates before they are fed onto the cold stone belt or elevator, each size designation or grading separation of the cold aggregates, as well as blending sand, shall be fed onto the cold stone belt or elevator by separate mechanical feeders of the plate, vibratory, or continuous belt types. A mechanical feeder may have one or more vertical divider plates for feeding two (2) or more size designations through a single feeder if the feeder is equipped with individual gates that can be operated separately for each aggregate size. The feeder for blending sand, when required, shall require particular attention, to ensure a consistent, uniform flow in the amount ordered by the Engineer.

Partition walls or other means shall be provided for keeping the various grades of cold aggregate from becoming mixed in the stockpile.

The aggregates, exclusive of mineral filler, shall be heated to a temperature directed by the Engineer, but within the limits of the following table, and immediately thereafter separated into 3 sizes or grades for classes A, B and E, and 2 sizes or grades for classes C, D and F asphalt concrete.

Grade of Asphalt to Be Used	Pugmill Mixing Temperature of aggregates	
	Min. °F.	Max. °F.
PAVING ASPHALTS		
AR-1000	225	275
AR-2000	275	350
AR-4000	275	350
AR-8000	275	350
AR-16000	300	350

EMULSIFIED ASPHALTS

CSS-1, SS-1	50	130
CSS-1h, SS-1h	50	130
CMS-2s, CMS-2, CMS-2h	60	140
CRS-1, RS-1	(Not used for mixing)	
CRS-2, RS-2	(Not used for mixing)	

LIQUID ASPHALTS

*SC, MC, 70 Viscosity	90	140
*SC, MC, 250 Viscosity	135	175
*SC, MC, 800 Viscosity	165	205
*SC, MC, 3000 Viscosity	200	240

*Rapid cure liquid asphalts are not shown because of volatility of cutback and hazard involved in use.

At least one of the above sizes or grades for each class of asphalt concrete shall be aggregate containing material passing the U. S. No. 10 sieve. The other separation of the aggregate shall be between such limits as may be necessary to produce the mixture specified under the direction of the Engineer.

The screening mechanism of the plant shall be of the vibratory or shaker type. The screens and storage bins shall be protected from the weather by adequate enclosures and shall be of sufficient capacity to furnish the necessary amounts of all aggregates when operating at the maximum rated capacity of the plant with no undue waiting for material. Each screen shall be of adequate size so that the aggregates of each bin will be separated within the limit set forth in the specifications.

The heating and drying of the aggregate shall be done in a suitably designed rotary drier. The drier shall be capable of preparing aggregates to specification requirements at a rate equal to the maximum rated capacity of the plant.

The plant shall be equipped with an adequate exhaust system including an exhaust fan and dust collector. The exhaust system shall be so constructed as to furnish adequate draft through the drier and screen and bin enclosures to eliminate leakage of dust and smoke. The dust collector shall be capable of collecting fine material passing through the exhaust system and shall be equipped with facilities for wasting and/or returning to the plant the material collected.

When the asphalt plant is erected at a site for the primary purpose of producing mixtures for a specific project, dust and smoke from the asphalt plant shall be eliminated to the extent that they will cause no inconvenience to property owners in the area or damage to their property. The Contractor will be required to install a satisfactory precipitation device or use such other methods as may be necessary to control the dust and smoke to the satisfaction of the Engineer.

On projects involving production of asphalt concrete, the asphalt plant shall have a minimum capacity rating by the manufacturer as shown in the following table.

For projects involving 3,000 tons or more:
Batch type plants—2,000 lbs. per batch.
Continuous mix type plants—90 tons per hour.

For projects involving less than 3,000 tons:
Batch type plants—1,000 lbs. per batch.
Continuous mix type plants—45 tons per hour.

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The plant shall be equipped with an approved dial scale mercury actuated thermometer, an electric pyrometer or other approved thermometric instrument so placed at the discharge chute of the drier as to register the temperature of the heated aggregates automatically. This device shall be in full view of the drum fireman or the head feeder.

The right is reserved for the Engineer to pass upon the efficiency of the above instruments, and for better regulation of temperature of the aggregates he may direct the replacement of the instrument by some approved temperature recording apparatus and may further require daily charts of the regulator to be filed with the Engineer.

Each size or grade of the heated aggregate shall be deposited in a separate bin. Each bin shall be provided with an overflow pipe of sufficient net opening so placed as to prevent the overflow from one bin into another.

Should the material in any one bin contain ten (10) percent or more of material which is undersize or oversize, the bin shall be drawn and the material rescreened.

Segregation of fine aggregate passing the U. S. No. 10 sieve shall be prevented by collecting and conveying it to the center of the bin. The bin for this material shall be equipped with two aprons fastened to opposite sides of the bin, at the upper edges. The aprons shall be at right angles to the center line of the screen and shall slope downward toward the center line of the bin at an angle of approximately forty-five degrees (45°). An opening on the center line of the bin of from four (4) to six (6) inches shall be left between the lower edges of the aprons.

34-3.04 HEATING ASPHALT

The asphalt shall be heated in insulated tanks so designed that the heating will be uniform throughout the entire mass and be positively controlled at all times. The asphalt circulating system shall be of adequate size to give proper and continuous circulation of asphalt throughout the operating periods. An armored thermometer reading from 200° F. to 400° F. shall be fixed in the asphalt line at a suitable location near the weigh bucket discharge valve.

The asphalt shall be heated to between 250 and 350 degrees Fahrenheit, the temperature within this range to be determined by the Engineer. The asphalt storage tanks and delivery lines shall be equipped so that the temperature of the asphalt shall not vary more than 25 degrees Fahrenheit plus or minus from the temperature ordered by the Engineer.

The discharge end of the asphalt circulation system shall be maintained below the surface of the asphalt in the storage tank to prevent discharging hot asphalt into open air.

Asphalt storage tanks shall be calibrated accurately to 100 gallon intervals and maintained to this accuracy. The Contractor shall provide a calibrated measuring rod and access for measuring the volume of the asphalt in the storage tank at any time.

34-3.05 PROPORTIONING

The aggregate shall be proportioned in a weigh box mounted on approved multiple beam or springless dial charging scales, the different sizes of aggregate being weighed into the weigh box one at a time in the proportions directed by the Engineer.

If no provision is made to weigh the mineral filler in the weigh box with the other aggregates, the proportions of mineral filler and/or collector dust shall be determined on a weight basis and shall be measured separately from the other aggregates. After the exact proportions of mineral filler and collector dust have been determined for one batch, the material or materials may be added to the mixer by volume measurement. After measuring, it may be added to the aggregates either in the weigh box or in the mixer. If added in the mixer, it shall be added at the center of the mixer at the time mixing is started.

The Engineer may order the mineral filler to be added to the aggregates in the weigh box if there is any

indication of improper or incomplete mixing of the filler when added directly to the mixer.

The asphalt shall be weighed on separate dial or beam scales limited in capacity to two times the weight of asphalt required for one mixer batch. The graduations on the scales shall be not more than one (1) pound. If a beam scale is used it shall be equipped with a "Tell Tale" dial with graduations of not more than one (1) pound.

The asphalt may also be proportioned by a device which sprays the asphalt into the mixer through six or more nozzles, and which weighs or proportions the material for each batch by a positive rotating meter which is calibrated in pounds. The metering device shall have an established background of service and shall be approved by the Engineer.

The number of pounds of each size or grade of aggregates, pounds of mineral filler, and pounds of asphalt to be used in each mixer batch shall be as the Engineer directs. The quantities directed by the Engineer shall be such, however, that the proportions of the different materials will be within the limits hereinbefore specified.

The scales used for weighing aggregate, filler, and asphalt shall conform to the requirements of Section 21, Weighing Equipment. The use of springs to carry part or all of the load in the weighing mechanism for the measuring of aggregate, filler and asphalt will not be permitted. The main weigh box shall be equipped with a discharge gate so arranged that, as the aggregates are discharged into the mixer, the different sizes of aggregates will be blended together uniformly.

Volumetric proportioning may be used instead of weight proportioning as described above.

The use of continuous mix plants will be allowed subject to the following requirements: The device for proportioning volumetrically the mineral aggregate shall be equipped with accurately controlled and calibrated gates or other satisfactory devices for each bin of the various sizes of aggregates and be so designed that the flow of aggregate from each bin can be accurately determined and controlled. Means shall be provided so that by actuation of a single lever the flow of aggregate from each feeder may be diverted simultaneously into separate compartments or containers placed beneath the feeder in order that each size of aggregate can be sampled at intervals determined by the Engineer. The Contractor shall furnish suitable containers of a minimum 200 lb. capacity and shall also furnish a platform scale of a minimum 300 lb. capacity. The drive shaft of the aggregate feeder shall be equipped with a revolution counter reading to 1/100th of a revolution and of sufficient capacity to register the total number of revolutions in a day's run.

A positive signal system shall be provided to indicate the level of aggregates in each bin, and a device shall be provided to close down the plant automatically at any time that the level of material in any one bin falls to the strikeoff capacity of the feed gate.

The volumetric proportioning device for the asphalt shall be a positive displacement type of pump and a satisfactory spray nozzle arrangement at the mixer. Means shall be provided to maintain pressures constant on each side of the pump. Means shall be provided for diverting the flow of asphalt from the pump into a suitable container of a minimum 100 lb. capacity in order that the accuracy of the asphalt delivery from the pump may be checked at intervals to be determined by the Engineer.

The driven speed of the pump shall be synchronized with the driven speed of the aggregate feeders by positive interlocking mechanical means and the driven speed of the asphalt pump shall be adjustable to control accurately the quantity of the asphalt delivered to the mixer as ordered by the Engineer.

-3.05A Automatic Controls—Batch Type Plants

When required by the Special Provisions and when asphalt concrete Class A and asphalt concrete Class B are mixed in a batch type mixer, the following provisions shall apply. Automatic control of batch mixing operations may be used even though not required by the

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Special Provisions providing the requirements of this subsection are complied with.

It is the intention of these provisions that the proportioning and timing devices shall be automatic to the extent that the only manual operation required for the proportioning and mixing of materials for one batch shall be a single operation of a switch or starter.

The mixing plant shall be equipped with automatic weight proportioning devices to monitor and control the weights of the several components of mineral aggregates and of the asphalt plus timing lock devices to monitor and control the position of the aggregate weigh hopper dump gate, the asphalt bucket discharge valve and the mixer discharge gate.

The means of withdrawal from the aggregate bins and the discharge of the weigh hopper shall be so interlocked that the weigh hopper cannot discharge until the required quantity of aggregate from each bin has been deposited therein. The weigh hopper may be of the single compartment individual weight control type or of the divided compartment, preset volume type. When the single compartment weight control type is used the automatic scale weight system shall discharge and weigh material from one bin at a time and provision shall be made to allow the order of discharge to be changed at the Engineer's discretion. When the preset volume weigh hopper is used the automatic control system shall check the total weight of each aggregate batch and provision shall be made to allow the Engineer to check easily and quickly the individual aggregate weights at any time.

The timing lock devices shall be actuated by the opening of the aggregate weigh hopper dump gate. They shall lock the asphalt bucket discharge valve until preset dry mixing time is expired and shall lock the mixer discharge gate throughout the preset dry and wet mixing periods. The dry mixing period is the interval of time between the opening of the aggregate weigh hopper dump gate and the opening of the asphalt bucket discharge valve. The wet mixing period is the interval of time between the opening of the asphalt bucket discharge valve and the opening of the mixer discharge gate. The control of the timing shall be flexible and capable of being set at intervals of not more than 5 seconds throughout cycles up to 60 seconds. The minimum dry mixing period shall be 5 seconds and the minimum wet mixing period shall be 25 seconds. The Engineer shall have the right to increase either or both the dry and wet mixing period up to a total mixing cycle of 60 seconds, as necessary to produce a homogeneous mixture of unvarying appearance.

The dials of the timing locks and automatic weighing controls shall be so arranged that the time interval and weight proportion controls may be set and locked by the Engineer.

If at any time a breakdown of the automatic proportioning and timing controls should occur, the Contractor may continue operation of the plant using manually operated controls for a maximum period of 3 working days, to allow time for repair of the automatic control system.

34-3.06 MIXING

The mixing of the asphalt concrete shall be done in a mixer of the pugmill type. The mixer shall be in first-class condition, and the number, type, arrangement and speed of rotation of the paddles shall be such as will quickly produce thoroughly and uniformly mixed asphalt concrete.

The properly proportioned hot aggregate and mineral filler shall be placed in the mixer first. The hot asphalt shall then be added and the mixing commenced. The mixing period, after the hot aggregate is placed in the mixer, shall be at least thirty (30) seconds and as much longer as may be necessary to produce a homogeneous mixture of unvarying appearance.

For batch type mixers the quantity of aggregate in each batch shall not exceed the manufacturer's rated capacity of the mixer. Each batch type mixer shall be equipped with a device for counting automatically the number of mix batches discharged during the day's operation.

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For continuous mix plants the rate of feed of aggregates to the mixer shall not exceed the manufacturer's rated capacity of the mixer. Each continuous type mixer shall be equipped with a discharge hopper having a minimum capacity of 1,000 lbs. of mixture. The hopper shall be equipped with dump gates which will permit rapid and complete discharge of the mixture without segregation. If the mixture shows segregation during discharge from the pugmill into the hopper or into the truck, the mixing operation shall be discontinued and the Contractor shall make whatever change is necessary to prevent segregation.

Upon each mixer shall be affixed a manufacturer's name plate upon which shall be stamped the manufacturer's rated capacity of the mixer.

34-3.07 HAULING

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.

When the asphalt concrete mixture has been mixed as specified, it shall be transported in suitable dump trucks of sufficient size and design to easily accommodate the load. When required by the Engineer, each load shall be covered with a suitable tarpaulin while in transit to prevent unnecessary loss of heat. The sides and bottoms of the trucks shall be lubricated with a mixture of water and light oil or diesel oil before receiving a load of mixture. Excess water and oil shall not be left in the bottom of the trucks.

Hauling trucks which contact the paving machine during the dumping or spreading process at any point other than the pushing rollers on the paving machine will not be allowed.

The speed and weight of hauling trucks shall be regulated so that, in the opinion of the Engineer, no damage will occur to any portion of the work under way. Any damage to the prime coat or the bituminous mat caused by Contractor equipment shall be repaired by the Contractor at his own expense.

34-3.08 SPREADING AND FINISHING

Unless otherwise provided in the special provisions, each course of the pavement shall be spread with a mechanical, self-propelled spreading and finishing machine equipped with a hopper or mixture compartment to receive the mixture from the hauling trucks, and a screed or cutoff device that oscillates in a horizontal motion or vibrates vertically when striking off the course or lift under construction.

The spreading machine shall be of a type and design approved by the Engineer. It shall have a runner length or wheel base of at least six feet (6'). It shall be operated in such a manner as to distribute the mixture to proper cross section, width, and thickness without segregation of aggregates. The spreading machine shall leave the mixture uniformly dense throughout, smooth, and free from inequalities and irregularities.

Any failure of the machine to produce a smooth and uniform spread of the mixture shall be corrected immediately to the satisfaction of the Engineer.

Small segregated or nonuniform surface areas which occur shall be immediately corrected by hand methods whereby the finer portions of the mix are raked into the segregated areas and the larger particles raked off and wasted.

The spreading machine shall be capable of placing a uniform layer of asphalt mix to the depth shown on the plans or ordered by the Engineer. The forward motion of the spreading machine shall be regulated, as directed by the Engineer, so that no irregularities in the pavement surface are caused by excessive forward speed of the machine. The forward speed shall be adjusted to that speed which obtains the best results for the particular spreading machine being used. The rate of placement of the mixture shall be uniform, and shall be coordinated with the rate of production from the mixing plant, without excessively intermittent operation of the spreading machine.

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Areas which are inaccessible to the spreading machine may be paved by other methods, as directed by the Engineer. When ordered by the Engineer, motor patrol graders or approved types of truck-attached spreaders shall be used to pave inaccessible or irregularly shaped areas. Hand raking shall be kept to a minimum.

Workmen shall not be allowed to walk or stand on the finished mixture before it has been rolled. Provisions must be made for breaking up any partially compressed masses of mixture after they are discharged from the truck.

34-3.09 COMPACTING

The Contractor will be required to place two (2) smooth-wheeled power rollers and one (1) self-propelled pneumatic-tired roller on each project to roll and compact the pavement mixture. The smooth-wheeled rollers shall weigh not less than eight (8) tons, exclusive of water ballast in the wheel drums, and may be either of the three-wheeled or tandem type, excepting that at least one (1) smooth-wheeled roller of the tandem type shall be placed on each project. The compression wheels on all three-wheeled rollers shall each be not less than twenty (20) inches wide, and all rollers shall be so constructed that they will be capable of rolling a true plane.

Self-propelled pneumatic tired rollers shall have a minimum gross weight of 8 tons and a minimum width of 5 feet. Wobble-wheel rollers will not be permitted. The tires shall be of equal size diameter and ply rating with smooth compactor treads. The inflation pressures of the several tires shall not vary more than 5 pounds per square inch from the designated pressure. The tires shall be so spaced that the entire gap between adjacent tires will be covered by the following tire at all operating tire pressures.

The relationship between tire sizes, tire characteristics, ply rating, tire inflation pressures and operating weights per tire shall be such that the roller is capable of developing tire contact pressures on the pavement through the entire range of 40 and 80 pounds per square inch. The exact contact pressure to be used within that range shall be as ordered by the Engineer.

Additional rollers shall be furnished and operated by the Contractor if, in the opinion of the Engineer, they are necessary to compact the pavement mixture satisfactorily. When asphalt concrete pavement Class D is being constructed, the use of pneumatic-tired rollers will not be permitted. The Contractor will be required to furnish 3 or more smooth-wheeled rollers, one of which shall be a tandem roller of not less than 8 tons weight exclusive of water ballast in the wheel drums. Other rollers shall weigh in excess of 3 tons not including ballasting.

All rollers shall be in good condition, and the reversing mechanism so maintained that the roller is capable of changing directions smoothly. The roller shall be kept in continuous motion while on the hot mat in such a manner that all parts of the pavement receive equal compression. Rollers shall be operated by competent and experienced personnel.

All rolling shall proceed as directed by the Engineer, but in general shall be longitudinal, starting near the edge of the pavement and proceeding toward the center of the roadway, overlapping on successive trips by not less than one-half (1/2) and not more than three-fourths (3/4) the width of the rear wheel of the three-wheeled roller. Alternate trips of the roller shall be of slightly different lengths. Rolling shall continue, as directed by the Engineer, until all roller marks are eliminated. The initial rolling shall take place as closely behind the laying machine as the temperature and condition of the mat will allow.

The motion of the roller shall be slow enough at all times to avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected immediately by the use of rakes and fresh mixture when required. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excess water will not be permitted.

Immediately after spreading, each course of the pavement mixture shall be compacted by rolling. The initial,

or "breakdown" rolling shall be accomplished with either type of smooth-wheeled roller. The pneumatic-tired roller shall be used to knead and compact the pavement mixture following the initial rolling and preceding the final rolling. Care shall be exercised in the use of the pneumatic-tired roller to ensure that the pavement mixture is sufficiently cooled to avoid "picking up" of the mixture on the tires of the roller, and also to ensure that the pneumatic-tired rolling is completed before the mixture becomes too cool to allow satisfactory finish rolling. Final, or finish rolling, shall be done with a tandem-type, smooth-wheeled roller.

The surface of the mixture after compaction shall be smooth and true to established section and grade. Any mixture which shows an excess or deficiency of asphalt, or uneven distribution of asphalt due to insufficient mixing, or which becomes loose, broken, raveled, mixed with dirt, or is in any way defective, shall be removed and replaced with fresh hot mixture at the Contractor's expense, and be immediately compacted to conform with the surrounding area. Areas of one square foot or more showing an excess or deficiency of asphalt shall be removed and replaced.

Areas inaccessible to the roller shall be compacted by tamping with mechanical or hand tampers.

34-3.10 PRELEVELING FOR ASPHALT CONCRETE

Preleveling of uneven or broken surfaces over which asphalt concrete is to be placed may be required by the Engineer, and if required may be accomplished by the use of an asphalt concrete (of class included in the project) placed with a motor patrol grader, a paving machine, by hand raking, or by a combination of these methods as directed by the Engineer.

After placement, the asphalt concrete used for preleveling shall be compacted thoroughly with pneumatic-tired rollers.

The unit contract price per ton for "Asphalt Concrete Pavement, Class" shall be full compensation for all costs and expense involved in furnishing all labor, material, tools and equipment necessary in preleveling the surface as herein specified.

34-3.11 CONSTRUCTION OF COURSES

The asphalt concrete pavement shall be constructed in one or more courses as shown on the plans or required in the special provisions.

Where more than one course is specified, the first course shall include widening of the existing pavement (if specified) and leveling up of all irregularities in the surface of the existing pavement or foundation as described in Section 34-3.10. The leveling shall be to such elevation that when a uniform wearing surface is placed the finished pavement will conform to the grade and cross section shown on the plans.

Longitudinal joints in the leveling and wearing courses shall be offset a minimum of two (2) inches, so that one joint will not be directly over the other. In construction of two-lane pavement, the longitudinal joints shall be offset in such a manner that the longitudinal joint in the wearing course will coincide with the centerline of the pavement.

As specified on the plans or in the special provisions, various classes of asphalt concrete shall be used to construct base, leveling and wearing courses. Unless otherwise directed by the Engineer, or specified on the plans or in the special provisions, the nominal compacted depth of any course shall not exceed the following depths:

Asphalt Concrete Class E	0.35 foot.
Asphalt Concrete Classes B and F	0.25 foot.
Asphalt Concrete Class G	0.10 foot.
Asphalt Concrete Class D	0.08 foot.

Where the compacted depth of any course, as shown on the plans, exceeds the depth specified above for the particular class of mixture, the course shall be constructed in two or more layers.

34-3.12 JOINTS

The placing of the top or wearing course shall be as

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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. 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.

34-3.13 SURFACE SMOOTHNESS

The completed surface of the top or wearing course shall be of uniform texture, smooth, uniform as to crown and grade, and free from defects of all kinds. The completed surface shall not vary more than 1/8 inch from the lower edge of a 10-foot straightedge placed on the surface parallel to the center line. The transverse slope of the completed surface shall vary not more than 1/4 inch in 10 feet from the rate of transverse slope shown on the plans.

When deviations in excess of the above tolerances are found, the pavement surface shall be corrected by the addition of asphalt concrete mixture of an appropriate class to low places or the removal of material from high places by methods satisfactory to the Engineer or by removal and replacement of the wearing course of asphalt concrete. Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.

All areas in which the surface of the completed pavement deviates more than twice the allowable tolerances described above shall be removed and replaced to the satisfaction of the Engineer.

However, if deviations are found which exceed the allowable tolerances but are not in excess of 2 times the dimensions specified above as allowable tolerances and in the opinion of the Engineer, correction by means of any of the methods specified above will not produce satisfactory results as to smoothness and serviceability, the Engineer may at his discretion accept the completed pavement and shall deduct from monies due the Contractor on the final estimate the sum of \$100.00 for each and every section of single traffic lane 100 feet in length in which any deviations as described above are found. Under the circumstances described above the decision whether to accept the completed pavement or to require corrections as described above shall be vested entirely in the Engineer.

All costs involved in making the corrections of defects described above shall be borne by the Contractor and no compensation will be made for this work.

34-3.14 HEATER-PLANING BITUMINOUS PAVEMENT

-3.14A General

Where shown on the plans or where directed by the Engineer, the existing bituminous pavement shall be planed in accordance with the following specifications:

This item shall consist of planing or shaving the surface irregularities from the existing bituminous pavement to produce a smooth surface by means of equipment hereinafter specified. The finished surface shall be free from gouges, grooves, ridges and other imperfections of workmanship.

The temperature at which the work is performed, the nature and condition of the equipment, and the manner of performing the work shall be such that the pavement is not torn, broken, burned or otherwise injured by the planing operations.

All cuttings or other debris resulting from the heater-planing operations shall be disposed of by the Contractor to the satisfaction of the Engineer. Unless otherwise provided, the Contractor shall provide his own waste site for the disposition of these materials.

-3.14B Equipment

The planing shall be performed with a pavement

planing machine of a type that has operated successfully on work comparable with that to be done under the contract.

The machine shall have a furnace for heating the pavement, the heat developer to be controlled from the operator's station; and a blade for cutting the high spots from the pavement, the blade to be controlled from the operator's station so that the proper depth of cut may be maintained at all times. The position of the blade shall be such that the cuttings will be delivered in a single windrow. The planing operation shall be performed continuously by the forward motion of the machine. The width of heating and cutting shall be not less than four (4) feet and the effective wheel base of the machine not less than eighteen (18) feet.

34-3.15 MISCELLANEOUS DETAILS OF CONSTRUCTION

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.

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

Asphalt concrete mixture shall not be deposited on the road if the rolling cannot be completed before dark. The placing of asphalt concrete mixture at night will not be permitted.

Where the asphalt concrete is to be placed against a concrete or stone curb or gutter, or against a cold pavement joint or any metal surface, a thin paint coat of cutback asphalt shall be applied in advance of the placing. The application shall be thin and uniform, care being exercised to avoid accumulation of asphalt in depressions.

No traffic other than that necessary for construction purposes shall be allowed on any course of the pavement until the course has completely cooled and set.

34-3.16 SAMPLES

When called upon to do so, the Contractor shall, without charge, provide the Engineer with test samples of asphalt concrete cut from the completed pavement or the individual courses thereof. He shall also provide the Engineer with test samples of the uncompressed asphalt concrete mixtures, and all materials incorporated in the work.

34-3.17 SHOULDERS

Shoulders, if required, shall be constructed to the lines, grades, and cross sections shown on the plans and in accordance with the specifications for materials and construction.

34-3.18 VACANT

34-3.19 UNFAVORABLE WEATHER

Asphalt for "Prime Coat" shall not be applied when the ground temperature is lower than fifty (50) degrees F., without written permission of the Engineer.

Asphalt concrete shall not be placed on a frozen subgrade, during rainfall, on any wet surface, when the average surface temperature is less than noted below, during the below stated periods of any year or when weather conditions otherwise prevent the proper handling or finishing unless written permission is given by the Engineer.

AVERAGE SURFACE TEMPERATURE LIMITATIONS

Compacted Thickness	When Placing	
	Surface Course	Sub-Surface Course
Less than 0.10'	55°F.	55°F.
0.10' to 0.20'	45°F.	35°F.
0.21' to 0.35'	35°F.	35°F.
More than 0.35'	Not Applicable	25°F.*

*Temperature must be rising.

34-3.20 TRAFFIC AND DETOURS

Unless otherwise provided in the special provisions, the Contractor shall plan his operations on the basis that traffic will be carried through the work continuously, or

Section 34—Asphalt Concrete Pavement

34-5.05 ASPHALT CONCRETE PAVEMENT

The unit contract price per ton for "Asphalt Concrete Pavement" of the class specified, shall be full compensation for the furnishing of all labor, equipment, materials, and supplies required in the construction of each class of asphalt concrete pavement complete in place, including the preparation of any existing portland cement concrete, brick or bituminous surface, or pavement base, and all other work incidental to fulfilling the requirements described in Section 34-3 and not set forth as bid items of any particular project.

In the event the Contractor is required to furnish the mineral aggregates, all costs of furnishing, hauling and processing mineral aggregates, blending sand, and mineral filler into the complete mix shall be included in the unit contract price per ton for "Asphalt Concrete Pavement" of the class specified, except that mineral filler and blending sand when set up as bid items will be paid for in the manner hereinafter described.

If any of the mineral aggregates are furnished in stockpile by the Owner the cost of hauling and incorporating those mineral aggregates in the mix, and all costs of furnishing, hauling, and incorporating the necessary blending sand mineral filler, and any additional mineral aggregate shall be included in the unit contract price per ton for "Asphalt Concrete Pavement," of the class specified, excepting however, that mineral filler and blending sand, when set up as bid items, will be paid for in the manner hereinafter described.

34-5.06 MINERAL AGGREGATES IN STOCKPILE

The unit contract price per ton for "Mineral Aggregate (size) in Stockpile" of the various size designations shall be full compensation for all costs in connection with the preparation of the stockpile sites, the quarrying, crushing, screening, washing, cleaning, loading, hauling, and placing of the mineral aggregate in stockpiles at sites designated in the plans or special provisions, and for all other expenses incidental thereto, excepting however, that clearing, grubbing, and stripping of quarries or pits made available to the Contractor by the State for the manufacture of mineral aggregate will be paid for under the provisions of Sections 12 and 13.

34-5.07 BLENDING SAND

The unit contract price per cubic yard for "Blending Sand" shall be full compensation for all costs in connection with the furnishing, hauling, and incorporating blending sand in the mixed aggregates, as required by the Engineer. Unless otherwise specified, measurement will be made by the cubic yard in trucks at the plant.

If there is a bid item for blending sand and the Contractor elects to provide mineral aggregates from a source other than that provided by the State, and if it becomes necessary, in the opinion of the Engineer, to use blending sand for proper grading of the aggregates, then in that event the Contractor shall furnish and incorporate sufficient quantities of blending sand to meet the requirements as determined by the Engineer. The pay quantity will be the amount actually used up to, but not exceeding, the quantity set up in the contract. If there is no bid item for blending sand, whatever amount of blending sand as may be needed to meet the requirements as determined by the Engineer, shall be furnished by the Contractor at his own expense.

34-5.08 FURNISHING MINERAL FILLER

Mineral filler, if used, will be paid for at the fixed rate of \$50 per ton, which shall be full compensation for all costs in connection with furnishing, hauling and incorporating mineral filler in the quantities ordered by the Engineer.

34-5.09 WATER

Water will be measured by the M gallons and paid for as provided in Section 16.

on detours if they are specifically mentioned and described in the special provisions. The Contractor will not be responsible for the maintenance of the designated detours unless otherwise specified in the special provisions, but all costs incurred by him due to continuous passage of traffic through the work, except as provided in special provisions, shall be considered as incidental to the construction and shall be included in the pay items of the contract.

34-3.21 ORGANIZATION AND EQUIPMENT

Each stage of the work shall be under competent supervision as outlined in Section 8-1.11. The plant foreman and street foreman shall be thoroughly experienced in the class of work they supervise.

34-5 MEASUREMENT AND PAYMENT

Payment will be made for such of the following bid items as are included and shown in any particular contract.

1. "Preparation of Untreated Roadway," per mile, or square yard.
2. "Asphalt (grade specified) Prime Coat," per ton.
3. "Prime Coat Aggregate," per cubic yard.
4. "Asphalt for Tack Coat," per ton.
5. "Asphalt Concrete Pavement (Class ———)," per ton.
6. "Mineral Aggregate (size) in Stockpile," per ton.
7. "Blending Sand," per cubic yard.
8. "Mineral Filler," per ton.
9. "Water," per M gallon.
10. "Removing (type) Pavement," per square yard.
11. "Heater-Planing Bituminous Pavement," per hour.

34-5.01 PREPARATION OF UNTREATED ROADWAY

The unit contract price per mile or per square yard for "Preparation of Untreated Roadway" shall be full compensation for all labor, tools, and equipment required to do the work described under Section 34-3.01B with the exception, however, that all costs involved in labor, materials, and equipment for patching the roadway prior to placement of asphalt concrete shall be included in the unit contract price per ton for "Asphalt Concrete Pavement" of the class used for patching.

Fractions of miles will be paid for to the nearest one-hundredth (0.01) mile.

34-5.02 ASPHALT—PRIME COAT

The unit contract price per ton for "Asphalt Prime Coat" of the grade specified shall be full compensation for furnishing and applying the asphalt, including heating, hauling, and applying to the roadway, and other incidental work as hereinbefore described in Section 34-3.01B.

The quantity of asphalt will be determined as described in Section 27-1.01K.

34-5.03 PRIME COAT AGGREGATE

The unit contract price per cubic yard for "Prime Coat Aggregate" shall be full compensation for furnishing, loading and hauling aggregate to the place of deposit and spreading the mineral aggregate in the quantities required by the Engineer.

Prime coat aggregate, unless otherwise specified in the special provisions, shall conform to the requirements of Section 23-2.01 for Crushed Surface Top Course, of Section 23-2.02 for Crushed Cover Stone, or of Section 34-2.02C for Class F Mineral Aggregate 1/4"-0".

The quantity of prime coat aggregate to be paid for shall be the quantity actually furnished, loaded, hauled, and used in construction of the prime coat.

Measurement will be made by the cubic yard at the point of delivery on the road. The volume shall be the "strike off" capacity of the truck bodies.

34-5.04 ASPHALT FOR TACK COAT

The unit contract price per ton for "Asphalt for Tack Coat" shall be full compensation for all costs of material, labor, tools, and equipment necessary for the application of the tack coat as specified. Water added to emulsion will not be paid for as emulsified asphalt. The pay quantity shall be the amount of undiluted emulsion used as tack coat.

Section 36—Extruded Cement Concrete Curb

34-5.10 REMOVING EXISTING PAVEMENT

The unit contract price per square yard for "Removing (type) Pavement" of the type shown on the plans and specified in the proposal, shall be full compensation for removing the pavement and disposing of it as hereinbefore specified, and for all other expense necessary to complete the work as specified.

34-5.11 HEATER-PLANING BITUMINOUS PAVEMENT

The unit contract price per hour for "Heater-Planing Bituminous Pavement," for the actual time consumed in heater-planing shall be full compensation for furnishing all tools, equipment, labor, materials, supplies, and incidentals necessary to accomplish the work in accordance with the specifications, including the removal and disposal of all cuttings and debris, and for all other costs required to accomplish the work. No allowance will be made for time consumed in making repairs to the equipment or for moving the equipment to or from the work on which heater-planing is ordered.

34-5.12 INCIDENTAL WORK

Any incidental work required to complete the asphalt concrete pavement specified herein, but which is not specifically mentioned in the foregoing specifications of Section 34, shall be performed by the Contractor and shall be considered as incidental to the construction, and all costs therefor shall be included by the Contractor in his unit contract prices of the bid items.

Section 35—Extruded Asphalt Concrete Curb

35-1 DESCRIPTION

Extruded asphalt curb shall be constructed at such locations as shown on the plans and to the cross section shown on the standard drawing.

35-2 MATERIALS

The extruded asphalt concrete curb shall consist of a hot-mix asphalt concrete Class B mix conforming to the provisions of Section 34-2.03. The grade of paving asphalt shall be penetration 85-100 unless otherwise specified in the special provisions or by the Engineer.

35-3 CONSTRUCTION DETAILS

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 fifteen 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.

35-3.01 EQUIPMENT FOR LAYING CURB

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 plans, and in an even homogeneous manner free of honeycombs.

35-3.02 MIXING AND PLACING

The asphalt concrete mixture shall be homogeneously mixed to conform with Section 34-3.06 and shall be delivered to the hopper of the laying machine at a temperature of not less than 200 F. nor more than 300 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.

35-3.03 JOINTS

Unless conditions warrant, asphalt concrete curb con-

struction 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. All 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.

35-3.04 CURING

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.

35-3.05 FURTHER PROVISIONS

Section 34 of the specifications shall apply where specific details are required and where such provisions have not been included in this section of the specifications.

35-4 MEASUREMENT AND PAYMENT

The extruded asphalt concrete curb will be measured by the linear foot along the front face of the curb and returns.

Payment will be made for the following bid item when included and shown in any particular contract:

1. "Extruded Asphalt Concrete Curb," 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 plans and specifications.

Section 36 - Extruded Cement Concrete Curb

36-1 DESCRIPTION

Extruded cement concrete curb shall be constructed at such locations as shown on the plans and to the cross section shown on the Standard Drawing.

36-2 MATERIALS

All materials, proportioning, testing, mixing and transporting shall meet the applicable requirements as outlined in Section 37 of these Specifications.

Portland cement content shall be a minimum of 6-sack per cubic yard.

Aggregate shall meet the requirements of Grading No. 2 for Fine Aggregate as outlined in Section 37-2.02B2.

Transparent curing compound as specified in Section 37-2.09 shall be used.

Air-entrained concrete shall be used as outlined in Section 37-3.02, except that air content shall be a minimum of 3% and a maximum of 6% by volume.

Tie bars shall be deformed steel bars meeting the requirements in Section 111-2.01. The bars shall be free from rust, loose mill scale, dirt, grease or other defects affecting the strength or bond with the concrete.

36-3 CONSTRUCTION DETAILS

The pavement shall be dry and cleansed of loose or deleterious materials.

36-3.01 EQUIPMENT FOR PLACING CURB

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 plans and the Standard Drawing.

36-3.02 MIXING AND PLACING

The cement concrete mixture shall be homogeneously mixed to conform with Section 37 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.

Section 37—Portland Cement Concrete—Materials

36-3.03 JOINTS

Joints in the cement concrete extruded curb shall be spaced at 10-foot intervals. Joint shall be cut vertically and to a depth of five inches as shown on Standard Drawing.

36-3.04 TIE BARS

Tie bars shall be spaced one foot on each side of every joint. Where angle points occur in curb alignment, additional tie bars shall be placed one (1) foot on either side of the angle point.

Tie bars shall meet dimensions as shown on Standard Drawings.

36-3.05 CURING

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 37-3.20E.

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.

36-3.06 FURTHER PROVISIONS

Section 37 of the Specifications shall apply where specific details are required and where such provisions have not been included in this section.

36-4 MEASUREMENT AND PAYMENT

The extruded cement concrete curb will be measured by the linear foot along the front face of the curb and returns.

Payment will be made for the following bid item when included and shown in any particular contract:

1. "Extruded Cement Concrete Curb," 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 plans and specifications.

Section 37—Portland Cement Concrete—Materials

37-1 DESCRIPTION

This section contains the materials requirements for portland cement concrete to be used in pavements, curbs, sidewalks, driveways and miscellaneous items in streets and public rights of way.

37-2 MATERIALS

The materials for portland cement concrete and related items shall conform to the following requirements:

37-2.01 CEMENT

-2.01A General Requirements

Cement shall be classified as (a) portland cement, (b) air-entraining portland cement and (c) high-early-strength cement.

-2.01B Storage on the Work (Vacated)

-2.01C Sampling and Acceptance (Vacated)

-2.01D Portland Cement

Portland cement shall conform to the requirements for Type II cement of the Standard Specifications for Portland Cement, AASHO Designation M85; except that a maximum of fifty-five (55) percent of tricalcium silicate (3 CaO SiO₂) will be permitted; also that the content of alkalies shall not exceed seventy-five hundredths (0.75) percent by weight calculated as Na₂O, plus 0.658K₂O. Alkalies shall be determined in accordance with ASTM Designation C 114. It shall meet the requirements of the above specifications both for tensile strength and compressive strength and for time of setting by both the Gillmore and Vicat methods.

-2.01E Air-Entraining Portland Cement

Air-entrained portland cement shall meet the requirements for Type IIA cement of the specifications for air-entrained portland cement of AASHO Designation M134, except that a maximum of fifty-five (55) percent of tricalcium silicate (3 CaO SiO₂) will be permitted, and also that the content of alkalies shall not exceed seventy-five hundredths (0.75) percent by weight, calculated as Na₂O plus 0.658K₂O. Alkalies shall be determined in accordance with ASTM Designation C 114. It shall meet the requirements of the above specifications for time of setting by both the Gillmore and Vicat methods.

-2.01F High-early-strength Cement

High-early-strength cement shall conform to the requirements for Type III cement of the standard specifications for portland cement AASHO Designation M85, except that the content of alkalies shall not exceed seventy-five hundredths (0.75) percent by weight calculated as Na₂O, plus 0.658K₂O. Alkalies shall be determined in accordance with ASTM Designation C 114. It shall meet the requirements of the above specifications both for tensile strength and compressive strength and for time of setting by both the Gillmore and the Vicat methods.

-2.01G Low-Alkali Cement

When the special provisions state that low-alkali cement shall be used, the percentage of alkalies in the cement shall not exceed six-tenths (0.60) percent by weight calculated as Na₂O, plus 0.658K₂O. This limitation shall apply to portland cement, air-entraining portland cement and high-early-strength cement. Alkalies shall be determined in accordance with ASTM Designation C 114.

37-2.02 CONCRETE AGGREGATES

Concrete aggregates shall be manufactured from ledge rock, talus or sand and gravel in accordance with the provisions of Section 22, Production from Quarry and Pit Sites.

-2.02A General Requirements

Aggregates shall possess such characteristics of shape and size that concrete, prepared from a mixture of fine and coarse material in the proportions specified, will be of satisfactory workability in the opinion of the Engineer. Regardless of compliance with all other provisions of these specifications, if the concrete is not of a workable character, or when finished does not exhibit a proper surface, either the fine or the coarse aggregate or both shall be rejected or altered as required by the Engineer.

If, in the judgment of the Engineer based on previous experience or on laboratory tests, concrete aggregates from a given source are detrimentally reactive with alkalies in portland cement, they shall be used in concrete in combination with low-alkali cement only.

-2.02B Fine Aggregate

Fine aggregate shall consist of sand or other inert materials, or combinations thereof approved by the Engineer, having hard, strong, durable particles, free from adherent coating. Fine aggregate shall be thoroughly washed to remove clay, loam, alkali, organic matter or other deleterious matter.

-2.02B1 Deleterious Substances. The amount of deleterious substances in the washed aggregate shall not exceed the following values:

- (1) Amount finer than No. 200 sieve (wet sieving) 2% by weight
- (2) Particles of specific gravity less than 1.95 1% by weight
- (3) Organic matter, by colorimetric test, shall not be darker than 250 parts per million unless other tests prove a darker color to be harmless.

-2.02B2 Grading. Fine aggregate shall be regularly graded from coarse to fine in two (2) sizes and when tested by means of the U.S. Standard sieves shall conform to the following requirements expressed as percentages by weight:

Section 37—Portland Cement Concrete—Materials

	Grading No. 1		Grading No. 2	
	Max.	Min.	Max.	Min.
Passing No. 4.....	100	95	100	100
Passing No. 6.....	98	82	100	93
Passing No. 8.....	88	68	95	85
Passing No. 16.....	65	47	80	63
Passing No. 30.....	42	27	60	40
Passing No. 50.....	20	12	30	15
Passing No. 100.....	7	2	8	2
Passing No. 200..... (wet sieving)	2	0	2	0

In individual tests, variations under the minimum or over the maximum will be permitted as follows provided the average of three consecutive tests is within the above limits:

Sieve Number	Permissible % of Variation in Individual Tests
No. 30 and coarser	2
No. 50 and finer	0.5

-2.02B3 Use of Substandard Gradings. Fine aggregate with more than the maximum percentage passing any sieve may be accepted provided the mix proportions are adjusted to produce concrete having the same net water-cement ratio, slump and workability. Any resulting increase in the cement content shall be at the expense of the Contractor. Under no circumstances shall fine aggregate, which has a grading finer than Grading No. 2, be used in paving concrete.

-2.02B4 Mortar Strength. Fine aggregate shall develop in the mortar strength test at an age of 14 days a compressive strength of not less than ninety-five (95)

	Grading No. 1		Grading No. 2		Grading No. 3		Grading No. 4		Grading No. 5	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Passing 2 1/2" sq. opening.....	98	100	.....	.....	95	100	.....	.....	.....	.....
Passing 2" sq. opening.....	92	100	.....	.....	75	100	.....	.....	.....	.....
Passing 1 1/2" sq. opening.....	72	87	100	100	30	60	100	.....	.....	.....
Passing 1" sq. opening.....	58	75	95	100	0	15	95	100	.....	.....
Passing 3/4" sq. opening.....	27	47	40	70	0	1	0	2	100	.....
Passing 3/8" sq. opening.....	3	14	5	20	.....	.....	0	20	95	100
Passing U. S. No. 4 sieve.....	0	1	0	2	.....	.....	0	2	10	40

The above values are in percentages by weight.

In individual tests a variation of four (4) under the minimum percentages or over the maximum percentages will be allowed. The average of three (3) successive tests

-2.02C4 Use of Substandard Gradings. Coarse aggregate containing more than the maximum percentage passing any screen may be accepted provided the mix proportions are adjusted to produce concrete having the same net water-cement ratio, slump and workability. Any resulting increase in the cement content shall be at the expense of the Contractor.

Coarse aggregate shall not be used under any circumstances in paving concrete when the amount by weight passing the screens exceeds the following:

3/4" square opening	70%
3/8" square opening	30%

-2.02C5 Concrete Strength. Concrete made from the coarse aggregate, graded to comply with the requirements of these specifications, combined with the specified proportions of cement and the fine aggregate proposed for use with the coarse aggregate, or the washed sand from Steilacoom, Washington, shall develop compressive and flexural strengths at age of 14 days of not less than ninety (90) percent of that developed by concrete made from the same cement and washed sand and gravel from Steilacoom of the same grading, and mixed in the same proportions and to the same consistency.

-2.02D Test Methods for Concrete Aggregates

The properties enumerated in these specifications shall be determined in accordance with the following methods of test:

percent Ottawa sand, as determined by ASTM Designation C 109.

-2.02C Coarse Aggregate

Coarse aggregate shall consist of gravel, crushed stone, or other inert material or combinations thereof approved by the Engineer, having hard, strong, durable pieces free from adherent coatings. Coarse aggregate shall be thoroughly washed to remove clay, loam, bark, sticks, alkali, organic matter, or other deleterious material.

-2.02C1 Deleterious Substances. The amount of deleterious substances shall not exceed the following values:

Amount finer than No. 200 sieve (wet sieving)	0.5% by weight
Pieces of specific gravity less than 1.95	2.0% by weight
Clay lumps	0.5% by weight
Shale	2.0% by weight
Wood waste	0.05% by weight

Wood waste is defined as all material which, after drying to constant weight, has a specific gravity less than 1.0.

-2.02C2 Wear in Los Angeles Machine. Coarse aggregate shall not have a percentage of wear in the Los Angeles machine in excess of thirty-five (35) after 500 revolutions.

-2.02C3 Grading. Coarse aggregate when tested by means of laboratory screens shall conform to one or more of the following gradings as called for elsewhere in the specifications, special provisions, or on the plans.

shall be within the percentages stated above. Coarse aggregate shall contain no piece of greater size than five (5) inches measured along the line of greater dimension.

-2.02D1 Sampling: ASTM Designation D 75.

-2.02D2 Amount of Material Finer than No. 200 Sieve in Aggregates: ASTM Designation C 117.

-2.02D3 Organic Impurities: ASTM Designation C 40.

-2.02D4 Compressive Strength of Concrete: ASTM Designation C 39.

-2.02D5 Flexural Strength of Concrete: ASTM Designation C 78.

-2.02D6 Percentage of Particles of Less than 1.95 Specific Gravity: AASHTO T 150.

-2.02D7 Clay Lumps in Aggregates: ASTM Designation C 142.

-2.02D8 Abrasion of Coarse Aggregate by Use of the Los Angeles Machine: ASTM Designation C 131.

-2.02D9 Mortar Strength: Compressive Strength of Concrete Mortars, ASTM Designation C 109.

37-2.03 MIXING WATER

-2.03A Requirements

Water for use with cement in mortar or concrete shall be reasonably clear and free from oil. It shall not contain chlorides calculated as sodium chloride in excess of 2,500 parts per million, nor sulphates calculated as so-

Section 37—Portland Cement Concrete—Materials

37-2.09 TRANSPARENT CURING COMPOUNDS

Transparent curing compounds shall meet the following requirements:

The compound shall be a liquid that, at the time of application, is free from suspended matter. It shall be 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, however, contain a dye of color strength sufficient to render the film distinctly visible on the concrete for a period of at least four (4) hours after application.

When tested for moisture retaining effectiveness as described in Section 6.03, the loss of moisture shall not exceed two (2) grams per specimen.

37-2.10 WATERPROOF PAPER

Waterproof paper shall meet the requirements of AASHTO Designation M139.

37-2.11 WHITE POLYETHYLENE SHEETING

White polyethylene sheeting shall meet the requirements of AASHTO Designation M171.

37-2.12 FORMS

Covered in Section 39-3.13.

37-2.13 JOINT-SEALANTS

Joint sealants used in sealing pavement joints shall meet the requirements of one of the following: (1) AASHTO Designation M 173, Concrete Joint Sealer, Hot Poured Elastic Type, (2) ASTM Designation D 1850, Concrete Joint Sealer, Cold Application Type, excepting however, that the tests for evaluation of bond requirements in the above mentioned specifications shall be in accordance with the method used by and available from the Materials Laboratory, Department of Highways, Olympia, Washington, 98501.

Unless otherwise stated in the special provisions, the Contractor will have the option of using either of the two types above noted.

Upon request by the Engineer, joint sealing materials shall be tested by an independent laboratory. In such case, a certificate shall be furnished by the laboratory stating that the materials have been tested and that they fully conform to the requirements of this section of the specifications.

37-3 CONSTRUCTION—CONCRETE MIXES

37-3.01 CLASSIFICATION AND USE

The class of concrete 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: 5.5 (1 1/2) is a 5.5 sack mix with 1 1/2 inch maximum size coarse aggregate.

H.E.S. indicates high-early-strength cement and may be required at the option of the Engineer for any of the classes of mix. Whenever it is called for, it will be measured and payment will be made as provided.

The Contractor may, with approval of the Engineer, elect to use high-early-strength cement in any of the mixes, but no extra compensation will be made him for the high-early-strength cement.

-3.01A Cement Content for Designed Age Requirements (Vacated)

37-3.02 AIR-ENTRAINED CONCRETE

Air-entrained concrete shall be used, unless otherwise provided for in the special provisions.

Either air-entrained portland cement or an air-entraining admixture shall be added at the mixer. Both the air-entrained cement and the air-entrained admixture shall conform to requirements of Section 37-2.01E.

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

dium sulphate in excess of 1,000 parts per million. It shall not contain any impurities in amount sufficient to cause unsoundness or marked change in time of setting in the cement with which it is mixed nor a reduction in mortar strength of more than five (5) percent compared to the results obtained with distilled water.

-2.03B Test Methods

The properties enumerated above shall be determined in accordance with AASHTO Method of Test No. T 26.

37-2.04 REINFORCING STEEL

All reinforcing steel and wire mesh shall meet the requirements in sections 111-2.01 and 111-2.02, respectively.

37-2.05 TIE BARS

Tie bars shall be deformed steel bars meeting the requirements in Section 111-2.01. The bars shall be free from rust, loose mill scale, dirt, grease or other defects affecting the strength or bond with the concrete.

37-2.06 PREMOLED JOINT FILLER

-2.06A Contraction and Longitudinal Joints

Premolded joint filler for use in contraction and longitudinal joints shall be not less than one eighth (1/8) 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. Premolded joint filler shall be kept on a flat surface in storage before insertion in the concrete, and no warped or damaged material shall be used. Warped or damaged material shall be removed from the project.

-2.06B Expansion (Through) Joints

Premolded joint filler for use in expansion (through) joints shall conform to the standard specifications for Preformed Expansion Joint Fillers for Concrete, AASHTO Designation M 213.

37-2.07 COTTON MATS

Cotton mats shall conform to the standard specifications for AASHTO Designation M73, Cotton Mats for Curing Concrete.

37-2.08 WHITE PIGMENTED CURING COMPOUNDS

White pigmented curing compounds shall consist of finely ground white pigment and vehicle, ready-mixed for immediate use without alteration other than stirring. It shall adhere firmly to concrete either partially set or hardened. It shall meet the requirements that follow.

The compound shall provide a uniformly white appearance and shall effectively obscure the original color of concrete when applied at the rate of 200 square feet per gallon. When tested with the Pfund Cryptometer, Model E, Black Plate, Wedge Constant 0.007 inch and viewed in light of approximately 50-foot candles intensity the scale reading shall not exceed 40.

The compound shall dry to touch in not more than 8 hours when applied to a glass plate at a film thickness of 0.006 inch and exposed at an atmospheric temperature of 70°.

The viscosity of the compound at a temperature of 77° F. shall not exceed 60 Krebs units when tested by means of the Krebs-Stormer viscosimeter, ASTM Designation D 562.

The compounds shall be of such composition that the coating formed by its application on concrete surfaces will provide an effective seal for at least 10 days. There shall be no evidence that new concrete surfaces are softened by reaction with the compound.

When tested for moisture retaining effectiveness, as described in Section 6.03 of these specifications, the loss of moisture shall not exceed two (2) grams per specimen.

Section 37—Portland Cement Concrete—Materials

AIR CONTENT OF FRESHLY MIXED CONCRETE

Maximum Size of Coarse Aggregate (Inches)	Air Content Percent by Volume
1½, 2, and 3	5 ± 1
¾ and 1	6 ± 1
¾ and ½	7½ ± 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.

If an air-entraining agent is used, it shall be introduced at the nominal rate of one fluid ounce per sack of cement, but the rate shall be varied, if necessary, to comply with the requirements for air content.

An automatic dispenser, accurate to 10%, which will introduce into the mixing water the specified amount of air-entraining agent for each cycle of mixing, shall be connected to the mixer.

Aggregates shall be adjusted to compensate for increased yield resulting from air-entrainment so that the specified amount of cement is contained in each cubic yard of concrete. Adjustment shall be made by decreasing the weight of fine aggregates only, unless otherwise directed by the Engineer.

Other admixtures: Calcium chloride or any other admixture for any purpose other than air-entrainment may be added only upon the approval of the Engineer and under his supervision.

37-3.03 MEASURING OF MATERIALS

-3.03A Aggregates

The fine aggregate and each size of coarse aggregate shall be measured by weighing. Corrections shall be made for variations in weight of material due to moisture content and specific gravity. The quantities of aggregates used in each batch shall be such that the cement can be measured in full sacks unless it is weighed in bulk.

The equipment for weighing aggregates shall conform to requirements set forth in Section 21, Weighing Equipment.

-3.03B Cement

Cement handled in bulk shall be weighed on scales meeting requirements specified in Section 21. Adequate precaution shall be taken to prevent loss of cement between the batch box and the mixer.

-3.03C Water

-3.03C1 Water Cement Ratio. In adjusting concrete mixes, the following water-cement ratios shall not be exceeded:

Class of Concrete	3(1½)	4(1½)	5(¾)	5(1½)	5(3)	5.5(1½)	6(1½)	6.5(1½)
Sacks per cu. yd.	3	4	5	5	5	5.5	6	6.5
Lbs. dry fine Aggregate No. 1	473	346	275	275	275	248	220	210
Lbs. dry fine Aggregate No. 2			291					280
Lbs. No. 2 coarse aggregate	710	521			248			
Lbs. No. 3 coarse aggregate					166			
Lbs. No. 4 coarse aggregate				166		150	132	
Lbs. No. 5 coarse aggregate			387	248		223	201	

37-3.05 TRANSPORTING MATERIALS

Materials shall be transported from the batch plant to the mixer in suitable batch trucks of approved design. The trucks shall meet all legal load restrictions when hauling on a public highway or street. Trucks shall be of sufficient size to prevent spillage from the trucks or from one compartment to another at any time during loading, hauling or dumping operations, and they shall be capable of dumping the entire batch into the mixer skip without spillage of cement or aggregates on the subgrade.

Cement Sacks per Cu. Yd.	Max. Water Gals. per 94 Lb. Sack
3	11.0
4	8.2
5	6.5
5.5	6.0
6	5.5
6.5	5.1

The slump of the mixes shall be as specified in the appropriate section, or as provided in the special provisions. If, however, it is necessary for purpose of placing, additional water may be used provided that additional cement is also added to maintain the water-cement ratio as shown above.

-3.03C2 Water Measuring Equipment. Water measuring equipment shall consist of a supply tank and a measuring tank. The supply tank shall be open to the air and shall receive water from the supply main. The water used for mixing concrete shall not be used to cool the mixer motor. The measuring tank shall receive water by gravity from the supply tank only. It shall be equipped with a riser pipe extending to the top of the supply tank, or shall have other adequate means of permitting free flow of air above water.

The valves on the supply and discharge lines to and from the measuring tank shall be so arranged that it will be impossible for both to be open at the same time or for the water to pass directly from the supply line to the mixer. The measuring tank shall be provided with an easily read device, at all times exposed to view, that will accurately indicate within one (1) quart the volume of water delivered to the mixer.

37-3.04 PROPORTIONING MATERIALS

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 sack—ninety four (94) pounds.

Weights of fine and coarse aggregate are based on a bulk specific gravity, saturated surface dry, of 2.67. When volume measurements are used, one cubic foot of sand shall be taken as equivalent to 100 pounds of sand, and one cubic foot of gravel shall be taken as equivalent to 105 pounds of gravel. Corrections 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 weighing 94 pounds. With approval of the Engineer, the proportion of aggregate may be altered to give better workability.

Transportation of cement in the same compartment with the aggregates will be permitted if the aggregates are fed simultaneously with the cement into the truck compartment to avoid loss of the dry cement while en route to the job site. Batches of concrete materials containing dry cement shall be used the same day they are made up. No dry batches left in trucks overnight shall be used for concrete. The Engineer may order suitable tarpaulins or other protective covers to be placed over the loaded batch beds of trucks if he deems it necessary to prevent loss of cement or aggregates.

Section 38—Cement Concrete Stairways, Landings and Steps

37-3.06 CONSISTENCY OF CONCRETE

The concrete materials shall be mixed with the required amount of water to give a stiff, workable mix. The consistency shall be such that the concrete will not crumble and handling will not cause the mortar to separate from the aggregates. Additional water to improve workability or prevent the formation of honeycomb or rock pockets may be added only if approved by the Engineer.

The consistency of the concrete will be evaluated by either of two test methods: Method of Test for Slump of Portland Cement Concrete, ASTM Designation C 143, and the Method of Test for Ball Penetration in Portland Cement Concrete, ASTM Designation C 360.

37-3.07 CONCRETE MIXED AT ROAD SITE

The materials shall be mixed in a batch mixer in first-class condition having a rating not less than 27-E + 10% and of the boom and bucket type, approved by the Engineer. Mixing shall continue after all materials are in the drum for at least fifty (50) seconds before any part of the batch is discharged from the drum.

The drum shall be completely emptied before receiving materials for the next batch. The drum shall revolve at the rate of speed specified for the particular mixer used but it shall make not less than fourteen (14) nor more than twenty (20) revolutions per minute.

Every concrete mixing machine shall be equipped with a suitable timing device. The mechanism of such timing device shall be so constructed as to automatically be put into operation as soon as all materials are in the drum and to lock the mixer so as to prevent discharge until the specified mixing time has elapsed. This timing device shall be tested each day before beginning work and shall be regulated only in the presence of the Engineer or his representative.

The interior of the drum of the mixer shall be kept free of incrustations of concrete. The pick-up and throw-over or mixing blades in the drum shall be replaced when they show a wear of more than three-fourths (¾) of an inch. The wear of blades shall not exceed the tolerance recommended by the manufacturer.

The boom bucket shall have discharge doors at right angles to the boom and be kept in good order so that mortar will not leak out when the doors are closed.

Concrete mixers shall not be operated with a batch in excess of the rated capacity of the mixer. The mixture shall be homogeneous and a mixer that discharges concrete with separation of gravel from mortar shall not be used.

37-3.08 READY MIXED CONCRETE

Ready mixed concrete may be used if the concrete delivered to the job site will meet the requirements of these specifications and the special provisions.

Ready mixed concrete may be produced by either a stationary mixer or a truck mixer. After the mixing, the concrete may be agitated by agitator truck or mixer truck. Agitators and mixers shall be identified as to uses, capacity in volume of concrete, and speed of rotation of mixing drums or blades. Stationary mixers shall be equipped with timing devices which will prevent the premature discharge of the concrete batch, and truck mixers shall have counters which will record the revolutions of the drum or blades.

Mixers and agitators must be capable of producing concrete, when delivered to the job site, that is thoroughly mixed with a satisfactory degree of uniformity and with the specified slump. Slump tests made at the one-quarter or three-quarter points of the load, if differing by more than two (2) inches, shall be cause to discontinue use of the equipment until the condition is corrected.

Ready mixed concrete shall be mixed and delivered by one of the following operations:

1. *Central-mixed Concrete:* Concrete mixed at central location and transported to job site in agitator truck or truck mixer operated at the agitator speed specified by the equipment manufacturer. Mixing time shall be sixty (60) seconds.

2. *Shrink-mixed Concrete:* Concrete is partially

mixed by stationary mixer and mixing is completed by truck mixer. Stationary mixing time shall be thirty (30) seconds and truck mixer shall make not less than fifty (50) nor more than 100 revolutions of the drum or blades at the equipment manufacturer's designated speed; further mixing at agitator speed.

3. *Transit-mixed Concrete:* Concrete is completely mixed by truck mixer, with mixing as specified above for truck mixer under "Shrink-mixed Concrete." Truck mixers shall be equipped with accurate revolution counters.

Concrete transported by agitator or truck mixer shall be completely discharged at the job site within ninety (90) minutes after water is added to the cement and aggregates, or after the addition of cement to the aggregates, or when the concrete has been subjected to a maximum of 250 revolutions of the drum or blades, whichever comes first. A lesser time will be required whenever the weather accelerates the stiffening of the concrete. When a truck mixer is used to mix the concrete, the mixing shall begin within thirty minutes after the cement is intermixed with the aggregates.

Ready-mixed concrete may also be transported to the job site in nonagitated conveyances provided that the concrete is delivered and discharged complete within 30 minutes after the introduction of mixing water to cement and aggregate.

All equipment used in producing ready-mixed concrete shall be maintained in first class condition. Equipment, deemed by the Engineer to be inadequate to produce the quality of concrete required under these specifications, shall be removed from service until restored to proper operation conditions or be replaced by acceptable equipment.

Mixing and transporting equipment shall be adequate in quantity to deliver the required amount of concrete to the job site. The rate of delivery shall be such that the concrete can be properly handled, placed and finished. The interval between batches shall not be more than thirty (30) minutes. Delivery shall be made in a manner that will minimize rehandling and prevent damage to concrete previously placed.

37-3.09 BATCH METERS (Vented)

37-3.10 RETEMPERING

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. No retempering of concrete (remixing with water or other materials) will be allowed.

Section 38—Cement Concrete Stairways, Landings and Steps

38-1 DESCRIPTION

Cement concrete stairways, landings and steps, unless otherwise shown on the project plans, shall be constructed in accordance with standard plan and these specifications.

38-2 MATERIALS

Portland cement concrete, reinforcing steel, forms and curing materials shall conform to the requirements therefor in Section 37.

The concrete mix shall be Class 6(¾), unless otherwise specified in the special provision or directed by the Engineer.

Galvanized iron pipe railing shall be fabricated from standard weight galvanized steel pipe conforming to ASTM Designation A 120.

38-3 CONSTRUCTION DETAILS

38-3.01 SITE PREPARATION AND GRADING

The staked area where cement concrete stairways and landings are to be constructed shall be cleared, grubbed

Section 39—Cement Concrete Pavement

and graded in accordance with the applicable requirements therefor in Sections 12 and 13. Excavation for cement concrete stairways and landings shall be considered as "Common Excavation," described in Section 13-1.01 unless otherwise provided in the special provisions. Any required compaction of excavation will be paid for as provided hereinafter for the type of equipment employed.

38-3.02 SUBGRADE PREPARATION AND FORMS

Subgrade preparation and compaction required in preparing a proper subgrade for cement concrete stairways and landings shall conform to the applicable requirements for subgrade for pavement as specified in Section 15, and shall be acceptable to the Engineer.

Forms may be of any suitable material provided the material used will form a finished cement concrete stairway or stairway landing of dense concrete conforming to the alignment, grade, and cross section dimensions required by the construction plans.

38-3.03 REINFORCING STEEL

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 in the plan location during the concrete placement.

38-3.04 RAILINGS

Hand railings for cement concrete stairways shall be of welded galvanized steel pipe construction, as shown on the plans. Welds shall be made by experienced welders and each weld shall be ground and buffed to a smooth surface and then hot dipped. Field welds shall be galvanized with "Galvalloy," or approved equal. Painting of welds will not be permitted. After installation is completed, the railing shall be painted with one (1) coat of metal primer and one (1) coat of aluminum paint as specified in Section 116-2.02T.

The railing may be placed either completely assembled at the time when stairway concrete is placed, or recesses may be provided in the concrete for grouting in the railing posts after the concrete has been placed, finished and cured. The installed railing shall be in true alignment, on proper grade, and all posts plumb.

38-3.05 PLACING CONCRETE, FINISHING AND CURING

Concrete for stairways and landings shall be Class 6 (¾) unless otherwise provided in the special provisions or ordered by the Engineer. Placing, finishing and curing shall conform to the applicable requirements in Section 39-3, as they would apply to cement concrete stairway construction.

Front and side edging of stair treads shall be to a radius of one-half (½) inch.

Landings for stairways shall be marked as specified for concrete sidewalks in Section 42 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.

38-4 MEASUREMENT

Measurement of "Common Excavation," when required, will be made on the basis of volume, as specified in Section 13-4.

Measurement of cement concrete stairways or cement concrete steps shall be by the linear foot for the horizontal distance from face of lower riser to face of upper riser, plus one (1) foot.

Measurement of railing shall be on the slope for the length of the top rail.

Measurement of concrete landings shall be by the square yard measured from the bottom of the riser at one end to the top of the riser at the other end, less one (1) foot.

Measurement for compaction equipment to compact

embankment or subgrades for cement concrete stairways and landings will be made to the nearest one-half (½) hour of actual time consumed for the particular type of equipment used in compacting, as directed. No allowances will be made for time consumed in making repairs to equipment, for moving equipment from one area to another, or for time the towing equipment is performing other work.

38-5 PAYMENT

Payment will be made for such of the following bid items as are included in any particular contract:

- (1) "Common Excavation," per cubic yard.
- (2) "Cement Concrete Stairway," per linear foot.
- (3) "Cement Concrete Stairway Landing," per square yard.
- (4) "Stairway Steel Pipe Railing," per linear foot.
- (5) "Mechanical Tamper," per hour.
- (6) "Cement Concrete Steps," per linear foot.

38-5.01 EXCAVATION FOR GRADING

The unit contract price per cubic yard for "Common Excavation," shall be full compensation for excavating, loading, placing or disposing of the material as may be required, including also the removal and disposal of debris from clearing and grubbing operations including top soil, organic matter and other deleterious matter from surface of a cut or fill, as may be necessary.

38-5.02 CEMENT CONCRETE STAIRWAY OR STEPS

The unit contract price per linear foot for "Cement Concrete Stairway," or "Cement Concrete Steps," shall be full compensation for all clearing and grubbing, subgrade preparation, constructing forms, furnishing and placing reinforcing steel, furnishing, placing and consolidating concrete Class 6 (¾), finishing and curing in accordance with the plan and specifications.

38-5.03 CEMENT CONCRETE STAIRWAY LANDINGS

The unit contract price per square yard for "Cement Concrete Stairway Landing," shall be full compensation for all clearing and grubbing, subgrade preparation, forms, reinforcing steel, furnishing, placing and consolidating concrete, finishing, marking and curing in accordance with the plan and specifications.

38-5.04 STAIRWAY STEEL PIPE RAILING

The unit contract price per linear foot for "Stairway Steel Pipe Railing," shall be full compensation for all costs of all materials, labor and equipment to construct and complete the railing in accordance with the plan and specifications.

38-5.05 COMPACTION EQUIPMENT

The unit contract price per hour for "Compaction Equipment (type specified)," shall be full compensation for the time the equipment is used in compacting embankments or subgrades for cement concrete stairways and landings to the density required by the Engineer.

Section 39—Cement Concrete Pavement

39-1 DESCRIPTION

The work covered in this section of specifications pertains to the construction of portland cement concrete pavements in streets, alleys and public rights of way.

39-2 MATERIALS

Cement and other concrete materials, joint filler, curing materials and reinforcing steel, required by the plans and specifications, shall conform to the requirements of Section 37. The class of concrete mix shall be that shown in the proposal. Ordinarily, the slump of the concrete when placed by machine methods shall not exceed two (2) inches. When hand methods are used, the slump shall not exceed three and one-half (3½) inches.

Section 39—Cement Concrete Pavement

39-3 CONSTRUCTION

NOTE: Section 39, Cement Concrete Pavement of the 1963 APWA edition, embraced specifications for both materials and construction. This new edition has recast specifications for materials into Section 37 and includes the construction specifications in this revised Section 39. In the breakdown of Section 39 (1963 edition), its sections 39-3.01 through 39-3.11 have become sections 37-3.01 through 37-3.11 because they pertain to materials. To accommodate numerous references in other sections of this new edition which were formulated before the split of Section 39 into Sections 37 and 39, the same numbering sequence is being continued, where applicable, in this revised Section 39. Consequently, disregard the apparent gap of sections 39-3.01 thru 39-3.11 because, as materials, they are included as 37-3.01 thru 37-3.10.

39-3.12 SUBGRADE

The preliminary subgrade before the setting of forms shall be graded and compacted as required under Section 15.

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 15.

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 trucks 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.

39-3.13 FORMS

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 plans.

Forms shall be adequately supported to prevent deflection or movement and which will result in concrete pavement conforming with the plans and specifications. The top of the forms shall not deviate more than one eighth (⅛) inch in 10 feet and the alignment of forms shall be within one fourth (¼) 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.

39-3.14 COMPACTION AND COMPACTING EQUIPMENT

Covered in Section 15-2.

39-3.15 PLACING CONCRETE

The concrete shall be placed upon the prepared subgrade 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 against and 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.

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 not being placed integral with the pavement slab, reinforcing steel dowels shall be placed in the base section for the curb in the manner described in Section 40-3.01C.

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

-3.15A Placing Concrete at Expansion Joints

Concrete placement around expansion joints shall be such that the expansion 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 spaded thoroughly or 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.

-3.15B Placing Concrete With Reinforcing Steel Bars or Wire Mesh

Concrete shall be placed in two courses. The first course shall be struck off at elevation established for reinforcing steel bar or wire mesh, or as designated on the plans. 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.

Reinforcing steel bars or wire mesh 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.

Reinforcing steel or wire mesh 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 is used to position and secure the reinforcing bars or wire mesh 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.

-3.15C Slip Form Construction

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 homogenous 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 one-half (½) inch from the alignment established by the Engineer.

Should the Contractor elect to use a slip-form paving machine that does not form an extruded curb, he will not be required to construct a depressed curb section at driveways. The driveway, when constructed may be poured

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against the back of the slip formed pavement. No payment will be made for the curb section that is not placed at the driveways.

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, 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 straight edge to comply with the tolerances and finish specified in Section 39-3.19E.

Final finishing of slip-form pavement shall be as specified in Section 39-3.19D.

39-3.16 COMPACTING CONCRETE

Concrete may be compacted by (1) hand methods, (2) machine methods and (3) combined machine and vibrators method at the option of the Contractor. The hand method will be limited to irregular areas, irregular sections, alleys and pavements placed in confined work areas.

-3.16A Hand Compacting

Concrete shall be spread evenly with shovels and spaded along the forms with a perforated spade after which it shall be struck off with a metal shod tamping rod. The rod shall be cut to exact crown of the roadway and be fitted with handles at each end and of such depth or trussed to be rigid. The strike-off rod shall be operated with a combined tamping, crosswise and sawing action to produce a smooth surface free from depressions or inequalities. A small amount of mortar must be kept ahead of and extending substantially along the entire length of the rod. Excessive swinging of the rod will not be permitted.

The concrete shall be struck off again with a "second strike rod" operated in the same manner as the first rod and following not closer than twenty (20) feet behind the first. The second strike rod may be eliminated on alley pavements having the "V" section of the center. The second rod may also be eliminated on small pours of pavement of substandard width, unless use of the rod is required by the Engineer.

-3.16B Machine Compacting

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 plans. 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.

-3.16C Combined Vibration and Machine Compacting

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 aggregates.

The equipment shall consist of the machine described

in Section 39-3.16B, 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 39-3.16B, Machine Compacting.

Two hardwood strips faced with metal shall be provided as described in Section 39-3.16B.

When combined vibration and machine compacting is used, the cement content of the specified concrete mix may be reduced by ten one-hundredths (0.10) barrel per cubic yard, except that no reduction will be permitted for mixes calling for 1.25 barrels per yard or less, provided it can be demonstrated to the satisfaction of the Engineer that:

(1) The equipment can compact and strike off concrete containing the full amount of cement specified in Section 37-3, Concrete Mixes, or the special provisions and with the water content reduced by 7%.

(2) With the cement content reduced, the water requirements must not exceed that for a mix with the full cement content and compacted without vibration.

(3) The workability of concrete with a reduced cement content will allow finishing of the surface free of depressions or inequalities of any kind.

As often as the Engineer may require, the Contractor shall make trial runs with concrete containing the full amount of cement as specified in Section 37-3, Concrete Mixes, or as specified in the special provisions, compacting with and without vibration to determine the relative water contents required.

-3.16D Vibrating Screed Concrete Pavement Construction

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 hand spading or 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.

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After the final passage 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.

39-3.17 WATER

Water for pavement construction will be furnished as provided in Section 16.

39-3.18 JOINTS

Transverse and longitudinal joints for street pavement may be contraction joints, construction or expansion joints as shown on the plans 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 plans or specified in the special provisions.

-3.18A Formed Transverse Contraction Joints

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 fifteen (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 fifteen (15) feet shall be along the outer edge of the 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 two hundred twenty-five (225) square feet and the greatest dimension thereof shall not exceed sixteen and one-half (16½) 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 resultant panel would be less than twelve and one-half (12½) 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 3/16-inch joint material extending from the surface to one (1) inch below the bottom of the concrete being placed.

Where full joint material is required to separate two paving lanes, its location shall be noted on the plans or in the special provisions and the cost thereof will be paid for at the unit bid price per linear foot.

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

-3.18B Construction of Formed Contraction Joints

Formed contraction joints shall be constructed by imbedding a preformed joint material. The filler shall be cut to the exact sections of the joint. The length of the premolded joint filler shall extend to within one-fourth (¼) 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 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 one-eighth (⅛) inch below the surface. The joint filler shall be at right angles 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 vertical or normal position, true to alignment. After finishing, the entire area of the joint shall be true to grade and smoothness without any irregularities.

No payment will be made for contraction joint material or its placement, and all costs thereof shall be included in the unit contract price per square yard for "Cement Concrete Pavement (class, inches)."

-3.18C Sawed Contraction Joints

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.

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 incidence 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 will not adhere to concrete if curing compound is present.

The depth of sawed transverse contraction joints shall be a minimum of one and one-half (1½) inches. Longitudinal joints shall be sawed to a depth of not less than one-fourth (¼) the depth of the slab.

After the curing period the joints shall be cleaned and sealed with joint sealants meeting requirements in Section 37-2.13. Excess sealing material shall be cleaned off the surface of the pavement before opening to traffic.

-3.18D Transverse Construction Joints

Transverse construction joints shall be made at the end of each day's paving, or when placing of concrete is discontinued for more than 60 minutes, by placing a header board transversely across the subgrade. 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 fastened 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 two-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 sealed or may have a two-inch strip inserted as specified herein.

No separate payment shall be made for construction joints or for the premolded joint material, extra concrete, or sealing compounds required for the construction joints. All costs thereof shall be included in the unit contract price per square yard for "Cement Concrete Pavement."

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-3.18E Transverse Expansion Joints

Transverse expansion joints are placed only where shown on the plans or where directed by the Engineer.

Transverse expansion joints shall be constructed with premolded material, three-fourths inch (¾") in thickness and conforming to Section 37-2.06B. They shall extend the full width of the pavement and from one inch (1") below the subgrade to one inch (1") below the top of the pavement. The joint alignment must be at right angles to the pavement center line unless otherwise specified.

The filler 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 at right angles 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.

Expansion 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 one inch (1") 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.

No additional payment will be made for expansion joint material or its placement. All cost therefor shall be included in the unit contract price per square yard for "Cement Concrete Pavement" of the required class and thickness.

-3.18F Sealing Expansion Joints

After the pavement is cured and before any traffic, the space above the top of expansion joint filler strip shall be thoroughly cleaned of all loose material. The groove three-fourths inch (¾") 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 Section 37-2.13.

The joint sealant material shall be heated and placed in complete accord with the manufacturer's instructions. Burned material will be rejected. The expansion 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.

-3.18G Longitudinal Contraction Joints

The joints shall be constructed in true alignment with respect to their proper location on center line or parallel thereto as is shown in a succeeding subsection. No payment will be made for contraction joint material and its placement except in case of alternate bids as described in Section 39-3.18B.

-3.18H Standard Location for Longitudinal Joints

Standard location for longitudinal joints, whether contraction or construction, shall be as shown below unless otherwise specified in the plans and special provisions:

Width Curb to Curb	Joint Locations
25 Feet.	Center line
32 Feet.	Center line
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

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.

-3.18I Longitudinal Expansion Joints

Longitudinal expansion joints shall be placed where shown on the plans or where required for concrete pavement between or along retaining walls, curbs or other structures. Unless otherwise shown on the plans, longitudinal expansion joints shall be three-fourths inch (¾") thick and of a width equal to the full depth of the pavement.

The furnishing and placing of longitudinal expansion joints, using premolded joint filler material, shall be considered as incidental to the construction of the pavement and the cost thereof shall be included in other bid items of the work unless otherwise covered in the special provisions and proposal.

-3.18J LONGITUDINAL CONSTRUCTION JOINTS

Longitudinal construction joints shall be as shown on the standard drawings. The Contractor may use an approved keyed joint in lieu of thickened edge for longitudinal construction joint. The Contractor shall submit plans for the keyed joint for approval by the Engineer prior to construction.

Payment for the approved keyed joint used in lieu of the thickened edge will be paid for at the unit price bid for, "Extra Concrete for Thickened Edge," per linear foot, as specified in Section 39-4.

39-3.19 FINISHING CONCRETE

Hand finishing or machine finishing of the entire pavement surface will be permitted unless otherwise provided in the special provisions.

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

All tools shall be kept in first-class working order and shall be inspected daily. Worn or defective tools will not be permitted. A sufficient number of tools shall be provided for the work to proceed efficiently.

-3.19A Hand Finish

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 one-half the length of the float. Floating shall continue until all irregularities are removed. Longitudinal floating shall follow the 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 the final passage of the longitudinal float, transverse floating shall be continued with long handled floats operated from outside the pavement slab.

After floating, the surface shall be scraped with a grout rod at least ten (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 39-3.18A, Formed Transverse Contraction Joints.

-3.19B Machine Finishing

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 two 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 texture surface, conforming to the exact crown and cross section specified on the plans.

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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.

The surface smoothness of the completed pavement shall be tested with a ten-foot straightedge and shall meet the surface smoothness requirements specified in Section 39-3.19E.

-3.19C Edging

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	One-half (½) inch
Formed longitudinal contraction joints	One-fourth (¼) inch
Longitudinal construction joints	One-fourth (¼) inch
Transverse construction joints	One-fourth (¼) inch
Formed transverse contraction joints	One-fourth (¼) inch
Through joints	One-half (½) inch
Curbs—back edge	One-half (½) inch
Curbs—front edge	One (1) 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.

-3.19D Final Finish

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 at least three (3) feet wide and the length 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 that the surface is not grooved or gouged in the finishing operation.

-3.19E Surface Smoothness

After all finishing is complete, the surface smoothness shall be checked with a straightedge ten (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 center line and at intervals of no more than five (5) feet across the full width of the pavement. At 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 one-eighth (⅛) inch in 10 feet on arterials, one-fourth (¼) inch in 10 feet on residential streets, three-eighths (⅜) inch in 10 feet in alleys, and one-half (½) inch in 10 feet in concrete bases.

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 the tolerance. If the surface tolerance cannot be met satisfactorily by grinding, then in that event the pavement shall be removed and be replaced in conformity with the specifications at the expense of the Contractor.

39-3.20 CURING AND PROTECTION

The concrete pavement shall be protected against excess loss of moisture, rapid temperature change, rain, water and mechanical injury during and immediately following the placing and finishing operations.

The concrete pavement shall be cured for the minimum number of days listed below, exclusive of the day the concrete is placed.

Portland cement	5 days
High-early-strength cement	3 days

Moist curing by sprinkling or by saturated mats, waterproof paper, white polyethylene sheeting, liquid membrane or a combination of these may be used for curing medium and shall be applied in a manner and in quantity appropriate to the particular conditions as approved by the Engineer. Pavement edges which are exposed by the removal of the forms shall be protected by the immediate application of a curing medium or 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.

-3.20A Sprinkling System

The sprinkling system shall keep the entire surface of the concrete pavement continuously wet, twenty-four (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.

-3.20B Saturated Mats

Cotton mats shall be placed over the entire area of the concrete pavement and kept saturated during the full curing period. The mats shall be lapped at all joints, and they shall be securely held in place to prevent displacement. The material which composes the mats shall conform to the requirements of Section 37-2.07.

-3.20C Waterproof Paper

The wet concrete shall first be wetted with a fine spray of water and then completely covered with a waterproof paper, lapping all joints at least twelve (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 37-2.10.

-3.20D White Polyethylene Sheeting

White polyethylene sheeting shall conform to requirements contained in Section 37-2.11. The installation and maintenance of the sheeting shall be as specified for "Waterproof Paper."

-3.20E White Liquid Membrane Curing Compound

White pigmented curing compound shall conform to the requirements in Section 37-2.08. The entire surface of the pavement shall be sprayed uniformly with sufficient compound to obscure the natural color of the concrete, but not less than one gallon for each 200 square feet of area. The curing compound shall be applied immediately after the finishing is completed and all free surface water has disappeared, or after initial curing when other methods are used in combination with the liquid curing compound.

If hair checking occurs before the finishing operations are completed, the Engineer may require a fog spray as defined in Section 39-3.20H. Any mortar scraped from the pavement surface shall be wasted. When it becomes necessary to fill depressions in the pavement surface, concrete shall be brought from the mixer. Whenever the pavement surface has been disturbed after the initial application of the curing membrane, it shall be restored by respraying.

The curing compound shall be applied with pressure spraying equipment having a feed tank equipped with a mechanically driven agitator and operated with sufficient air to properly atomize the compound.

If forms are removed from the pavement prior to the end of the curing period, curing compound shall be applied to the exposed surfaces within a period of one hour.

Curing compound shall not be applied either immediately before or after a rainfall. If the curing membrane is damaged by rain, it shall be restored to the original condition by respraying.

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Provision shall be made for the Engineer to ascertain the rate at which the curing compound is being applied to the pavement. The compound shall be drawn directly from manufacturer's containers bearing the manufacturer's name, brand and lot number. Before placing the compound in the spray tank, it shall be agitated thoroughly to disperse the pigment. The compound shall not be diluted with solvent or altered in any way from its original condition. If the compound has become chilled, it shall be heated but not above 100 degrees Fahrenheit.

After the compound has been applied, the curing membrane shall be protected against damage from any source, including traffic by foot or other. If any traffic is permitted, a protective cover approved by the Engineer shall be placed over the pavement not less than 24 hours after application of the compound.

The Contractor shall have readily available protective covering such as waterproof paper or plastic membrane sufficient to cover concrete pavement that can be placed in one full day.

The Contractor shall assume all liabilities for and protect the Owner from any damages or claims arising from use of materials or processes described herein.

-3.20F Transparent Liquid Curing Compound

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 37-2.09. 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 39-3.20E.

-3.20G Emulsified Asphalt

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.

-3.20H Curing in Hot Weather

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.

39-3.21 COLD WEATHER WORK

Concrete shall not be placed when the temperature is below forty (40) degrees Fahrenheit, nor shall concrete be placed on a frozen subgrade.

If, during a period of concrete placement and curing, the temperature is expected to drop to thirty (30) degrees Fahrenheit within twenty-four (24) hours in the opinion of the Engineer, all concrete not already cured for at least six (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 shall be replaced at the Contractor's expense.

39-3.22 CONCRETE PAVEMENT CONSTRUCTION IN SINGLE LANE

Concrete pavement may be placed in single lane full width or multiple lanes between longitudinal joints.

Concrete shall not be placed in a succeeding lane sooner than 48 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:

1. The concrete in the new lane shall have attained a compressive strength of twenty five hundred (2500) pounds per square inch as determined by the Engineer.
2. 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.
3. 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.
4. 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. 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 strip three (3) inches wide by one-eighth ($\frac{1}{8}$) inch thick and at least five (5) feet in length shall be placed on the complete pavement lane near to the common joint with the adjacent lane to be paved, and the concrete placed in the adjacent lane 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 dust upon the freshly placed concrete.

39-3.23 CONCRETE BASE PAVEMENT

Cement concrete pavement, which is intended as a base for an asphalt wearing course, shall be constructed in accordance with the appropriate sections of these specifications for finished concrete pavement with the following exceptions:

- (1) The surface tolerance shall be three-eighths ($\frac{3}{8}$) inch to ten (10) feet.
- (2) The surface of the concrete base, if hand compacted, may be struck off with only one strike-off rod. Brushing of the surface of concrete base will not be required.
- (3) The curing compound shall be an asphalt emulsion.
- (4) Dummy or through joints shall not be constructed unless required in the special provisions.

39-3.24 VIBRATING SCREED CONCRETE PAVEMENT CONSTRUCTION

Refer to Section 39-3.16D.

39-3.25 TEMPORARY TRAFFIC CROSSINGS AT NEW PAVINGS (Special Provisions)

39-3.26 BARRICADES AND SAFEGUARDS

See Section 7.14.

39-3.27 OPENING PAVEMENTS TO TRAFFIC

The Contractor shall not open newly constructed cement concrete pavement to traffic until the concrete has attained a compressive strength of twenty five hundred (2500) pounds per square inch, as determined by the Engineer.

Section 40—Cement Concrete Curb, Curb and Gutter

Streets with curbs shall not be opened until the curb has cured for at least 72 hours. If the curb has not attained the above-mentioned 2500 pound strength for the pavement, the Contractor shall place form lumber on the pavement two feet away from the curb, or place standard barricades and maintain them to the satisfaction of the Engineer. Such curb protection remain in place as long as may be necessary for protection of the curb.

39-3.28 CLEANUP

In addition to the cleanup specified in Section 4.08 and Section 57, the Contractor shall, before final acceptance of the work, flush the pavement clean and remove the debris. He shall also clean out all open culverts and drains, inlets, catch basins, manholes and water main valve chambers, within the limits of the project, of dirt and debris of any kind which is the result of the Contractor's operations. The cleaning and disposal of such waste material shall be considered as incidental to the construction and all costs thereof shall be included in the unit contract prices of various items of the work, unless there is included in the proposal an item for "Finishing and Cleanup," per lump sum, or per station (100').

39-3.29 EXTRA CONCRETE FOR ALLEY APPROACH RAMP

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 six (6) inches above the original planned concrete surface at any point.

Payment for placing and finishing such ramps will be made at the unit contract price per square yard for cement concrete pavement by increasing the area of alley pavement by the amount of area occupied by such ramp or ramps. Measurement shall be to the meet line area of each ramp placed.

39-4 MEASUREMENT AND PAYMENT

Payment will be made for such of the following bid items as are included in any particular contract:

- (1) "Cement Concrete Pavement (class, thickness)," per square yard.
- (2) "Cement Concrete Base Pavement (class, thickness)," per square yard.
- (3) "Extra Concrete for Thickened Edge (inches \times inches)," per linear foot.
- (4) "Steel Reinforcing Bars," per pound.
- (5) "Sawing Contraction Control Joints (depth)," per linear foot.
- (6) "Extra for Furnishing High-early-strength Cement," per barrel.

39-4.01 CEMENT CONCRETE PAVEMENT

Payment for "Cement Concrete Pavement" and "Cement Concrete Base Pavement" shall be at the unit contract price for the specified class and thickness, complete in place.

Measurement for payment shall be by the square yard of concrete in place, including the area underneath curbs. No deduction will be made for castings in pavement.

The unit contract price shall be full compensation for subgrade preparation, furnishing of all labor, tools, equipment, materials excepting reinforcing steel, and for constructing, curing and protecting the cement concrete pavement.

All work, material and equipment not included in a separate unit contract price item shall be considered as incidental to the construction of the pavement and the costs thereof shall be included in the unit contract price per square yard of the cement concrete pavement.

39-4.02 EXTRA CONCRETE FOR THICKENED EDGE

Measurement and payment of "Extra Concrete for Thickened Edge (inch \times inch)," shall be by the unit

contract price per linear foot as measured along the face of the thickened edge.

The unit contract price per linear foot shall be full compensation for excavation and all costs of labor, tools, equipment and materials required in shaping the subgrade to the required section, and for constructing the thickened edge of the same mix and consistency as the pavement with which it will become an integral part.

39-4.03 STEEL REINFORCING BARS

Steel required for pavement reinforcement will be paid for at the unit contract price for "Steel Reinforcing Bars" which shall be full compensation for furnishing and placing steel reinforcement as detailed on the construction plans. Measurement for payment will be by the pound of steel reinforcement in place.

Reinforcing steel shown on the standard drawings and required for ties of the pavement to driveway, curb, and gutter will not be paid for under the item of "Steel Reinforcing Bars," per pound. Such steel shall be considered as incidental to the construction of the pavement and all costs thereof shall be included in the unit contract price per square yard of "Cement Concrete Pavement."

39-4.04 SAWING CONTRACTION CONTROL JOINTS

Measurement for payment will be by the linear foot of contraction joint sawed, cleaned and sealed in accordance with the plans and specifications.

The unit contract price per linear foot for sawing joints shall be full compensation for all labor, equipment and materials required to saw joints to the depth specified, and the unit contract price shall include all costs of labor and material for the sealing of the sawed joint as specified.

39-4.05 EXTRA FOR FURNISHING HIGH-EARLY-STRENGTH CEMENT

If the Engineer shall direct that high-early-strength cement be used on any part of the work in lieu of standard portland cement, extra compensation will be made the Contractor in an amount per barrel equal to the difference between the price paid by him for standard portland cement and the price paid by him for high-early-strength cement.

39-4.06 COMPACTION OF SUBGRADE, EQUIPMENT

Compaction of subgrade and other parts of the contract will be considered as incidental to the construction and the expense therefor shall be included by the Contractor in other items of work unless the special provisions specify payment for compaction and the proposal includes items of compaction equipment.

Measurement and payment for such of the equipment as may be shown in the proposal will be by the hour for the following items as described in Section 15-2.01A:

1. "Variable Load Compactor," per hour.
2. "Grid Roller," per hour.
3. "Pneumatic-tired Roller," per hour.
4. "Smooth-wheeled Power Roller," per hour.
5. "Mechanical Tamper," per hour.
6. "Vibratory Compactor," per hour.

Section 40—Cement Concrete Curb, Curb and Gutter

40-1 DESCRIPTION

The construction of cement concrete curb, and curb and gutter shall be in conformance with these specifications and with the standard drawings. The particular type of curb used shall be that specified in the plans and proposal.

Section 40—Cement Concrete Curb, Curb and Gutter

40-2 MATERIALS AND FORMS

40-2.01 CONCRETE

The portland cement concrete, joint filler, reinforcing steel and curing materials shall conform to specifications in Section 37, Portland Cement Concrete—Materials. Concrete mix for curbs shall conform to the requirements for Class 5 (1½), but when doweled curb is constructed, Class 5 (¾) mix may be used. Slump of the concrete mix shall not exceed three and one-half (3½) inches.

40-2.02 REINFORCING STEEL AND STEEL DOWELS

See Section 111-2.01.

40-2.03 PREFORMED EXPANSION AND DUMMY JOINT FILLER

See Section 37-2.06.

40-2.04 CURING COMPOUNDS

See sections 37-2.08 and 37-2.09.

40-2.05 FORMS

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 plans.

Forms shall be adequately supported to prevent deflection or any movement so that the finished construction will conform in all ways with the plans and specifications. The top of the forms shall not deviate more than one-eighth (⅛) inch in ten (10) feet, and the alignment of forms shall be within one-fourth (¼) inch in 10 feet.

Forms may be removed on the day following pour if the concrete is sufficiently set that removal will be 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 be examined for defects before they are used again.

40-3 CONSTRUCTION DETAILS

40-3.01 CURBS

40-3.01A Erecting Forms

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 shall not be set until the subgrade has been compacted within one 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 one-eighth (⅛) inch when checked with a ten-foot straightedge. The alignment shall not vary more than one-fourth (¼) inch in ten (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.

40-3.01B Placing Concrete

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 the 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.

The concrete shall meet the strength requirements as set forth in Section 37-2.02C5.

40-3.01C Dowels and Keyways

Dowels and keyways shall be placed in the pavement slab as detailed on standard drawings.

Keyways shall be formed by forcing a pointed stick, two inches square, into the plastic concrete midway between each set of dowels. The dowel bars shall be set while the concrete is still plastic enough to not require hammering them into place.

In lieu of the straight dowel bar, three-eighths (⅜) inch dowel bar bent into the shape of a "U" may be used. Dimensions of this alternate dowel are shown on standard drawings. When this type of dowel is used, the keyway may be omitted.

40-3.01D Stripping Forms and Finishing

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 thereon.

Forms shall not be removed until the concrete has set sufficiently to retain its true shape. For Type A curb, 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.

40-3.01E Curing

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 four (4) hours after application.

When the curb section is to be placed separately, the surface of the gutter directly underneath the curb section shall be covered with a protective cover to protect that area from the curing agent when the gutter is sprayed. This cover must remain in place until the curb is placed. Care shall be taken in the placing of this cover to prevent the steel dowels from puncturing the cover.

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 39-3.20.

40-3.01F Expansion and Dummy Joints

Joints shall be constructed in the manner and at the locations shown on standard drawings. They shall be cleaned and edged as shown on the drawings and as further specified in Section 39. All expansion and contraction 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.

40-3.01G Curb Drains

Curb drains shall be placed to vent all existing drains. Additional curb drains shall be placed as directed by the Engineer.

Curb drains shall be three (3) inches in diameter and shall be formed with metal, plastic or other suitable tubular material approved by the Engineer. Curb drains that are required shall be considered as incidental to the construction and all costs thereof shall be included by the Contractor in his unit contract price for the curb.

40-3.01H Finished Work

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,

Section 41—Cement Concrete Driveway and Alley Return

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 ten (10) foot straightedge, grade shall not deviate more than one-eighth (⅛) inch, and alignment shall not vary more than one-fourth (¼) inch.

40-3.02 TYPE A AND TYPE B CURB

Types A and B curb may be constructed concurrently with the concrete pavement, or construction may be delayed until after the pavement slab has been placed and cured, unless otherwise noted in the special provisions. Dowels shall be placed as shown on standard drawing.

Types A or B curb, when placed separately, may be constructed with conventional forms as described herein, or by the extruded method if so provided for in the special provisions. If constructed by the extruded method, the curb shall conform in all respects to the requirements of Section 40-3.01H.

In transporting concrete over the new pavement slab to construct Type A or Type B curb, if ready-mix concrete trucks are used, the concrete shall have attained a compressive strength of 2,500 lbs. or a flexural strength of 500 psi using test specimens cured under the same conditions as the concrete pavement.

If concrete buggies are used, at least 48 hours shall have elapsed between the placing of the new pavement slab and the start of curb construction. Damage to the liquid curing membrane on the pavement surface resulting from the curb construction shall be repaired by spraying the damaged area with curing compound.

40-3.03 TYPE C AND TYPE D LOW CURB

Type C low curb shall be constructed at the time the concrete pavement is placed.

Where Type D low curb is used as a driveway crossing, and if the curb is to be constructed separately, then the concrete pavement or concrete gutter section shall be blocked out to provide for later installation of the curb. For details of construction see standard drawings.

40-3.04 TYPE E SEPARATE CURB

Type E curb may have the batter on the front or on the back side, whichever the Engineer may direct. See standard drawing for construction details. Excavation required shall be considered as incidental to the cost of the curb and no payment will be made therefore.

40-3.05 TRANSITIONAL CURB

Transitional curb shall be constructed monolithically with the pavement slab on which it is located. The curb shall be carefully shaped to blend in with existing or new construction. Dowels and keyways are not required.

40-3.06 CURB AND GUTTER

Curb and gutter shall be constructed on a compacted subgrade prepared in accordance with applicable subgrade specifications for cement concrete pavement in Section 39. The placing, consolidating, jointing, finishing and curing of the concrete shall comply with the requirements for concrete curb as specified in Section 40-3.01, 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. The curb and gutter may be extruded as a unit, or the curb may be extruded upon the gutter section in which case steel dowels and keyways shall be provided as specified in Section 40-3.01C.

40-4 MEASUREMENT AND PAYMENT

Measurement and payment will be made for such of the following bid items as may appear in the proposal:

1. "Cement Concrete Curb, Type" per linear foot.
2. "Cement Concrete Curb and Gutter, Type" per linear foot.
3. "Cement Concrete Transitional Curb," per linear foot.

4. "Extra for Furnishing High-early-strength Cement," per barrel.

Concrete curb and curb and gutter will be measured by the linear foot along the face of curb for the actual length constructed.

Curbs types A, B, C, D and the transitional curb do not include the pavement slab upon which they are placed. That portion of the pavement slab underneath the curb will be paid for as concrete pavement.

The unit contract prices for the above items shall be full compensation for furnishing all labor, materials, equipment, work, and incidentals necessary to construct the various types of curb, and curb and gutter in accordance with the requirements of the specifications. Excavation, select materials, and other work items will be paid for by applicable bid items in the proposal.

Section 41—Cement Concrete Driveway and Alley Return

41-1 DESCRIPTION

Cement concrete driveway and alley returns shall be constructed at the locations shown on the construction plans and where directed by the Engineer, and shall be in accordance with these specifications and standard drawings.

The number of private driveways may be increased over that shown on the construction plans, if required by the Engineer. Sufficient notice of the additional installations shall 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 plans and included in the proposal.

41-2 MATERIALS

The portland cement concrete, joint filler, reinforcing steel and curing materials shall conform to requirements outlined in Section 37, Portland Cement Concrete—Materials. The concrete mix shall be as specified for Class 5 (1½), or Class 5 (¾) and the slump of the concrete shall not exceed three and one-half (3½) inches.

41-3 CONSTRUCTION DETAILS

41-3.01 EXCAVATION AND SUBGRADE

Excavation for driveways and alley returns shall be considered incidental to the construction of the driveway, and no payment will be made the Contractor therefor.

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 13-3.10E3. Payment for excavation below grade and additional selected materials will be paid for under the unit contract prices for "common excavation" and "ballast," respectively.

Payment will not be allowed for excavation below grade nor for the additional backfill materials required to compensate for excavation below the required depth resulting from negligence of the Contractor.

Subgrade preparation for driveways and the required compaction shall conform to the applicable requirements in Section 15-2.02 to provide a firm, unyielding subgrade, acceptable to the Engineer.

41-3.02 FORMS AND FINE GRADING

Forms for the straight sections of the driveway or alley return shall have a minimum thickness of two (2) inches and be equal to the nominal depth of the concrete. Plywood or one (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 42—Cement Concrete Sidewalks

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.

41-3.03 PLACING AND FINISHING CEMENT CONCRETE DRIVEWAY

The concrete shall be spread uniformly between the forms and thoroughly compacted with an approved type of strikeboard. Through joints and dummy 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.

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 steel float. Joints shall be edged with one-fourth (1/4) inch radius edger and the driveway or alley return edges shall be tooled with one-half (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.

41-3.04 CURING AND PROTECTION

The curing materials and procedures defined in sections 37 and 39 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.

41-4 MEASUREMENT

Measurement for cement concrete driveway and for alley return will be made by the square yard for the class and thickness of concrete placed, and will be measured as shown on the standard plans.

Measurement for cement concrete transitional curb will be by the linear foot for curb constructed.

Measurement for cement concrete curb Type D will be by the linear foot, radius point to radius point through the driveway for curb constructed.

41-5 PAYMENT

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

1. "Cement Concrete Driveway (thickness, class)," per square yard.
2. "Cement Concrete Transitional Curb," per linear foot.
3. "Cement Concrete Curb Type D," per linear foot.

The unit contract prices shall be full compensation for all labor, tools, equipment and materials required to perform the work as specified. Any work which is essential to the construction but for which no bid item is included in the proposal shall be considered as incidental and the costs thereof shall be included in the pay items of the proposal.

Section 42—Cement Concrete Sidewalks

42-1 DESCRIPTION

Cement concrete sidewalks shall be constructed in compliance with these specifications and the standard drawings. The particular type of sidewalk to be used will be that specified in the plan and proposal.

42-2 MATERIALS

The portland cement concrete, joint filler, reinforcing steel and curing materials shall conform to the requirements specified in Section 37, Portland Cement Concrete—Materials. The concrete mix for sidewalk shall conform to the requirements for Class 5 (1 1/2) or Class 5 (3/4). Slump of the concrete mix shall not exceed three and one-half (3 1/2) inches.

42-3 CONSTRUCTION DETAILS

42-3.01 EXCAVATION AND SUBGRADE

Excavation for sidewalks shall be considered as "Unclassified Excavation," as described in Section 13-1.01, unless otherwise provided for in the special provisions. Where directed by the Engineer, unsuitable material in the subgrade shall be removed to a specific depth and then backfilled with selected materials. Payment will not be allowed for excavation below grade and for backfill materials required when such excavation is caused by negligence of the Contractor.

Embankments shall be compacted by Method B as specified in Section 13-3.10E3. Equipment used for the compaction of this embankment shall meet requirements described in Section 15-2.01A. 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 one (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 construction plans.

42-3.02 FORMS AND FINE GRADING

Forms shall conform to requirements outlined in Section 39. Wood forms shall be two (2) inches by four (4) inches and in lengths of not less than ten (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 three and five-eighths (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. No payment will be made for water and the work of placing and cost thereof shall be considered as incidental to the construction of the concrete sidewalk.

42-3.03 PLACING AND FINISHING CEMENT CONCRETE SIDEWALK

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 standard drawing. In construction of through joints, the premolded joint filler shall be adequately supported until the concrete is placed on both sides of the joint.

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 standard drawing.

After the concrete has been thoroughly compacted and leveled, it shall be floated with wood floats and finished at the proper time with a steel 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

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into panels by scoring one-fourth (1/4) inch deep in the manner shown on the standard drawing.

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.

Additional requirements for placing and finishing concrete in cold weather shall be as outlined in Section 39-3.21.

-3.03A Depressed Curb (Wheelchair Ramp)

At intersections where new cement concrete curbs are to be constructed, the Contractor shall construct depressed curbs. The depressed curbs shall be constructed in accordance with the standard drawings and as directed by the Engineer.

42-3.04 CURING AND PROTECTION

The curing materials and procedures outlined in Section 39-3.20 shall prevail, except that white pigmented curing compound shall not be used on sidewalks. The curing agent shall be applied immediately after brushing and be maintained for a period of five (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 39-3.20H. Additional requirements for curing in cold weather shall be as outlined in Section 39-3.21.

42-4 MEASUREMENT

Measurement for cement concrete sidewalk will be by the square yard for all surface of concrete walk placed. Measurement for thickened edge of sidewalk will be by the linear foot for the distance thickened.

Measurement for depressed curb (wheelchair ramp) will include that portion of the curb necessary to make the transition from the standard curb and gutter to the depressed curb and gutter.

42-5 PAYMENT

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

1. "Cement Concrete Sidewalk Type A," per square yard.
2. "Cement Concrete Sidewalk Type B," per square yard.
3. "Type A Thickened Edge for Sidewalk," per linear foot.
4. "Extra for Furnishing High-early-strength Cement," per barrel.
5. "Depressed Concrete Curb and Gutter (wheelchair ramp)," per linear foot.
6. "Depressed Concrete Curb (wheelchair ramp)," per linear foot.

The unit contract prices shall be full compensation for all labor, tools, equipment and materials required to perform the work as specified. Any work which is essential to the construction but for which no bid item is included in the proposal shall be considered as incidental and the costs thereof shall be included in the pay items of the proposal.

Excavation, selected materials, water and compaction will be measured and paid for in accordance with applicable sections of the specifications only if they are set up among the items in the proposal; otherwise, the work and materials involved shall be considered as incidental to the sidewalk construction and the costs thereof shall be included in the bid items of the proposal.

Section 43—Cement Concrete Combined Sidewalk Curb and Gutter

43-1 DESCRIPTION

Cement concrete combined sidewalk, curb and gutter, and combined cement concrete curb and sidewalk shall be constructed in accordance with these specifications and the standard drawing. The type of construction to be used and the location will be as shown on the construction plans, or as directed by the Engineer, and shall be in accordance with the provisions of this section.

43-2 MATERIALS

Portland cement concrete, joint filler, reinforcing steel and curing materials shall conform to the requirements in Section 37, Portland Cement Concrete—Materials. The concrete mix shall conform to the requirements for Class 5 (1 1/2). Slump of the concrete mix shall not exceed three and one-half (3 1/2) inches.

43-3 CONSTRUCTION DETAILS

43-3.01 GENERAL

The curb and gutter section shall be placed prior to the placement of the sidewalk section unless otherwise directed by the Engineer. Basic construction shall conform to Section 42, "Cement Concrete Sidewalk," and Section 40, "Cement Concrete Curbs, Curb and Gutter."

43-3.02 EXCAVATION AND SUBGRADE

Excavation and subgrade shall be as defined in Section 42-3.01.

43-3.03 FORMS AND FINE GRADING

Forms and fine grading shall be as defined in sections 42-3.02 and 40-3.01A.

43-3.04 PLACING AND FINISHING CONCRETE

Placing and finishing concrete shall be as defined in sections 42-3.03 and 40-3.01B.

43-3.05 DOWELS AND KEYWAYS

Dowels and keyways, where called for in the special provisions or directed by the Engineer, shall be as defined in Section 40-3.01C and as shown on the standard drawing.

43-3.06 STRIPPING FORMS AND FINISHING

Stripping forms and finishing shall be as defined in Section 40-3.01D.

43-3.07 CURING AND PROTECTION

Curing shall be as defined in sections 42-3.04 and 40-3.01E.

43-4 MEASUREMENT

For purposes of measurement and payment, the "Cement Concrete Combined Sidewalk, Curb and Gutter" shall be considered as three component sections.

The first component, "cement concrete sidewalk," shall comprise that portion of the combined section beginning six (6) inches behind face of curb and shall be the actual square yards of sidewalk constructed.

The second component, "curb and gutter," shall comprise that portion of the combined section beginning at back of curb and through the gutter section, and shall be the actual linear feet of curb and gutter constructed.

The third component, "thickened edge," shall comprise the triangular portion of the combined section

Section 44—Precast Concrete Traffic Curb, Plastic Traffic Buttons and Extruded Traffic Curb

below the bottom of sidewalk and butting the back of the curb and gutter section. The thickened edge shall be actual length in linear feet of thickened edge constructed.

Measurement for combined cement concrete curb and sidewalk shall be made as shown on the standard drawing.

43-5 PAYMENT

Payment will be made for such of the following bid items as are included in any particular contract:

1. "Cement Concrete Sidewalk Type A," per square yard.
2. "Cement Concrete Sidewalk Type B," per square yard.
3. "Cement Concrete Curb and Gutter Type A," per linear foot.
4. "Cement Concrete Curb and Gutter Type B," per linear foot.
5. "Type A Thickened Edge for Sidewalk," per linear foot.
6. "Extra for Furnishing High-early-strength Cement," per barrel.

The unit contract prices for the above items shall be full compensation for all labor, materials and equipment and incidentals in the construction of them in accordance with specifications and standard drawing.

Excavation, selected materials, water and compaction will be measured and paid for in accordance with specifications in applicable sections only when they are included in the bid proposal; otherwise, the work and materials involved shall be considered as incidental to the construction and all costs thereof shall be included in bid items of the proposal.

Section 44—Precast Concrete Traffic Curb, Plastic Traffic Buttons and Extruded Traffic Curb

44-1 DESCRIPTION

Precast concrete traffic curb, plastic traffic buttons, and extruded traffic curb shall be constructed in accordance with the design standards, or as shown on the plans and shall be placed in locations shown on the plans, or as directed by the Engineer.

44-2 MATERIALS

44-2.01 PRECAST CONCRETE TRAFFIC CURB

The cement, fine and coarse aggregates, and reinforcing steel shall conform to the following requirements:

The cement shall conform to the requirements for either Type I or Type III of the standard specifications for Portland Cement, AASHO Designation M 85.

The aggregate shall be a granular material uniformly graded up to a maximum size of 3/8 inch and shall contain sufficient fine fractions to permit securing the type of surface finish specified herein. The aggregate shall be approved by a materials laboratory or by the Engineer before it is used.

Reinforcing steel shall conform to the requirements of Section 37-2.04.

44-2.02 PLASTIC COVERED TRAFFIC BUTTONS

Plastic traffic button size and shape shall conform to the details shown on the Standard Drawing No. 27.

-2.02A Traffic Buttons—Type 125A and 125B

-2.02A1 Description

Plastic traffic buttons shall be white in color, essentially in the form of a single-based modified spherical segment (with shoulder). They shall be composed of thermosetting resins, pigments and clean, fine gravel and

white sand, and shall be of uniform composition throughout.

-2.02A2 Physical Properties

The exposed surface shall be free of irregularities such as chips, cracks, and mold marks interfering with appearance or application. The bottom surface may have molded patterns, but must not show general convexity or concavity in excess of one-quarter (1/4) inch.

The molding process shall be such that coarse aggregate particles on the curved surface are covered by not less than one-sixteenth (1/16) inch of pigmented material. The buttons shall meet the following requirements:

Weight - Pounds.....Type 125A.....9.0 maximum
Type 125B.....4.0 maximum

Brightness.....70% minimum
Flexural strength - pounds total load.....1,500 minimum

Brightness will be measured with equipment conforming to ASTM Designation E97 using a Brightness Standard of seventy-five percent (75%).
Flexural strength will be measured by placing the button base down on two (2) three-quarter (3/4) inch round supports on five (5) inch centers and loading vertically at the center of the curved section by means of a flat plate.

-2.02B Traffic Buttons—Type 125C (Lane Markers)

-2.02B1 Description

The markers shall be precast, plastic markers in the form of a single-based spheroidal segment, composed of thermosetting resins, pigments, and inerts and shall be of uniform composition throughout. The markers shall not contain glass.

-2.02B2 Physical Properties

The markers shall be of uniform composition and free from surface irregularities, cracks, checks, chipping and other physical damage interfering with appearance or application and shall conform to the detail shown on the standard drawing.

The markers shall meet the following requirements:

Property:
Weight.....ounces.....4.14 minimum
Planeness of base:
Concavity.....inches.....0.02 maximum
Concavity.....inches.....0.05 maximum
Brightness.....80% minimum
Color.....White
Impact Resistance.....inches.....15 minimum
Titanium dioxide.....% by weight.....21 minimum
Resin content.....% by weight.....20 minimum

-2.02B3 Test Methods

Brightness will be measured with equipment conforming to ASTM Designation E97 using a Brightness Standard of seventy-five percent (75%).

Impact resistance will be measured by allowing a one (1) pound steel ball to fall fifteen (15) inches (free fall) onto the marker, supported by but not bonded to a steel base plate.

The titanium dioxide content will be determined by ashing representative portions of the marker, treating the ash with a boiling (NH₄) SO₄H₂SO₄ solution, filtering, and measuring the absorbance of the filtrate at about 410 micromicrons. This method is calibrated with known samples using ASTM Designation D 921.

Resin content will be determined by ashing and igniting representative portions of the marker.

Additional information on the test method is available from the Materials Laboratory.

-2.02B4 Adhesive (Epoxy)

-2.02B4(1) Description

The adhesive shall be furnished as two (2) components, each packaged separately. The components shall have the following composition:

Parts by Weight	
Package A	
Epoxy Resin (1)	100.00
Titanium Dioxide (2)	7.31
Resin Grade Asbestos (3)	5.00
Talc (4)	37.64

Section 44—Precast Concrete Traffic Curb, Plastic Traffic Buttons and Extruded Traffic Curb

Package B	
N-Aminoethyl Piperazine (5)	23.16
Nonylphenol (6)	52.00
Carbon Black (7)	0.22
Talc (4)	77.37
Resin Grade Asbestos (3)	1.00

At the time of use the contents of Packages A and B shall be thoroughly redispersed by mixing. One (1) volume or weight of Package A shall be mixed with one (1) 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.

-2.02B4(2) Raw Materials

Raw materials for the adhesive shall meet the following specifications:

1. Epoxy Resin—Viscosity, 5-7 poises at 25° C.; epoxide equivalent 175-205; color (Gardiner) 5 maximum; manufactured from epichlorohydrin and bisphenol A. The reactive diluent shall be butyl glycidyl ether.
2. Titanium Dioxide—TT-P-00442, Type IV.
3. Resin grade Asbestos—Specific gravity, grams per milliliter 2.45; moisture content, % by weight, 2.0 maximum; surface area, square meters per gram—60 approximately; reflectance, G.E. brightness, 72-76; nature of surface charge, electro-positive (cationic); pH in water, 9.5; bulking value, gallons per 100 pounds, 4.3; oil absorption (DOP) pounds per 100 pounds, 120; refractive index n_D 25° C., 1.54—1.56; wet bulk density in water, after dispersion, 2 grams per liter, settling 1 hour, 100 ml clean maximum; dry bulk density, pounds per cubic foot, 4.
4. Talc—Percent passing U.S. No. 325 sieve, 94-96; maximum particle size, 70 microns; oil absorption (Gardiner-Coleman), 6-7 ml per 20 grams; fineness in oil (Hegman) 1-2; specific surface, 0.5-0.6 square meter per gram; consistency (40% suspension in linseed oil), 55-60 K.U.
5. N-Aminoethyl Piperazine—color (APHA) 50 maximum; amine value, 1250-1350 based on titration which reacts with 3 nitrogens in the molecule; appearance, clear and substantially free of suspended matter.
6. Nonyl Phenol—Color (APHA) 50 maximum; hydroxyl number, 245-255; distillation range, °C. at 760 mm, first drop 295 minimum, 5% 298 minimum, 95% 325 maximum; water, % (K.F.) 0.05 maximum.
7. Carbon Black—TT-P-343, Form 1, Class B.

-2.02B4(3) Physical Requirements of Mixed Adhesive

Mixed adhesive shall meet the following requirements: A blend of one (1) part of Component A and one (1) part of Component B shall exhibit the following properties:

Gel Time (100 gm Batch)	5-30 Minutes
Tensile strength (1/16 in film between steel blocks cured 24 hours at 70°)	
Tested at 70°F	1,000 psi (Minimum)
Shore D Hardness.....(Cured 24 hours at 70°F)	
Tested at 70°F	70-80
Tested at 120°F	(Minimum) 30
Deformation Temp.....(Minimum)	120°F

-2.02B4(4) Acceptance

The manufacturer shall certify that each batch of adhesive conforms to these specifications.

The lot or batch number shall appear on the certificates, on all samples, and on all lots of adhesives delivered. A one (1) pint sample of the A and B components shall be sent to the Materials Laboratory by the supplier no less than ten (10) days before using.

44-2.03 EXTRUDED TRAFFIC CURB

Extruded traffic curb shall be constructed with a cement concrete mix that will have a dense, uniform texture which will not sag or displace behind the machine.

The concrete mix shall be proportioned as follows:

Sacks of cement per cubic yard	6.5
Pounds of dry fine aggregate per sack of cement	245

Pounds of dry 3/4" maximum coarse aggregate per sack of cement..... 238
Slump (ASTM Designation C 143).....Not over one inch
The 3/4" maximum coarse aggregate shall meet all requirements of Section 39 except that it shall meet the following requirements for grading:

Passing 1" square screen	100%
Passing 3/4" square screen	95-100%
Passing 3/8" square screen	20-40%
Passing U. S. No. 4 sieve	0-3%

The Contractor will be allowed to use a different concrete mix if approved by the Engineer, provided that it develops not less than 4,000 pounds per square inch compressive strength at 28 days. It is the intent of these specifications to provide a concrete mix having such characteristics of mobility and workability that it can be extruded without slumping, deforming or displacing. The finished curb shall have a dense, smooth and uniform surface texture and shall develop a minimum of shrinkage cracks upon curing.

44-3 CONSTRUCTION DETAILS

44-3.01 PRECAST CONCRETE TRAFFIC CURB

-3.01A Manufacture

-3.01A1 Proportioning

The cement concrete mix shall be composed of not less than one (1) part portland cement to approximately two (2) parts of sand and three and one-fourth (3 1/4) parts of coarse aggregate (1:2:3 1/4). The ratio of fine and coarse aggregates may be adjusted to secure proper workability.

The Contractor may use a different concrete mix if approved by the Engineer, provided it develops not less than 4,000 pounds per square inch compressive strength when tested at the age of 28 days.

-3.01A2 Mixing

The mixers shall be kept in good repair and be equipped with an automatic timing device and a positive device for regulating the quantity of water added to each batch. Such device must be approved by the Engineer before use.

After all materials, including water, have been placed in the mixer, the materials shall be mixed for a period of not less than 1 1/2 minutes, or as much longer as may be necessary to produce a thorough and uniform mixture of the concrete. No water shall be added to any batch after the completion of the initial mixing period. Each batch of concrete shall be completely emptied from the mixer before placing more materials in it. A batch which has not been placed within 30 minutes from the time water was first added, shall not be used.

The amount of water in the concrete shall be kept at a minimum consistent with the manufacture of dense curb, free from air bubbles and surface defects in excess of the tolerance limits herein specified.

-3.01A3 Forms

Forms shall be of concrete or steel. The use of forms or molds made of plaster of paris, wood, or other absorptive material will not be permitted.

Bulkheads shall be tight fitting so that there is no leakage of mortar between the bulkhead and form.

The materials and methods used for lubricating the forms shall be such as will not result in discoloration of the curb at any time. A minimum quantity of lubricant shall be used and all excess shall be removed.

-3.01A4 Placing Concrete

The concrete shall be consolidated by external vibration, or by other means if approved by the Engineer, so as to produce a dense concrete throughout having a minimum of air bubbles and honey-combing.

Reinforcing steel shall be placed and maintained in its proper position as shown in the standard drawing.

Curbs shall not be manufactured in an atmospheric temperature of less than 50° Fahr.

Section 44—Precast Concrete Traffic Curb, Plastic Traffic Buttons and Extruded Traffic Curb

-3.01A5 Removal of Forms

The curb shall be removed from the molds or forms in accordance with the instructions pertaining thereto, or by some other method acceptable to the Engineer. Failure to remove the curb from the molds in accordance with the instructions issued by the Engineer, or removal by any method which, in the opinion of the Engineer, is detrimental to the curb will be cause for rejection of the curb.

The loosening of the curb from the molds shall be carefully performed to avoid excessive shock and straining of the curb. When, in the opinion of the Engineer, undue shock is required to remove the curb from the molds, the stripping operation shall be deferred until such time as the curb may be removed without breakage.

-3.01A6 Curing Concrete

Immediately after the concrete has been placed and consolidated in the mold each unit shall be placed in a curing room fitted with water sprays and maintained at a relative humidity of not less than 90% and a temperature of not less than 60 degrees Fahr., nor more than 100 degrees Fahr. Each unit shall remain in the curing room for a period of not less than ten (10) days except that if high-early-strength cement is used the period in the curing room may be reduced to five (5) days.

-3.01A7 Finish

Curb shall have a smooth, glassy finish on all exposed surfaces.

Excess honey-combing in the back of the curb may be cause for rejection of the curb. Honey-combing areas in the back of the curb which, in the opinion of the Engineer, are not detrimental to the curb need not be patched. The workmanship of the bottom finish shall be such that no mechanical interlocking of the mortar bed and the curb bottom or anchor groove will occur.

-3.01A8 Surface Treatment

As soon as the units have been taken out of the curing room the curb shall be placed in a drying room and thoroughly surface dried to a depth of at least one-fourth (1/4) inch, and then one coat of an approved water-repellent compound shall be flowed on with a brush.

When the first coat has dried, a second coat of water-repellent compound shall be applied. The water-repellent compound shall be approved by a materials laboratory, or by the Engineer before it is used.

The water-repellent compound shall be a clear, penetrating type silicone resin base compound containing no filler or other material which will leave a film on the surface of the masonry after it is applied. It shall be of such consistency that it can be readily applied by brush or spray to the masonry at atmospheric temperature down to -20° Fahr.

The average absorption of three test specimens treated with the water-repellent compound, when tested in accordance with the methods used in the materials laboratory, shall not exceed two percent (2%) after being partially immersed in water for 72 hours immediately after curing.

The average moisture vapor transpiration (breathing) of three test specimens, when tested in accordance with the methods used in the materials laboratory, shall not be less than 50% at seven days.

-3.01A9 Dimensions and Shape

The curb shall be manufactured according to the dimension and shape shown on the standard drawing within a tolerance of 1/4" in length and 1/8" in alignment.

-3.01A10 Curb Lengths

The curb shall be made and laid in pieces not less than five (5) feet nor greater than nine (9) feet in length, except in special instances where shorter lengths are required. However, no curb piece less than four (4) feet in length shall be laid without the approval of the Engineer. Circular curbing shall be made only for such radii as called for on detail plans. For radii from 100 feet to 600 feet the curb shall be in straight pieces with beveled ends as shown on plans, the length of which

shall vary between four and eight feet, as required. For any radius greater than 600 feet the curb pieces shall be straight and the ends shall be square.

-3.01A11 Defective Curb

Not more than two (2) percent of the top area in any one piece of curb shall be defective and not more than five (5) percent of the total length of the top corners of reflecting faces in any one piece of curb shall be broken or rounded. There shall be not more than 30 air holes in any linear foot of curb nor more than 50 in any three (3) linear feet of curb. All curb having defects in excess of any of the above will be rejected immediately upon inspection after removal from the forms. However, failure to reject the curb at that time will not assure its final acceptance. Ninety (90) percent of the curb laid shall have not more than ten (10) percent of the maximum allowable number of defects specified above.

An air hole shall be defined as any hole 1/2 inch or larger in diameter or depth.

All defects within the limits herein permitted, apparent upon removal of forms, shall be repaired immediately thereafter.

The sum of the lengths of the lines of discoloration caused by a cracked mold in any one piece of curb shall not exceed fifty (50) percent of the length of the curb, and the maximum length of any single line of discoloration shall not exceed eighteen (18) inches. Seventy-five (75) percent of the curb laid shall be entirely free from lines of discoloration. The employment of means involving the use of heat to obliterate lines of discoloration will not be permitted. Any means utilized to obliterate lines of discoloration shall be subject to the approval of the Engineer.

The repairing of molds which are chipped or broken shall be done in such a manner that the broken or chipped areas will not be apparent on the curb made in these molds.

All curb in which surface checking develops during the first five (5) days after manufacture will be rejected.

Hidden air holes at or immediately below the exposed surface of the curb, in excess of the limits specified herein, which are disclosed by testing the surface by means of a rubber hammer will be cause for rejection of the curb.

All curb in which cracking is in evidence immediately after removal from the molds will be rejected. A crack is defined as any separation of the concrete of a continuous length greater than three (3) inches.

All curb which varies in dimensions, alignment, or surface contour in excess of the tolerance specified herein will be rejected.

Not more than one (1) square inch of gray concrete shall be apparent in any one location in the exposed surface of the curb and the total area of the gray concrete showing through shall not exceed four (4) square inches for any piece of curb. Not more than 16 square inches of the exposed surface of any piece of curb shall be discolored by reason of the gray concrete mixing with the white concrete. At least 75 percent of the curb pieces laid shall be entirely free from discoloration.

Failure to comply with the plans, specifications or instructions of the authorized representative of the Owner in the manufacture and laying of any curb will be cause for rejection of such curb.

-3.01A12 Repairing Curb

Curb having defects which are not sufficient cause for its rejection shall be neatly repaired immediately after removal from the molds, in a manner subject to the approval of the Engineer. However, no patching or other repairs shall be made without the permission of the inspector. Patches shall be undercut if, in the opinion of the inspector, this operation is necessary to cause the patch to remain.

All holes larger than one-sixteenth (1/16) inch diameter in the exposed surface of acceptable curb shall be filled with cement mortar.

-3.01A13 Identification Marking

The date of manufacture, the length and the identification number corresponding to the detail layout shall be stenciled in black paint on the back or end of each piece of curb.

Section 44—Precast Concrete Traffic Curb, Plastic Traffic Buttons and Extruded Traffic Curb

Rejected curb shall be marked on the back or end surfaces in a practicable and semi-permanent manner to identify each cause of rejection.

-3.01A14 Shipping

No unit of curb shall be shipped from the manufacturing plant prior to 21 days after manufacture, excepting however, that if Type III cement has been used the units may be shipped 14 days after manufacture.

-3.01A15 Samples

The Contractor shall submit, for the approval of the Engineer, an advance sample of curb which shall be at least equivalent in color, surface texture, and bottom finish to the standard as set forth in these specifications. No repairing of any kind shall be done to the advance sample. Upon approval, the advance sample shall be stored at the plant or site of manufacture in a location readily accessible to the inspector where there is adequate daylight for examination. The advance sample shall be protected from damage and discoloration, and shall be used as a standard of comparison for color, surface texture, and bottom finish for all curb manufactured. All curb furnished for this contract shall be at least equivalent thereto in the foregoing respects.

-3.01A16 Inspection at Plant

The inspection at the plant will be made just prior to shipment, at which time examination will be made of the alignment, contour, color, cracks, surface damage or discoloration, broken corners or edges, and any other defects which may have developed, and to check with the laboratory test reports for strength. Intermediate inspections, however, may be made to determine surface checking and hidden air holes if it is impractical to examine for these defects at the final inspection.

-3.01B Installation of Curbs

-3.01B1 Nosings

Where curb nosings are to be placed on asphalt pavement the Contractor will be required to construct a recess two (2) inches deep and six (6) inches in width, continuous under each nose piece only. No recess will be required except under nose pieces.

-3.01B2 Joints

Except where expansion joints are to be placed as designated by the Engineer, all joints between adjacent pieces of curb shall be filled with mortar composed of one part portland cement and two parts sand.

The joints between adjacent units of block traffic curb will not require mortaring.

-3.01B3 Bedding

The curb shall be firmly bedded for its entire length and breadth on a mortar bed composed of one (1) part portland cement and two (2) parts of concrete sand. The anchor grooves in the bottom of the curb shall be entirely filled with the mortar.

-3.01B4 Alignment

The alignment and the top surface of adjoining sections of curb shall be true and even within a maximum tolerance of one-sixteenth (1/16) inch.

-3.01B5 Cleaning Pavement

Before the cement mortar bed is laid, all dirt shall be cleaned from the pavement surface by washing.

All old pavements and any portion of new pavements constructed under this contract, which are covered with oil or grease within the curb limits, shall be further cleaned as follows:

1. The concrete shall be flushed with water.
2. While the concrete is still wet, sodium metasilicate, complying with the requirements as specified elsewhere herein shall be evenly distributed over the pavement surface at a rate of 1 to 2 pounds per 100 square feet of pavement surface.
3. The sodium metasilicate shall remain on the pavement for at least 15 minutes. Where patches of oil, tar or grease occur these areas shall be scrubbed with a brush or broom.

4. The pavement surface shall be thoroughly rinsed.

-3.01B6 Sodium Metasilicate

Sodium metasilicate shall comply with ASTM Designation D 537.

-3.01B7 Layout Design

Before starting manufacture of curb for any project, the manufacturer shall make a complete detailed layout of each island and submit the same in duplicate to the Engineer for his approval. The Engineer will mark necessary corrections on the drawings and return one to the manufacturer. The manufacturer shall then make corrected layout drawings and furnish one copy to the Engineer and two copies to the Contractor.

-3.01C Installation of Buttons

-3.01C1 Type 125A and 125B

The plastic traffic buttons shall be attached to the pavement by placing a tack coat of hot 85-100 penetration asphalt on the pavement and firmly pressing the traffic button onto it.

-3.01C2 Type 125C (Lane Markers)

-3.01C2(1) Surface Preparation

All sand, dirt and loose extraneous material shall be swept or blown away from the marker location to the satisfaction of the Engineer.

-3.01C2(2) Marker Preparation

The resin-rich, waxy or greasy surface that characterizes the marker is not satisfactory as a bonding surface. A satisfactory bonding surface may be secured by: (1) Cleaning in a fluid heating bath, (2) sanding off the bottom of the marker, or (3) structurally bonding a layer of sand into the bottom surface during manufacture.

Markers, whose surfaces have not been prepared by structural bonding, must be preheated in a fluid cleaning bath controlled between 275° F. and 300° F. for not less than ten (10) minutes before setting.

Markers, whose surfaces have been prepared by sanding or structurally bonding, may be preheated in either the fluid heating bath or a dry oven controlled between 275° F. and 300° F. for not less than ten (10) minutes before setting.

-3.01C2(3) Adhesive Preparation

The adhesive shall be maintained at a temperature of 60°-85° F. before use and during application.

Catalyst shall be added to the base just before use and mixed to a smooth, uniform blend. Unused mixed adhesive shall be discarded when catalytic action has caused stiffening and reduction of workability or a small ball of gelled resin has formed in the center of the container.

-3.01C2(4) Application Procedure

The mixed adhesive shall be applied to the marker and the marker pressed onto the pavement so as to squeeze out a small bead of adhesive around the entire periphery of the marker. The required amount of adhesive per marker will normally be in the range of 20-40 grams. Lane markers shall be spaced and aligned as directed by the Engineer. A displacement of not more than one-half (1/2) inch, left or right of the established guide line will be permitted. The Contractor shall remove and replace at his own expense all improperly placed markers. The markers shall be installed on dry pavement.

Bonding of the marker shall take place in not more than fifteen (15) minutes. Bonding shall be considered satisfactory when adhesive develops a minimum bond strength in tension of not less than 800 grams. When roadway sections are opened to public traffic before or during the installation of the markers, the fifteen (15) minute set-to-traffic provision will be enforced, and necessary flagging and traffic control will be required. Provided such delay in installation is not caused by failure of the Contractor to perform, the Owner will provide flagging and traffic control at no cost to the Contractor.

44-3.02 EXTRUDED TRAFFIC CURB

Where the extruded curb is to be constructed, the existing pavement shall be swept clean of all drippings

Section 46—Illuminated Terminal Nosing

from cars, grease, dirt and any other matter found objectionable by the Engineer.

The curb shall be placed, shaped and compacted true to line and grade with an approved machine capable of shaping and thoroughly compacting the material to the required cross section as shown on the plans. Where the length of curb is more than 200 feet, drainage openings two (2) feet in width shall be provided at 200-foot intervals along the curb.

The extruded traffic curb shall be protected from traffic for a period of 48 hours by the use of sufficient portable barricades, and by lighted bombs or flashing light of a type approved by the Engineer, during the hours of darkness.

All additional costs required to hand form the curb at the terminals shall be included in the unit contract price per linear foot.

-3.02A Joints in Extruded Curb

Through joints shall be made at all points of tangents to returns, and not to exceed 15-foot intervals elsewhere. The through joints shall be made by hand sawing through the entire curb section so it will be clearly opened throughout while the concrete is yet in plastic state. The cut shall be neatly dressed. No filler will be required. The work of sawing and dressing joints shall be considered as incidental to the construction of the extruded traffic curb and all costs incurred shall be included in the unit contract price per linear foot of "Extruded Traffic Curb."

44-4 MEASUREMENT

Type A traffic curb (Standard Plan No. 25) will be measured along the front face of curbs and returns. Type C traffic curb (Standard Plan No. 25) will be measured along the axis of the curb. Nosing pieces and dividers will be measured as for Type A and Type C, respectively.

Plastic traffic buttons (Standard Plan No. 27) will be measured by "each".

Extruded cement concrete traffic curb as detailed on the plans will be measured by linear feet along the axis of the curb.

44-5 PAYMENT

Payment will be made for such of the following bid items as are included and shown in any particular contract:

1. "Precast Traffic Curb Type ()," per linear foot.
2. "Plastic Traffic Button Type ()," per each.
3. "Extruded Cement Concrete Traffic Curb," per linear foot.

The unit contract price for each of the above bid items shall be full compensation for all costs of labor, tools, and materials and for complete installation in accordance with the standard drawings and specifications.

Section 45—Block Precast Traffic Curb

45-1 DESCRIPTION

Block precast traffic curb shall be constructed at the location shown on the plans and in accordance with the details as shown on the standard drawing. In construction of the block precast traffic curb, the Contractor shall have the option of using either length of block shown in the standard drawing, provided the same length of block is used throughout the entire project.

45-2 MATERIALS

The curb units shall be made from portland cement and high quality sand and gravel, the proportions of which will be left to the discretion of the producer as long as the unit develops a minimum compressive strength of 4,000 psi at 28 days when tested for end loading.

45-3 CONSTRUCTION DETAILS

The proportions of sand, gravel and cement, the type of forms used, and the method of compacting the con-

crete in the forms shall all be such that a dense, smooth and uniform surface as is practicable for a concrete masonry unit will be obtained on the finished curb units. The faces that are to be exposed shall be free from chips, cracks, air holes, honeycomb or other imperfections except that if there be no more than five (5) percent of the curb units having slight cracks, small chips not larger than 1/2 inch, or air holes not more than 1/2 inch in diameter or depth, the imperfections will not be deemed grounds for rejection.

Special reflector blocks shall be installed at spacings noted in the block precast traffic curb detail shown in the standard drawing.

45-3.01 INSTALLATION

The curb shall be installed in accordance with Section 44-3.01B except that the joints between the adjacent units will not be filled with mortar.

After the curb is installed, it shall be covered with one full brush coat of water-repellent compound, meeting the requirements of Section 44-3.01A8. The surface of the curb shall be dry when the water-repellant compound is applied.

45-4 MEASUREMENT

Type A block type precast traffic curb (Standard Plan No. 26) will be measured by the linear foot along the front face of the curb and returns. Type C block type precast traffic curb (Standard Plan No. 26) will be measured by the linear foot along the axis of the curb. Precast nosing pieces and dividers (Standard Plan No. 25) will be measured as for Type A and Type C traffic curbs, respectively.

45-5 PAYMENT

1. "Type A Block Precast Traffic Curb," per linear foot.
2. "Type C Block Precast Traffic Curb," per linear foot.

The unit contract price for each of the above items shall be full compensation for all costs of labor, tools and materials and for complete installation in accordance with the standard drawings and specifications.

Section 46—Illuminated Terminal Nosing

46-1 DESCRIPTION

The work to be performed consists of furnishing and installing all necessary materials to complete in place the illuminated terminal nosing as shown on the plans and as specified in the standard drawings and specifications.

Included in the work is the furnishing and placing of the terminal nose castings, lamp box, conduit, pull boxes or junction boxes, as specified herein, in the special provisions, or as shown on the plans.

Unless otherwise noted, the location of the illuminated terminal nosings, pull boxes or junction boxes and conduit shown on the plans are approximate and the exact location will be established by the Engineer in the field.

46-1.01 REGULATIONS AND CODE

All electrical equipment shall conform to the standards of the National Electrical Manufacturers Association (NEMA) or the Radio Manufacturers Association, whichever is applicable. In addition to the requirements of these specifications, the plans and the special provisions, all material and work shall conform to the requirements of the National Electrical Code, hereinafter referred to as the Code; the Rules for Electrical Construction and Installing Electric Wires and Equipment, of the Department of Labor and Industries, State of Washington; the American Society for Testing Materials (ASTM); the United States of America Standards Institute (USASI), and any local ordinance which may apply.

Wherever reference is made in these specifications or in the special provisions to the Code, the rules or the standards mentioned above, the reference shall be construed to mean the code, rule or standard that is in effect at the date of advertising of these specifications.

Section 46—Illuminated Terminal Nosing

Attention is directed to the provisions of Section 7.10, Permits and Licenses, of these specifications.

-1.02 INDUSTRY CODES AND STANDARDS

The following electrical industry codes and standard procedures are listed for reference purposes:

National Electrical Manufacturers' Association (NEAMA), 155 East 44th Street, New York 17, New York.

National Board of Fire Underwriters—National Electrical Code (NEC), 85 John Street, New York 7, New York.

Underwriters' Laboratories (UL), 207 East Ohio Street, Chicago 11, Illinois.

Institute of Traffic Engineers (ITE), 2029 K Street, Washington 6, D. C.

Edison Electric Institute (EEI), 420 Lexington Avenue, New York 17, New York.

Insulated Power Cable Engineers' Association (IPCEA) 283 Valley Road, Montclair, New Jersey.

American Society for Testing Materials (ASTM), 1916 Race Street, Philadelphia, 3, Pennsylvania.

United States of America Standards Institute (USASI), 70 East 45th Street, New York 17, New York.

American Wood Preservers' Association (AWPA), 839 Seventeenth Street, Washington 6, D. C.

46-2 MATERIALS

46-2.01 GENERAL

Unless otherwise indicated on the plans or specified in the special provisions, all materials shall be new.

Where existing systems are to be modified, the existing material shall be incorporated in the revised system, salvaged, or abandoned as specified in the special provisions, or as ordered by the Engineer.

46-2.02 INSPECTION

All material shall be subject to inspection after delivery to the site and during installation in the work. Failure of the Engineer to note faulty material during construction shall not relieve the Contractor of the responsibility for removing or replacing any such material at his own expense.

Inspection or sampling of certain materials may be made at the factory or warehouse prior to delivery to the site, when required by the Engineer.

Material which has been rejected previous to delivery shall not be delivered to the work, and all material which has been rejected at the work shall be immediately removed from the site.

46-2.03 TERMINAL NOSE CASTING

The casting shall be malleable iron casting, ASTM Designation A 47 or steel casting, ASTM Designation A 27, Grade 60-30.

The lamp box and cover shall be No. 16 gage galvanized sheet metal, or aluminum sheeting of equivalent thickness.

The terminal nose casting together with the lamp box and fittings shall be made in accordance with the detail plans or standard drawings.

46-2.04 CONDUIT

-2.04A Conduit, Rigid Steel Hot-Dip Galvanized

Rigid steel conduit shall be zinc-coated by the hot-dip galvanizing process and shall meet the requirements of ANS C80.1 and Underwriters' Laboratories Standard UL6. This specification also covers couplings, elbows, bends and nipples.

Zinc Coating. The minimum average thickness of the zinc coating shall be 1.72 mils, equivalent to one (1) ounce per square foot of surface area. The minimum thickness of any point on the surface shall be 1.38 mils, equivalent to 0.8-ounce per square foot of surface area.

The minimum average thickness may be determined by magnetic thickness gauge or by the acid stripping method of ASTM A90. The minimum thickness at any point on the surface shall be determined only by magnetic thickness gauge.

Inspection and Test. Conduit, couplings, elbows, bends and nipples are subject to inspection and test upon receipt in accordance with the referenced specifications.

The Preece Test will not be considered as proof of compliance with this specification.

Rejection and Replacement. Failure to meet the requirements of this specification shall, at the discretion of the Owner, constitute grounds for rejection of:

- A The lot as received in whole or part, or
- B Future bids to supply the product of the manufacturer, or
- C Both A and B.

The supplier shall at his own expense replace any rejected conduit or fittings with an equal amount complying with this specification.

Reference Specifications: ANS C80.1; ASTM A90; UL6, latest revisions.

Approved Manufacturers: Armo, Clifton, Knight, Republic, Rome, Steelduct, Western, Wheatland, Youngstown.

-2.04B Conduit, Rigid Polyvinyl Chloride

This specification covers Rigid Unplasticized Polyvinyl Chloride Conduit, Schedule 40, for applications such as direct burial, encasement in concrete, pole risers and corrosive exposures.

Conduit in this specification shall comply with ASTM D-1785, latest revision.

Lengths—Polyvinyl chloride conduit shall be furnished in 10 foot lengths, except where 20 foot lengths are expressly ordered. The color shall be white or dark grey.

Polyvinyl chloride conduit shall be furnished unthreaded. One cementable coupling shall be furnished with each length. The conduit shall be packed in such a manner as to prevent damage in ordinary handling and transportation. Each package shall be marked with the gross and net weights and name and address of the manufacturer. The conduit may be subject to inspection and tests as indicated in CS207.

The supplier shall at his own expense replace any rejected conduit.

-2.04C Conduit, Aluminum Rigid Metallic

This specification covers the ordering, purchase and acceptance of Aluminum Rigid Metallic Conduit and associated elbows, nipples, bends, and couplings as electrical raceway.

Applicable specifications are Underwriters' Laboratories, Inc. Standard for Rigid Metallic Conduit UL8 latest revision and ASTM Tentative Specification for Aluminum-Alloy Extruded Tubes B-235, latest revision.

The material shall be Aluminum-Alloy extruded tube of 6063 alloy with a T42 temper in accordance with ASTM B-235.

Trade size and dimensions of threaded conduit, elbows, bends, and couplings shall be in accordance with Underwriters' Laboratories, Inc. UL 6.

Identification and UL label shall be in accordance with Underwriters' Laboratories, Inc. UL 6.

The threaded end, other than the end to which the coupling is attached, shall be protected by a suitable cover.

Packing, marking, and shipping shall be in accordance with Section 16 of ASTM B-235.

Conduit, elbows, bends, and couplings may be subject to inspection and test as outlined in Section 17 of ASTM B-235.

Conduit, elbows, bends and couplings shall be inspected in accordance with the provisions of Underwriters' Laboratories, Inc. UL 6.

The supplier shall at his own expense replace any rejected conduit.

46-2.05 PULL BOXES, JUNCTION BOXES

Metallic pull boxes may be cast iron or welded 3/16 inch thick or cast aluminum of the sizes noted on the plans. Boxes used shall not be of dissimilar metal to the conduit used in any given electrical system. Boxes shall be watertight with lids securely gasketed to exclude water. Boxes installed underground shall have screened drains installed as detailed on the plans. Cast iron or steel boxes shall be hot-dipped galvanized conforming to the applicable portions of ASTM Designation A 153.

Section 46—Illuminated Terminal Nosing

Where indicated on the plans, concrete pull boxes shall be used and shall be constructed as detailed on the standard drawings. Where concrete pull boxes or junction boxes are to be placed in areas subject to traffic load, a steel or cast iron cover of approved design to withstand such loads shall be used. Such pull boxes or junction boxes shall be installed on a suitable concrete footing to withstand traffic loads. Covers shall be inscribed as specified on the plans.

46-3 CONSTRUCTION DETAILS

46-3.01 GENERAL

All electrical construction shall be carried out by competent crews under the direction of able foremen of the Contractor, or by the manufacturer's representatives where so required in the special provisions. All workmanship shall be complete and in accordance with the latest accepted standards of the industry, as determined by the Engineer, and the special provisions.

Failure of the Engineer to note faulty workmanship during construction shall not relieve the Contractor of the responsibility for correcting the faults at his own expense.

46-3.02 EXCAVATING AND BACKFILLING

The excavations required for the installation of conduit, foundations, poles and other appliances shall be performed in such a manner as to cause the least possible injury to the streets, sidewalks, and other improvements. The trenches shall not be excavated wider than necessary for the proper installation of the electrical appliances and foundations. Excavating shall not be performed until immediately before installation of conduit and other appliances. The material from the excavation shall be placed in a position where the least damage and obstruction to vehicular and pedestrian traffic, and the least interference with the surface drainage will occur.

All surplus excavated material shall be removed and disposed of by the Contractor in accordance with Section 13, or as directed by the Engineer.

The excavations shall be backfilled in conformance with applicable requirements of Section 17.

Excavations after backfilling shall be kept well filled and maintained in a smooth and well drained condition until permanent repairs are made.

At the end of each day's work and at all other times when construction operations are suspended, all equipment and other obstructions shall be removed from that portion of the roadway open for use by public traffic.

Excavations in the street or highway shall be performed in such a manner that not more than one traffic lane is restricted in either direction at any time.

46-3.03 REMOVING AND REPLACING IMPROVEMENTS

Improvements such as sidewalks, curbs, gutters, portland cement concrete and asphalt concrete pavement, bituminous surfacing, base material, and any other improvements removed, broken or damaged by the Contractor, shall be replaced or reconstructed with the same kind of materials as found on the work, or with materials of equal quality. The new work shall be left in a serviceable condition satisfactory to the Engineer.

Whenever a part of a square or slab of existing concrete sidewalk or driveway is broken or damaged, the entire square or slab shall be removed and the concrete reconstructed as above specified.

The outline of all areas to be removed in portland cement concrete sidewalks and pavements shall be cut to a minimum depth of 1½ inches with a saw, prior to removing the sidewalk and pavement material. Cut for remainder of the required depth may be made by a method satisfactory to the Engineer. Cuts shall be neat and true with no shatter outside the removal area.

46-3.04 CONDUIT

Installation of conduit shall conform to appropriate articles of the Code, and these specifications.

The size of conduit used shall be as shown on the plans. Conduits smaller than one-inch electrical trade size shall not be used, unless otherwise specified, except

that grounding conductors at service points may be enclosed in ½-inch diameter conduit.

Conduit installed under the travelled way, including auxiliary lanes, shall be a minimum of one and one-fourth (1¼) inch diameter. No smaller size diameter shall be used except by written permission of the Engineer.

It shall be the option of the Contractor, at his own expense, to use larger size conduit if desired, and where larger size conduit is used, it shall be for the entire length of the run from outlet to outlet. No reducing couplings will be permitted. Plastic conduit to rigid steel conduit connections shall be made with a plastic female adapter.

The ends of all steel conduits shall be well reamed to remove burrs and rough edges. Field cuts shall be made square and true so that the ends will butt or come together for the full circumference thereof. Slip joints or running threads will not be permitted for coupling conduit. When a standard coupling cannot be used, an approved threaded union coupling shall be used.

The threads on all conduit shall be well painted with a good quality of lead or rust preventative paint before couplings are made up. All couplings shall be screwed up until the end of the conduits are brought together, so that a good electrical connection will be made throughout the entire length of the conduit run. Where coating on conduit has been injured in handling or installing, such injured places shall be thoroughly painted with rust preventative paint.

All conduit ends shall be threaded and capped with standard pipe caps until wiring is started. When caps are removed, the threaded ends shall be provided with approved conduit bushings. The use of any plugs, even though temporary, in lieu of the aforementioned pipe caps is expressly prohibited. Plastic conduit shall be capped with an appropriate plastic cap.

Conduit stubs from bases shall extend at least six inches from face of foundation and at least 18 inches below top of foundation.

Steel conduit stubs, caps, and exposed threads shall be painted with rust preventative paint.

Conduit bends, except factory bends, shall have a radius of not less than six times the inside diameter of the conduit. Where factory bends are not used, conduit shall be bent without crimping or flattening, using the longest radius practicable.

Conduit shall be laid to a depth of not less than 18 inches below the curb grade in the sidewalk areas and to a depth of not less than 18 inches below the finished grade in all other areas, except that conduit may be laid on top of and secured to the existing pavement in curbed dividing strips. Conduit under railroad tracks shall be not less than 24 inches below bottom of tie.

Conduit shall be placed under existing pavement by approved jacking or boring methods. Pavement shall not be disturbed without the approval of the Engineer. Upon approval of the Engineer, small test holes may be cut in the pavement to locate obstructions. If the depth of the conduit below the surface of the street is within one (1) foot of the outside perimeter of the existing facilities, the facilities shall be uncovered for inspection purposes during the jacking or boring operation. Jacking or drilling pits shall be kept two feet clear of the edge of any type of pavement wherever possible. Excessive use of water such that pavement might be undermined, or subgrade softened, will not be permitted.

Conduit terminating in standards of pedestals shall extend vertically above the foundation and shall be sloped towards the handhole opening.

Conduit entering through the bottom of a pull box shall be located near the end wall from the direction of the run to leave the major portion of the box clear. Conduit shall terminate six (6) inches to eight (8) inches below the pull box lid and shall be spaced at least three (3) inches from the wall of the box.

Conduit entering through the bottom of a pull box shall be located near the end walls to leave the major portion of the box clear. At all outlets, conduit shall enter from the direction of the run.

Suitable marker stakes shall be set at the ends of conduits which may be buried so that they may be easily located.

Section 47—Erosion Control

Condulets and other fittings shall be installed at locations as designated by the Engineer so as to provide a conduit channel that will permit freedom for installing the electrical control wires. When condulets are called for on the plans, or where their installation is required by the Engineer, the Contractor shall also furnish all necessary condulet covers and gaskets.

Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel and blown out with compressed air.

A 450# test (minimum strength) nylon pull cord shall be installed, with at least two (2) feet of excess cord at each outlet, in all conduits which are to receive future conductors. A plastic cap shall remain on the unused conduits and the cord shall be passed through a small hole in the center of the cap. The excess cord for each outlet shall be wound around and tied to its respective conduit.

Conduit runs shown on the plans are for bidding purposes only and may be changed, with approval of the Engineer, to avoid underground obstructions.

46-3.05 PULL BOXES, JUNCTION BOXES

Pull boxes or junction boxes shall conform to standard drawings and shall be installed at the locations shown on the plans and at such additional points as ordered by the Engineer, when conduit runs are more than 200 feet. The Contractor may install, at his own expense, such additional boxes as may be desired to facilitate the work.

Location of underground pull boxes shall be marked by the installation of a standard guide post installed on the shoulder adjacent to the pull box, or in the island near the pull box, with the top six inches painted red.

46-4 MEASUREMENT AND PAYMENT

Payment will be made for each of the following bid items as are included and shown in any particular contract:

1. "Illuminated Terminal Nosing (Type No.)," per each.
2. "() Conduit (Diameter)," per linear foot.

The unit contract price per each for "Illuminated Terminal Nosing (Type)," shall be full compensation for furnishing all labor, material including lamp box and flasher, tools and equipment necessary to install each unit in accordance with the plans and specifications.

The unit contract price per linear foot, measured by the actual length of completed conduit in place for () Conduit (Diameter), shall be full compensation for furnishing all conduit, conduit connections, elbows, bend caps, reducers, condulets, unions, pull boxes and junction boxes for placing the conduit in accordance with the above provisions, including all excavation or jacking required, backfilling of the trenches, chipping of pavement and bedding of the conduit and all other work incidental to the construction of the conduit.

Section 47—Erosion Control

47-1 DESCRIPTION

Erosion control shall consist of preparing slopes, placing and compacting top soil, seeding, fertilizing and mulching all graded and disturbed areas in accordance with these specifications, the details shown on the plans and the special provisions.

47-2 MATERIALS

47-2.01 TOP SOIL

Top soil material shall conform to the requirements of Section 55-2.01.

47-2.02 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:

- (1) Seed name
- (2) Lot number
- (3) Net weight
- (4) Percentage of purity
- (5) Percentage of germination (in cases of legumes percentage of germination to include hard seed).
- (6) Percentage of weed 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 (6) 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 and rate of application shall be as specified in the special provisions.

47-2.03 FERTILIZER

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:

- (1) A dry free-flowing granular fertilizer suitable for application by agricultural fertilizer spreader.
- (2) A soluble fertilizer ground to a fineness that will permit complete suspension of insoluble particles in water, suitable for application by power sprayer.
- (3) A granular or pelleted fertilizer, suitable for application by blower equipment.
- (4) A non-volatile liquid fertilizer.

Commercial fertilizer formulation and rate of application shall be as specified in the special provisions.

47-2.04 MULCH

-2.04A Straw

All straw mulch material shall be in an air dried condition free of noxious weeds, weed seeds, and other materials detrimental to plant life. Straw shall be seasoned before baling or loading and shall be acceptable to the Engineer. Straw mulch so provided shall be suitable for spreading with mulch blower equipment. Rate of application shall be as specified in the special provisions.

-2.04B Wood Cellulose Fiber

Wood cellulose fiber mulch shall be specially processed wood fiber containing no growth or germination inhibiting factors and shall be dyed a suitable color to facilitate inspection of the placement of the material. It shall be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material will become uniformly suspended to form a homogenous slurry. When hydraulically sprayed on the ground, the material shall allow the absorption and percolation of moisture.

Each package of the cellulose fiber shall be marked by the manufacturer to show the air dry weight content. All mulch material must be acceptable to the Engineer.

47-2.05 ASPHALT EMULSION

Asphalt emulsion used as a tie-down for mulch shall be CSS-1, CMS-2, CRS-1 or CRS-2, complying with the requirements of Section 27-1.01.

47-2.06 JUTE MATTING

Hay mulch will not be required where jute matting is specified. Jute matting shall be of a uniform open plain weave of undyed and unbleached single jute yarn. The yarn shall be of a loosely twisted construction and shall

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not vary in thickness by more than one-half its normal diameter. Jute matting shall be furnished in rolled strips as follows:

Length approximately fifty (50) yards.

Matting width shall be forty-eight (48) inches with an average weight of 0.92 pounds per square yard. A tolerance of plus or minus one (1) inch in width and five percent (5%) in weight will be allowed.

47-2.07 EXCELSIOR MATTING

The excelsior matting shall consist of a machine produced mat of curled wood excelsior of 80% six (6) inches or longer fiber length, with consistent thickness and the fiber evenly distributed over the entire area of the blanket. Fiber dimensions shall be .021" x .042" ± 25%. Average weight per square yard to be .08 lbs. ± 10% at the time of manufacture.

The top side of each mat shall be covered with a biodegradable extruded plastic mesh. The mat shall be made smolder resistant without the use of chemical additives.

47-2.08 SHEAR BOARDS

Where shear boards are required, as determined by the Engineer, they shall be furnished and installed by the Contractor. Details of the installation shall be similar to that shown in Standard Plan No. 85. Boards shall be 2 x 10 rough finished lumber. The top edge of the installed boards shall project two inches above the grade of the ground.

47-3 CONSTRUCTION DETAILS

47-3.01 PREPARATION

Before the placing of top soil, all soil conditioners shall be applied at the rate specified in the special provisions. All areas shall be cultivated to a depth of two (2) inches unless otherwise specified.

Cultivation of the soil may be done by farm disk, harrow or other suitable equipment approved by the Engineer. This operation shall be done at right angles to the natural flow of water on the slopes unless otherwise ordered by the Engineer. All cost and expense incurred in performing the work herein specified shall be considered incidental to other bid items on the project and no additional compensation will be made.

Remove all visible rocks, clods and debris three (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.

47-3.02 PLACEMENT OF SOIL

Top soil shall be evenly spread over the specified areas to the depth shown on the plans or as otherwise ordered by the Engineer. After the top soil has been spread, all large clods, hard lumps, rocks and litter shall be raked up, removed and disposed of by the Contractor.

Top soil shall not be placed when the ground or top soil is frozen, excessively wet or in the opinion of the Engineer, in a condition detrimental to the work.

All damage occurring to existing roadbeds, shoulders, walks, curbs 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.

47-3.03 COMPACTION

All top soil shall be compacted unless otherwise specified or ordered by the Engineer. Compaction shall be by sheepfoot roller, cleated crawler tractor or similar equipment approved by the Engineer, which will produce a minimum of one hundred fifty (150) pounds per square inch ground pressure to a maximum of three hundred (300) pounds per square inch ground pressure. Equipment shall be so designed and constructed to produce a uniform rough textured surface ready for seeding and mulching, and which will bond the top soil to the underlying material. The entire area shall be covered by a minimum of four (4) passes or two (2) round trips of the roller or approved equipment. Compaction equipment shall be operated parallel to the natural flow of water on the slopes unless otherwise ordered by the Engineer. Conveying the roller or approved equipment up and down the slopes

shall be by means devised by the Contractor, providing that the required results are obtained to the satisfaction of the Engineer. After compaction, the finished grade of the top soil shall be one (1) inch below the top of all curbs, catch basins and other structures.

If, in the opinion of the Engineer, water is required to condition the top soil for rolling, it shall be immediately furnished and applied by the method and in the amount designated by the Engineer.

47-3.04 SEEDING

The Contractor shall notify the Engineer not less than twenty-four (24) hours in advance of any seeding operation and he shall not begin the work until areas prepared or designated for seeding have been approved. Following the Engineer's approval, seeding of the approved slopes shall begin immediately.

Seeding shall not be done during windy weather or when the ground is frozen. Seed shall be placed at the rate and mix specified herein or as directed by the Engineer. Seed and fertilizer may be sown by one of the following methods:

- (1) An approved type, hydro-seeder which utilizes water as the carrying agent, and maintains continuous agitation through paddle blades. It shall have an operating capacity sufficient to agitate, suspend and mix into a homogenous slurry of the specified amount of seed and water or other material. 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.
- (2) Approved blower equipment with an adjustable disseminating device capable of maintaining a constant measured rate of material discharge that will insure an even distribution of seed and fertilizer at the rates herein specified.
- (3) Helicopters properly equipped for aerial seeding shall have the following:
 - (a) Two hoppers or seed compartments capable of containing a minimum of one hundred (100) pounds each of grass seed, or granular fertilizer.
 - (b) Power-driven, readily adjustable disseminating mechanisms capable of maintaining a constant, measured rate of distribution of seed, or granular fertilizer.
 - (c) Where liquid fertilizer is furnished in lieu of dry granular fertilizer, the helicopter shall be equipped with two barrels or containers capable of containing a minimum of fifteen (15) gallons each. Distribution shall be by a spray boom of sufficient size and length, fitted with proper nozzles to distribute uniformly liquid fertilizer as herein specified.
- (4) Approved power-drawn drills or seeders.

Areas inaccessible to above methods of application shall be seeded and fertilized by approved hand methods. Distribution of the material shall be uniform and at the rates specified.

It shall be the Contractor's responsibility to provide qualified personnel experienced in all phases of the seeding and fertilizing operation, equipment and methods as herein specified.

-3.04A Fertilizing

Fertilizer shall be applied in accordance with the procedures and requirements for seeding in Section 47-3.04 at the rates and analysis specified.

47-3.05 SPREADING MULCH

-3.05A Straw

Mulch material of the type herein specified shall be furnished, hauled and evenly applied at the rates indicated, and shall be spread on seeded areas within forty-eight (48) hours after seeding unless otherwise specified. Distribution of mulch material shall be by means of an approved type mulch spreader which utilizes forced air to blow mulch material on seeded area. The spreader shall produce a uniform distribution of the hay, without cutting or breaking it into short stalks. Areas beyond the range

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of the mulch spreader shall be mulched by approved hand methods. Distribution of the material shall be uniform and at the rate specified.

-3.05B Wood Cellulose Fiber

Wood cellulose fiber utilized as a mulch may 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 homogeneously 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.

47-3.06 APPLICATION OF ASPHALT EMULSION

Mulch material shall be anchored in place with asphalt emulsion as herein specified. Asphalt emulsion shall be sprayed into the mulch as it leaves the blower pipe and shall be uniformly mixed with the mulch. Asphalt emulsion as specified shall be applied at the rate of one hundred (100) gallons per acre. Any mulch disturbed or displaced following application shall be removed and reapplied as specified.

47-3.07 PLACING JUTE OR EXCELSIOR MATTING

Jute or excelsior matting shall be unrolled parallel to the flow of water immediately following the establishment of the finished grade. Seed and fertilizer shall be placed prior to the placing of excelsior matting. Where more than one strip of jute matting is required to cover the given area, they shall overlap the adjacent mat a minimum of 4 inches. The excelsior matting shall be placed adjacent to the preceding strip. The ends of both jute and excelsior matting shall overlap at least 6 inches with the upgrade section on top. The up-slope end of each jute and excelsior strip of matting shall be staked and buried in a 6 inch deep trench with the soil firmly tamped against the mat. Three stakes per width of matting (one stake at each overlap) shall be driven below the finish ground line prior to backfilling of the trench. The Engineer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be staked and buried in a similar manner. With the jute matting only, check slots, when specified, shall be placed between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as up-slope ends. Check slots must be spaced so that one check slot or one end occurs within each 50 feet of slope. Rolling of jute matting, when specified, shall be with a grid type roller.

Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting must be spread evenly and smoothly and in contact with the soil at all points.

Jute and excelsior matting shall be held in place by approved wire staples, pins, spikes or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than three feet apart in three rows for each strip of matting, with one row along each edge and one row alternately spaced in the middle. All ends of the matting and check slots shall be fastened at six (6) inch intervals across their width. Length of fastening devices shall be sufficient to securely anchor matting against the soil and driven flush with the finished grade.

47-3.08 CONTRACTOR'S RESPONSIBILITY FOR WORK

The Contractor shall be responsible for all work herein described in accordance with Section 7 and the following requirements as directed by the Engineer.

- (1) Protect all areas involved against vehicle with barricades.
- (2) Reseed and fertilize areas failing to show a uniform stand of grass after germination of seed, or damage through any cause before final inspection.

Maintenance and protection during a suspension of work shall be as herein described and in accordance with Section 8 and as directed by the Engineer.

47-3.09 FINAL INSPECTION AND ACCEPTANCE

Acceptance of areas receiving seed, fertilizer and mulch as herein specified shall be based on a uniform stand of grass at the time of final inspection. Areas failing to show uniform stand of grass after germination, or damage through any cause prior to final inspection shall be reseeded as herein specified at the Contractor's expense.

47-4 MEASUREMENT

47-4.01 TOP SOIL

Measurement for top soil shall be by the cubic yard in the haul conveyance at the point of delivery.

47-4.02 SEEDING AND FERTILIZING

The quantity of seeding and fertilizing to be paid for will be ground slope measurement in acres of actual seeding and fertilizing completed and accepted.

47-4.03 MULCHING

The quantity of mulching to be paid for will be by ground slope measurement in acres of actual mulching completed and accepted, including anchoring with asphalt emulsion or by any other means specified, in accordance with these specifications and as shown on the plans.

47-4.04 JUTE MATTING AND EXCELSIOR MATTING

The quantity of jute matting and excelsior matting to be paid for will be by the square yard measurement of surface area covered and accepted in accordance with the special provisions and the plans.

47-4.05 SOIL CONDITIONERS

The quantity of soil conditioners to be paid for will be by the ton. Contractor shall furnish duplicate bills of lading to the Engineer.

47-5 PAYMENT

Payment will be made for such of the following bid items as are included in any particular contract:

1. Furnishing and placing top soil, per cubic yard.
2. Placing top soil, per cubic yard.
3. Seeding and fertilizing, per square foot.
4. Hydro-seeding, per square foot.
5. Mulch (Type), per square foot.
6. Matting (Type), per square foot.
7. Soil conditioners, per ton.

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48-1 DESCRIPTION

Where shown on the plans, trees, shrubs, and ground covers shall be furnished and planted by the Contractor in accordance with accepted horticultural practice, these specifications and as directed by the Engineer. Trees, shrubs and ground covers will hereinafter be referred to collectively as "plants" or "plant material."

48-2 MATERIALS

48-2.01 NOMENCLATURE

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 Horticultural Nomenclature.

Names not included in the latest edition of "Standardized Plant Names" should conform to names accepted in the nursery trade.

48-2.02 QUALITY OF PLANT MATERIAL

All plant material furnished 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:

Section 48—Roadside Planting

- (a) All plant material shall comply with State and Federal laws with the 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.
- (b) Plants shall not have cuts over three-fourth (¾) inch diameter which have not completely healed over. Leader shall be intact on all plants.
- (c) Ground plants furnished in pots or other containers shall be acclimated to outside conditions and equal to field grown stock.
- (d) When so specified, collected plant material shall conform in quality, size and grade as for nursery stock, except that roots and ball shall be one-third (⅓) greater in diameter than required of nursery grown stock.

48-2.03 HANDLING AND SHIPPING

All plants shall be dug with care by experienced workmen immediately before shipment. Plants shall be packed for shipment according to standard practice for the type of plant being shipped. The root system of all plants shall not be permitted to dry out at any time. Plants shall be protected at all times against heat and freezing temperatures, sun, wind, climatic or seasonal conditions during transit. When transported a considerable distance in closed vehicles, plants shall receive adequate ventilation to prevent "sweating." In open vehicles, plants are to be protected by tarpaulins or other suitable cover material. All deciduous plant material shall be furnished bare root (BR) unless otherwise specified. All evergreen plant material shall be furnished balled and burlapped (B&B) unless otherwise specified. Broken or "made" balls will not be accepted. All balled and burlapped plants shall at all times be handled by the ball of earth and not the plant. Unless otherwise specified, all 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.

48-2.04 TAGGING PLANT MATERIAL

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, caliber 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.

48-2.05 INSPECTION OF PLANT MATERIAL

The Contractor shall, as soon as practical, inform the Engineer as to the source of plant materials for the project. All plants intended for use by the Contractor are subject to inspection at any time by the Engineer. Approval of plant material for a project shall not be considered as final acceptance. The Contractor shall notify the Engineer not less than two (2) days in advance of delivery of plants from the nursery.

All plants will be inspected by the Engineer on arrival at the project and before the time of planting. 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 his own expense.

48-2.06 SUBSTITUTION OF PLANTS

No substitution of plant material will be permitted un-

less evidence is submitted in writing to the Engineer that a specified plant cannot be obtained and has been unobtainable since the award of the contract. If substitution is permitted, it can be made only with written approval by the Engineer. The nearest variety, size and grade as approved by the Engineer shall then be furnished.

48-2.07 TEMPORARY STORAGE

Plant material delivered and accepted shall be placed immediately. Plants that cannot be planted within one (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 accepted material.

Plants stored under temporary conditions shall be protected at all times from extreme weather conditions, and shall be kept moist. All plants that must be stored longer than one month shall be planted in nursery rows and maintained by the Contractor at his own expense.

48-2.08 TOP SOIL

Top soil material shall conform to the requirements of Section 55, including any soil conditioners specified in the special provisions.

48-2.09 PLANTING SOIL

Planting soil shall be a mix of sandy loam, peat, cow manure, or other ingredients in the combination and proportions specified in the special provisions. Mixed planting soil shall have a pH range of 5.0 to 6.0. The Contractor shall notify the Engineer as to the date and location he is going to mix planting soil. Any planting soil mixed without approval of the Engineer shall be rejected.

The ingredients to be used in mixing planting soil shall meet the following requirements:

- (a) Sandy loam shall consist 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 will fall apart when the pressure is released; on squeezing when moist, it will form a cast that will not only hold its shape when the pressure is released, but will withstand careful handling without breaking.
- (b) Peat shall consist of fibrous sedge, woody or reed type peat, containing less than twenty percent (20%) of ash by dry weight.
- (c) Manure shall be composed of well rotted cow manure free of weeds and weed seed, with a minimum of litter (straw, shavings and sawdust) content.

At the time of mixing, planting soil shall have added to it commercial fertilizer of the type and at the rate specified in the special provisions.

48-3 CONSTRUCTION DETAIL

48-3.01 LAYOUT OF PLANTING

Plant locations and outline of planting areas shall be staked by the Contractor and approved by the Engineer before the planting of any trees, shrubs or ground covers.

48-3.02 ORDER OF PLANTING

In mixing planting areas, trees shall be planted first, followed by the larger shrubs, low shrubs and the final planting of ground covers.

48-3.03 PLANTING

Plants shall not be placed in any areas that are below the finished grade as shown on plans. Planting areas which, in the opinion of the Engineer, require cultivating shall be cultivated to a depth of six (6) inches and all rocks, sticks, roots and other debris shall be removed before any plants are planted. In addition thereto all plant-

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ing shall be performed in accordance with the following requirements:

- (a) Planting shall not be done during freezing weather or when conditions are unfavorable to the work.
- (b) Plant locations shall be established, approved and holes dug before moving the plants out to the planting area.
- (c) Plants shall be protected at all times to prevent roots from drying out during the planting operation.
- (d) Unless otherwise specified, holes shall be dug for trees, twelve (12) inches greater in diameter than the diameter of the root ball or natural spread of the roots. Depth of hole shall provide a minimum backfill under roots or root ball of six (6) inches. Shrub holes shall be twelve (12) inches greater in diameter than the root ball or natural spread of the roots. Depth of shrub holes shall allow for a minimum backfill under roots or balls of six (6) inches. Ground covers shall have a minimum backfill on all sides of the root system of two (2) inches.
- (e) When trees are to be planted in cement concrete sidewalk areas, pits shall be dug at the locations shown on the plans. The pits shall be a minimum of three (3) feet by three (3) feet and have a depth of three (3) feet.
- (f) Planting shall be done by experienced workmen in accordance with recognized horticultural practice. All plants shall be set plumb and at such an elevation that after backfill settlement plants will bear the same relationship to the finished grade as they were planted in the nursery.
- (g) Bare root plants shall be set in the plant holes with roots spread out in a natural position. Backfill material as specified shall then be worked in and around the roots filling all voids. Firming or tamping of backfill material around roots shall be done in such a manner so as not to damage the roots. Balled and burlapped material shall have all strings or cords cut, and the burlap shall be laid back from the top half of the ball. This shall be done only after the plant is placed in its final position and before completion of the backfill. Plants supplied in containers shall be removed from the containers in such a manner as to prevent disturbances of the root system or material in which they were planted. Under no circumstances shall the plant be removed from the container by pulling the main stem. Plants removed from their containers shall be planted without delay, in the manner described for balled and burlapped plants. A shallow rain basin consisting of a ridge of earth one (1) to three (3) inches high and equal in diameter to the planting hole, shall be left around each plant. Immediately after a plant is planted and basin constructed, the basin shall be filled with water.
- (h) All excess or unsuitable material excavated from plant holes shall be removed and disposed of off the project site and to the satisfaction of the Engineer.

48-3.04 PRUNING, STAKING AND GUYING

Before planting, all bare root stock shall have damaged or torn roots removed with clean cut. After planting, all plant material shall be pruned in conformance with the best horticultural practice, appropriate to the type of plant. Top pruning 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 one-third (⅓) of the top growth unless otherwise specified or directed by the Engineer. Removal of top growth shall be in such a manner as to retain the natural growth characteristics of the plant. Cuts greater than three-fourth (¾) inch in diameter shall be treated with an approved tree wound dressing. 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.

Staking of trees shall follow either Alternate A or Alternate B as follows:

Alternate A:

All deciduous and evergreen trees, over five feet in

height, shall be staked at the time of planting. Deciduous trees up to sixteen (16) feet in height and evergreen shrubs or trees up to twelve (12) feet in height shall be staked with a single ⅝-inch diameter deformed steel reinforcing bar ten feet long. The bar shall be driven into the ground at a distance of from one to three inches from the tree trunk. The bar shall penetrate at least one foot of undisturbed soil in a tree pit three feet deep, more if tree pit is more shallow. The bar and the tree shall be joined by three tree ties formed of twelve gauge wire in one loop which crosses itself between the tree and the bar. Before placing, a 4 to 8 inch 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 one-quarter inch space should be allowed between the hose tie face and the tree trunk. The top most tie should be at a minimum height of 5 feet 10 inches with 1 foot 3 inches vertical spacing between the three ties (plus or minus one inch).

Other methods of staking will be considered as alternates but can be used only with the approval of the Engineer.

Alternate B:

All deciduous trees shall be staked at the time of planting unless otherwise specified. Trees up to twelve (12) feet in height shall be staked with one two-inch by two inch by eight foot or ten foot maximum stake (2" x 2" x 8'), stained dark brown. The stake shall be placed in the tree pit and driven a minimum of one (1) foot into firm ground at the time of planting, before backfilling around roots. The tree shall be fastened to the stake with two (2) hose and No. 12 galvanized wire ties each. Ties shall be spaced two feet six inches (2' 6") apart and shall be centered on a point approximately three-fifths (⅔) the height of the tree. Ties shall be No. 12 galvanized wire securely anchored to the posts. Loops shall be formed around the trunk of the tree with each tie leaving at least four (4) inch diameter open space after the hose protection has been applied. Good quality rubber hose, brown in color, shall be used to protect the bark of the tree. If the coat of stain is broken during placing, the unprotected areas of the stake shall be recoated after installation is complete. All stakes shall be placed to the windward side of the tree. The Contractor shall stake one (1) tree as a sample and get the approval of the Engineer before making further installations.

Deciduous trees over sixteen (16) feet in height and all evergreen shrubs or trees over twelve (12) feet in height shall be guyed with three (3) guy wires or cables. Guy wires shall be a strand of twelve (12) gauge wire passed through a loop of garden hose around the tree trunk at a point at least one-half (½) the height of the tree and fastened securely to a six foot 2 x 4 stake placed approximately three-fourths (¾) the fastening height from the trunk or main stem. Guy stakes shall be placed equal distances apart.

48-3.05 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. The soil surrounding each individual plant shall be cultivated and loosened to a depth of three (3) inches and all rocks, grass, weeds, hard clods, and other debris shall be removed. An area three (3) feet in diameter around each individually planted tree or shrub shall be cultivated as specified and an area not less than one (1) foot around small shrubs and ground covers. Where trees and shrubs are planted in groups or mass plantings the total area shall be treated as a unit and cultivated as specified. Planted areas shall be neatly edged with a sharp edging tool.

48-3.06 FERTILIZERS AND SOIL CONDITIONERS

Fertilizers and soil conditioners when called for in the special provisions shall be thoroughly and uniformly incorporated into the top soil at the rates specified.

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48-3.07 PLANTING MULCH

Mulch shall be applied where shown on plans or where directed by the Engineer. Planting areas of trees, shrubs, and ground covers shall be mulched with hardwood or softwood to the depth shown. Mulch shall be free of chips, chunks and large splinters and shall not contain resin, tannin or other compounds in quantities that would be detrimental to plant life.

48-3.08 CARE DURING CONSTRUCTION

The Contractor shall insure adequate and proper care of all plant material and work done on this project until the contract is completed and accepted by the Owner. Adequate and proper care shall consist of keeping all plant material in a healthy, growing condition by watering, cultivating, pruning, spraying and any other necessary operations. This work shall also include keeping the grass, litter and other debris along with retaining the finished grades in a neat uniform condition.

48-3.09 PROTECTION OF EXISTING FACILITIES

See sections 5-1.09 and 5-1.10.

48-3.10 REPLACEMENT

All plants not in a healthy, growing condition at the time of final inspection shall be removed and replaced in species, size and grade by the Contractor at his own expense.

48-4 LANDSCAPE ESTABLISHMENT

Scope of Work: The Contractor shall maintain all landscaping within the limits of this project. Maintenance shall include the care and maintenance of all tree plantings and ground covers, removing weeds from ground cover area, and the general cleanliness of the area within the boundaries of the project.

It shall be the Contractor's responsibility to maintain all the landscaped area of this contract from the time of installation until the project is accepted by the Owner as complete. No separate payment will be made for maintenance performed from the time of installation to the date of acceptance by Owner. The 365 calendar day maintenance period will begin on the day the completion letter is written indicating completion of the work.

General Provisions: The Contractor shall furnish all materials and tools needed to do the work called for under this contract. This will include sprays, insecticides, weed killers, fertilizers, shears, rakes, brooms, and all other materials and tools needed to keep the area presentable and the trees healthy.

The Contractor will be held responsible for all damage or loss of trees and ground covers caused by his inattention or carelessness. The Contractor shall repair minor damage to trees caused by traffic, wind or other causes.

Engineering: The Engineer shall perform all engineering functions in connection with work including inspection.

Failure to Perform: If the Contractor fails to perform any of the work required under this contract, the Owner may:

1. Cause the work to be done by others and the cost thereof to be deducted from the Contractor's monthly payment or payments. Should the money due the Contractor be insufficient to cover said cost, the Owner shall have the right to recover the balance from the Contractor.
2. Withhold a portion of the Contractor's monthly payment or payments until the necessary work is accomplished. The amount to be withheld shall be determined by the Engineer.
3. Terminate the contract.

Trees and Ground Covers: Weeds shall be removed from the ground cover area as often as is necessary to maintain a presentable appearance.

Dead trees shall be removed as directed by the Engineer who shall record plants removed.

Pruning shall be done as directed by the Engineer so as to maintain a neat, healthy appearance, in accordance with good horticultural practice for that particular type of tree.

All weeds and branches removed during normal maintenance shall be disposed of by the Contractor. Weed control may be accomplished by using a pre-emergent chemical herbicide such as Simazine or Casoron.

Watering: The quantity of water to be applied by each watering shall be approximately five gallons per tree.

All trees and ground covers shall be thoroughly watered as often as needed to keep the plants healthy.

The Contractor shall furnish in writing, a watering schedule to the Engineer. Any change in the watering schedule shall require 24-hour advance notice. The Engineer shall be notified immediately of any sprinkler system malfunction, major sprinkling repair and winterizing of the systems shall be the responsibility of the Contractor.

The area around trees is to be kept weed-free. All undesirable growth is to be removed and disposed of by the Contractor. Weed control in shrub beds and around the individual trees may be accomplished by using an approved pre-emergent chemical herbicide such as Simazine or Casoron or approved equal.

Pavement: Concrete pavement shall be hosed off with water regularly and otherwise kept clean and free from dirt and litter.

Water: In the event that water restrictions are established during the summer months, watering shall be scheduled as directed by the Engineer.

Mulch: Mulching material is to be applied and replaced as directed by the Engineer. The final mulch application must be made one (1) week prior to final inspection. Weeds shall be removed from the planting beds as often as is necessary to maintain a presentable appearance.

Cleanup: A general cleanup shall be made immediately after and as a part of all work done in the area. The cleanup shall include the entire area under this contract. Adjacent areas shall be cleaned to the extent that the work under contract may scatter litter. In addition, the contract area shall be cleaned of litter and debris at least every week or as directed by the Engineer. Such cleanup shall include the pickup and removal from the contract area of all clippings, trimmings, leaves, and all other litter and debris originating from any source whatsoever, and emptying the waste receptacles.

The Contractor will be held responsible for all damage for loss of shrubs and trees caused by his inattention or carelessness. The Contractor shall repair minor damage to shrubs, trees, or ground covers caused by traffic, wind or other causes.

Inspection of Work: Work performed on this contract shall be regularly inspected by the Engineer. He may at any time request correction of or improvement of landscaping practices if they fall below contract standards. The Contractor will be expected to make the necessary corrections within 72 hours of receipt of such request, which may be made either in writing, by telephone, or communicated in person to the Contractor or his representative.

Payment: Payment will be made at the rate of 8 percent per month of the lump sum price bid for "Plant Establishment" for the first eleven months, and the remainder paid at the end of the establishment period. The Contractor shall contact the Engineer on or before the 20th of each month, at which time he shall have completed the monthly establishment period. Work will be inspected about the 25th of each month, and if satisfactory, the monthly payment will be paid. The lump sum price bid will be full compensation for all labor, tools, materials, equipment and any other incidental items required to perform the work as specified.

In the event that no work is done, or the work is not corrected to the satisfaction of the Engineer, the monthly payment, or a portion thereof, will be forfeited.

48-5 MEASUREMENT AND PAYMENT

Payment will be made for such of the following bid items as are included and shown in any particular contract:

1. "Trees," per each.
2. "Shrubs," per each.
3. "Ground Cover Plants," per each.

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4. "Furnishing and Placing Top Soil," per cubic yard.
5. "Placing Top Soil," per cubic yard.
6. "Furnishing and Placing Planting Soil," per cubic yard.
7. "Placing Planting Soil," per cubic yard.
8. "Planting Mulch," per cubic yard.
9. "Landscape Maintenance," per lump sum.

The price per each for "Trees," "Shrubs" and "Ground Cover Plants" shall be full compensation for all costs necessary to furnish, plant, fertilize and cultivate the particular items called for on the plans.

The price per cubic yard for "Top Soil," "Planting Soil" or for "Planting Mulch," measured in the hauling conveyance at the point of delivery, shall be full compensation for all costs necessary for furnishing and placing as shown on the plans.

Any incidental work required to complete the roadside planting specified herein but not specifically mentioned in these specifications shall be considered as incidental to the roadside planting and all costs therefor shall be included in the unit contract prices of the bid items.

Section 49—Sprinkler Irrigation System

49-1 DESCRIPTION

The work under this section 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 plans.

49-2 MATERIALS

All materials and equipment incorporated in the sprinkler system shall be new, undamaged, of standard quality and shall be subject to testing as specified herein. Materials shall meet the following requirements.

49-2.01 PIPE AND FITTINGS

Pipe shall be galvanized iron, polyvinyl chloride, or polyethylene, as specified on the plans or in the special provisions.

-2.01A Galvanized Pipe and Fittings

Pipe shall be standard weight, hot dipped galvanized iron or steel pipe, threaded and coupled. Pipe shall meet the current requirements of ASTM Designation A 120.

All pipe fittings shall be standard threaded galvanized malleable iron fittings.

-2.01B Plastic Pipe and Fittings

Plastic pipe, where indicated on the plans, shall be Polyvinyl Chloride (P. V. C.). PVC piping shall be 1120, Schedule 40. The PVC pipe shall be made to conform to ASTM D-2241 or ASTM D 1785, and shall be National Sanitation Foundation (NSF) approved.

The Engineer may require impact and quick burst tests of samples of the pipe after its arrival at the jobsite and acceptance of the pipe shall be subject to passing of the designated test.

Each length of PVC pipe is to be marked with an identifying extrusion "run" number and the manufacturer's name or trade name plus the pipe size and schedule.

Pipe shall be free from manufacturing defects in materials and workmanship. The pipe is to be guaranteed to operate within the limits of pressures and temperatures as required in the above specification.

Fittings shall be manufactured from PVC 1120 conforming to ASTM D 2466. The wall thickness of the fitting shall be equal to or exceed that of Schedule 40 pipe of similar size.

-2.01C Polyethylene Pipe

Polyethylene pipe shall be class 80, SDR 15, medium density polyethylene pipe, meet the requirements of ASTM D 2239, conform to U.S. Commercial Standard CS-255, and be National Sanitation Foundation (NSF) approved.

49-2.02 CONTROL TUBING

Control tubing shall be copper refrigerator tubing meeting the current requirements of ASTM Designation B 280 in the size specified on the plans. Tubing and fittings shall be capable of withstanding a 300 p.s.i. operating pressure, and shall be of the size indicated on the plans.

49-2.03 AUTOMATIC CONTROLLERS

When called for on the plans, the Contractor shall furnish and install on a concrete base, automatic controllers as herein specified. They shall be an electrically timed device for automatically opening and closing control valves for predetermined periods of time and mounted so that all normal adjustments will be conveniently located for use by the operator. Controllers shall be enclosed in a weather-proof metal housing with hasp and lock or locking device. All locks or locking devices shall be master keyed and three (3) sets of keys provided. Operating features shall include the following:

- (a) Each valve in the circuit shall be adjustable for setting to remain open for any desired period of time—from one (1) to thirty (30) minutes.
- (b) Controller adjustments shall be such that the open cycle may be doubled or repeated not less than three (3) times during the complete watering cycle.
- (c) Adjustments shall be provided whereby any number of days may be omitted and whereby any one or more positions on the controller can be skipped. When adjustments are made they shall continue automatically within a fourteen (14) day cycle until the operator desires to make new adjustments.
- (d) Controls shall allow any position to be operated manually both on or off whenever desired.
- (e) Controls shall provide for resetting the start of the irrigation cycle at any time and advancing from one position to another.
- (f) Controllers shall contain an "on-off" switch and fuse assembly.
- (g) Controller shall have a power failure cutout.

49-2.04 SPRINKLER HEADS

Sprinkler heads shall be of the style, pattern and coverage shown on the plans. 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 turf heads shall be designed with turf flanges having two gripping holes to facilitate removal of the head.

49-2.05 VALVE BOXES AND PROTECTIVE SLEEVES

All automatic control valves, flow control valves, pressure reducing valves and twin check valve units shall be provided with valve boxes. Valve boxes shall conform to the plans and shall be extendable to obtain the depth required. All manual drain valves and manual control valves shall be equipped with a protective sleeve and cap as shown on the plans.

49-2.06 GATE VALVES

Gate valves when called for on the plans 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.

49-2.07 CONTROL VALVES

-2.07A Manual Control Valves

Manual valves shall be bronze or brass, angle type with hex brass union. Service rating shall be not less than 150 p.s.i. non-shock cold water. Valves shall be designed for underground installation with suitable cross wheel for operation with a standard key. The Contractor shall fur-

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nish three suitable operating keys per contract. Valves shall have removable bonnet and stem assembly with adjustable packing gland and shall house long acme threaded stem to assure full opening and closing. Valve discs shall be full floating with replaceable seat washers.

-2.07B Automatic Control Valves

Automatic remote control valves shall be globe pattern with flanged or screwed connections as required. Screwed valves shall be provided with union connections.

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 lb. 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.

-2.07C Automatic Control Valves With Pressure Regulator

The automatic control valve with pressure regulator shall be similar to the automatic control valve and shall also reduce the inlet pressure to a constant lower pressure regardless of supply fluctuations. The regulator must be fully adjustable.

49-2.08 QUICK COUPLER VALVES

Quick coupler valves shall have a service rating not less than 150 p.s.i. for non-shock cold water. Body of the valves shall be of single piece construction of cast leaded semi-red brass alloy #5-A conforming to ASTM Designation B 145. Base of the valve shall have standard female pipe threads. Design of the valve shall be such that it will open only upon inserting a coupler device, and will close as the coupler is removed from the valve. Leakage of water between the coupler and valve body when in operation will not be accepted. The valve body receiving the coupler shall be designed with double worm slots to allow smooth action in opening and closing of the valve with a minimum of effort. Slots shall be notched at the base to hold the coupler firmly in the open position. Couplers shall be of the same material as the valve body with stainless steel double guide lugs to fit the worm slots. Couplers shall be of one piece construction with steel reinforced side handle attached. All couplers shall have standard male pipe threads at the top. Couplers shall be furnished with all quick coupler valves unless otherwise specified.

49-2.09 DRAIN VALVES

Drain valves shall be of the size, type, and construction indicated on the plans.

49-2.10 HOSE BIBS

Hose bibs shall be constructed of bronze or brass, angle type threaded to accommodate a 3/4-inch hose connection and shall be key operated. Design shall be such as to prevent operation by wrench or pliers.

49-2.11 VACUUM BREAKERS

When called for in the plans and special provisions or as required by local ordinances, vacuum breakers meeting the following requirements shall be furnished and installed. All vacuum breaker installations are subject to inspection by authorized county or municipal authorities.

-2.11A Atmospheric Vacuum Breakers

Atmospheric vacuum breakers shall have all bronze bodies and be of the same dimension as the pipe on which it is attached. Design shall permit free flow of water under

pressure. When vacuum conditions exist it shall automatically close the check valve stopping all flow of water and admit air into the main line. Upon restoration of water pressure the air intake shall be shut off and the check valve re-opened without spillage. Unless otherwise specified, the vacuum breaker shall be installed on the discharge side of the control valve six inches above the highest sprinkler head on the line. Atmospheric vacuum breakers shall have a service rating of 150 p.s.i. for non-shock cold water and shall be designed for operation up to temperatures of 140° F.

-2.11B Pressure Vacuum Breakers

Pressure type vacuum breakers shall be installed on the discharge side of the meter or service connection as shown on the plans. Vacuum breakers shall be of heavy duty construction with all bronze bodies, check valves and test cocks. Pressure type vacuum breakers shall be designed to operate under continuous pressure permitting the free flow of water at all times. Air intake shall be spring loaded to insure positive opening upon release of pressure or vacuum created in the supply lines. Vacuum breakers shall be furnished with approved check valves, inlet and discharge shut-off valves and field testing cocks. Assembly for various pipe sizes shall be according to local requirements or as specified on plans and in the special provisions. Unless otherwise specified pressure type vacuum breakers shall have a service rating of 300 p.s.i. for non-shock cold water.

49-2.12 CHECK VALVES

-2.12A Check Valve

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.

-2.12B Double Check Valve Unit

The unit shall be of a type approved by the Washington State Department of Social and Health Services. The double check valve shall be tested by backflow prevention device testers certified by the Washington State Department of Social and Health Services. Test records shall document that double check valves are in good operating condition prior to flushing and testing of sprinkler system mainline pipes. During the life of the contract, double check valve units will be tested annually, or more often if successive inspections indicate repeated failure. Double check valve units shall be repaired or replaced whenever they are found defective.

49-2.13 PRESSURE REDUCING VALVES

Pressure reducing valves shall have a minimum of 150 p.s.i. working pressure with an adjustable outlet range of 20 to 70 p.s.i. The valves shall be factory set as shown on the plans. Pressure reducing valves shall be rated for safe operation at 175 p.s.i. non-shock cold water.

49-2.14 FLOW CONTROL VALVES

Valve body materials shall be plastic or metal. Internal parts shall be stainless steel. Valves shall be factory set to plan flows. Valve shall have no external adjustment and be tamper proof when installed. One-fourth (1/4) inch and smaller flow control valves shall have a minimum pressure absorption range of 2-32 p.s.i. 1/2 inch and larger flow control valves shall have a minimum pressure absorption range of 3-50 p.s.i.

Flow shall be controlled to ± 5% of plan volumes.

49-2.15 AIR RELIEF VALVE

The air relief valve shall automatically relieve air and break a vacuum in the serviced pipe. Body materials shall be installed exactly at all high points.

49-2.16 ELECTRICAL WIRE

All electrical control and ground wire shall be #14 irrigation control cable. All wiring to be used for connecting the automatic remote control valve to the automatic

Section 49—Sprinkler Irrigation System

controllers shall be Type 'UF', 600 volt, solid copper, single conductor wire with PVC insulation and bear UL approval for direct underground burial feeder cable.

Insulation shall be 4/64-inch thick minimum covering of ICC-100 compound for positive waterproofing protection. The wire shall be single conductor solid copper wire. All control or 'hot' wires shall be of one color (orange) and all common or 'ground' wires shall be of another color (white).

Verification of wire types and installation procedures shall be checked to conform to local codes.

49-2.17 METAL CONDUIT

Cast iron conduits shall be placed under all pavement in the locations shown on the plans. Sizes and installation shall be according to plans and details.

49-2.18 WATER LOOPS

Water loops for the temporary irrigation systems shall be plastic and shall be so constructed that watering is accomplished by oozing through the seam of the loop which shall be sewn with nylon thread. The loops shall be 16 inches in diameter unless otherwise specified. They shall have 60-inch leader tubes for connection with the water supply line. The leader tubes shall be seamless plastic and have an inside diameter of 3/64-inch, plus or minus 1/64-inch.

49-3 CONSTRUCTION DETAILS

All 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.

All 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 Owner will furnish meters at the locations as noted on the plans.

49-3.01 EXCAVATION

Pipe trenches shall be no wider at any point than is necessary to lay the pipe or install equipment. The top six (6) inches of top soil, when such exists, shall be kept separate from subsoil and shall be replaced as the top layer when backfill is made. Trenches shall be excavated with vertical sides and provided with bracing and shoring to be placed as directed by the Engineer. Trench bottoms shall be of sand or other suitable material free from rocks, stones, or any material which might damage the pipe. Trenches in rock or other material unsuitable for trench bottoms shall be excavated six (6) inches below the required depth and shall be backfilled to required depth with sand or other suitable material free from rocks or stones.

Care shall be exercised by the Contractor when excavating trenches near existing trees. Where roots are 2 inches and greater in diameter, except in the direct path of the pipe, the pipe trench shall be hand excavated and tunneled. When large roots are exposed they shall be wrapped with heavy burlap for protection and to prevent excessive drying. Trenches dug by machines adjacent to trees having roots 2 inches and less in diameter, shall have the sides hand trimmed making a clean cut of the roots. All roots 1/2-inch or greater in diameter that are cut and trimmed shall be treated with an approved tree wound dressing. Trenches having exposed tree roots shall be backfilled within 24 hours unless adequately protected by moist burlap or canvas as directed by the Engineer.

49-3.02 PIPING

All live main lines shall be a minimum of 24 inches below finished grade measured from the bottom of the pipe. Lateral or section lines shall be a minimum of 18 inches below finished grade or at a shallower depth as directed by the Engineer, measured from the bottom of the pipe. Pipes shall be sloped uniformly to drain. All live mains to be constructed under existing pavement shall be placed in conduits jacked under pavement unless otherwise noted on the plans or directed by the Engineer. Conduits shall be

no larger than necessary to conveniently accommodate the pipe and fittings. All jacking operations shall be performed as directed by the Engineer and conduit run at a depth below the pavement as may be so ordered. Where possible, mains and laterals or section piping shall be placed in the same trench.

Unless otherwise specified, it shall be the Contractor's responsibility to establish the locations of the drain valves during installation to insure complete drainage of the lateral and section lines.

49-3.03 JOINTING

All galvanized steel pipe shall have sound, clean cut standard pipe threads well fitted. All pipe shall be reamed to the full diameter and burrs removed before assembly. Threaded joints shall be made up with the best quality pure lead paste, applied smoothly and evenly to the male thread only. All screwed joints shall be made tight with tongs and wrenches without the use of handle extensions. Any joints that leak shall be cleaned and remade with new material. Caulking or thread cement to make joints tight will not be permitted.

P.V.C. plastic pipe couplings and fittings shall be handled and installed in accordance with the manufacturer's recommendation. The outside of the PVC pipe shall be chamfered to a minimum of 1/16 inch at approximately 22 degrees. Pipe and fittings shall be joined by solvent welding.

Chemicals used must penetrate the surface of both pipe and fitting which will result in complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer.

On plastic to metal connections, work the metal connection first. Use a non-hardening compound on threaded connections. Light wrench pressure is all that should be used. Connections between metal and plastic are to be threaded utilizing female threaded adapters only, not male adapters.

Polyethylene pipe and fittings shall be installed in accordance with the manufacturer's recommendations. The ends of the polyethylene pipe shall be cut square and inserted to the full depth of the fitting. Clamps for insert fittings shall be stainless steel.

49-3.04 SPRINKLER INSTALLATION

Sprinkler heads located within lawn areas shall be installed on temporary high risers approximately 12 inches above finished grade. Once turf has been established the Contractor shall, upon written notice from the Engineer, lower the heads to final position as a part of the contract. Lowering of sprinkler heads shall be completed within 30 days after receipt of written notice. Final position of turf heads shall be between 1/2 and 1 inch above finished grade measured from the top of the sprinkler. All sprinklers adjacent to walks, curbs and pavement shall be placed at the same elevation and 6 inches from such structure.

Shrub heads, unless otherwise specified, shall be placed on high risers elevating them approximately 12 inches above finished grade. Lowering of shrub heads will not be required.

Final position of valve boxes, capped sleeves and quick coupler valves shall be between 1/2 and 1 inch above finished grade.

49-3.05 WATER LOOPS

The water loops shall be placed so they encircle the base of the planted trees which should be centered within the loops.

49-3.06 ELECTRICAL WIRE INSTALLATION

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 ty-wraps.

All splice insulation shall consist of electrical conductors twisted and bonded by approved pressure connectors and contained in a rigid clear plastic epoxy filled mold. Splices will be permitted only at junction boxes, valve boxes, pole bases or at control equipment. A minimum of 2 feet excess of conductors shall be left at junction boxes

Section 50—Monuments

and automatic control valves to facilitate splicing and inspection.

49-3.07 FLUSHING AND TESTING

All main supply lines shall be flushed completely of foreign particles before placing section control valves, quick-coupler valves and hose bibs. After flushing and when valves are in place, all main supply lines shall be hydrostatically tested at one hundred and fifty (150) p.s.i. static pressure with valves closed. When test pressure is applied for a period of not less than 30 minutes with a pressure loss of not more than 5 p.s.i. the section tested may be considered acceptable.

After installation of section lines, the piping shall be completely flushed of foreign particles before attaching sprinkler heads and drain valves. After flushing, section lines shall be tested at maximum design operating pressure with risers capped and drain valves closed. Any pipe, fitting or joints showing leaks shall be separated, cleaned and remade. When test pressure is applied for a period of not less than 30 minutes with a pressure loss of not more than 5 p.s.i. the section tested may be considered acceptable.

All polyethylene piping shall be completely flushed, capped and tested before placing valves, heads, drains or leader tubes. Lines shall be tested for minimum periods of one hour at operating line pressures with drain valves closed. At the ends of the test periods, the installations shall be inspected for leaks and any such found shall be corrected by the Contractor and the lines retested. When conditions exist which interfere with visual inspections of lateral installations the Engineer may require that testing be done with pressure gauges installed on the lines. In this event the laterals shall be tested for minimum periods of one hour at static line pressure with risers capped and valves closed. Lines which show 5 p.s.i. or greater loss of pressures at the end of specified periods shall be rejected. The Contractor shall check the installation for leaks and retest the line as specified until leaks are stopped.

Water loop leader tubes shall be tested after installation at operating pressure of 1/2 hour.

These same testing procedures shall be used, at the discretion of the Engineer, to test all mainlines and laterals following the repair of any break or disruption of service of the system throughout the life of the contract.

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 manufacturer's direction and test until operation is satisfactory.

49-3.08 ADJUSTING SYSTEM

Before final inspection the Contractor shall adjust and balance all sprinklers to provide adequate and uniform coverage. Spray patterns shall be balanced by adjusting individual sprinkler heads with the adjustment screws or replacing nozzles to produce a uniform pattern. Unless otherwise specified, sprinkler spray patterns will not be permitted on pavement, walks or structures.

49-3.09 BACKFILL

Backfill shall not be started until all piping has been inspected, tested and approved by the Engineer, after which, backfilling shall be completed as soon as possible. Upon completion of all piping in the same trench, backfill shall be completed as specified. Trenches containing P.V.C. Plastic Pipe shall have a sand cushion from 1 inch depth below the pipe to 2 inches above the pipe. Backfill from the bottom of the trench to approximately 6 inches above the pipe shall be by continuous compacting in such a manner that will not damage pipe or wiring and shall proceed evenly on both sides of the pipe. The remainder of the backfill shall be thoroughly compacted, except that heavy equipment shall not be used within 18 inches of any pipe. All backfill material shall be free of rocks, roots or other objectionable material. The top 6 inches of the backfill shall be of top soil material or the first 6 inches of material removed in the excavation.

49-4 MEASUREMENT AND PAYMENT

Payment will be made for such of the following bid items as are included and shown in any particular contract:

"Manual Sprinkler Irrigation System Complete," lump sum.

"Automatic Sprinkler Irrigation System Complete," lump sum.

The lump sum contract prices for "Manual Sprinkler Irrigation System Complete" and/or "Automatic Sprinkler Irrigation System Complete" shall be full compensation for furnishing all labor, materials, tools and equipment necessary or incidental to the construction of the complete sprinkler system as shown on the plans.

All additional material and labor, not shown on the plans or called for herein and which are required to complete the sprinkler system, shall be considered as incidental to the construction and be included in the lump sum contract prices. No additional compensation will be allowed.

Section 50—Monuments

50-1 DESCRIPTION

This work consists of the resetting of survey monuments, cast iron frames and covers which during construction will be covered over, damaged or otherwise rendered useless. The work may consist of constructing monuments, adjusting monuments to proper grade, and the furnishing and placing of materials and other related work in accordance with the standard drawings.

50-2 MATERIALS

Monument cast iron frames and covers, bronze marker plugs, precast concrete monuments, poured monuments, or other types of monuments shall be of the quality, material, and the dimensions shown on the standard drawings, the plans and the special provisions.

Frame and cover castings shall conform to the requirements of ASTM A 48 Class 25 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 provide test bars as per ASTM A 48 for all orders of 200 or more units when called for in the special provisions, and upon request of the Owner the manufacturer shall certify that the product conforms to the requirements of these specifications.

When painting is called for in the special provisions, a bituminous coating equivalent to Preservative Paint Co. No. 25-22 Black Dip Paint shall be applied to all faces. The Owner shall have the right to require inspection and approval of all castings prior to painting.

Monument cast iron frames and covers shall be machine finished or ground on seating surfaces so as to assure non-rocking fit in any position, and interchangeability. At the request of the Owner, there shall be made available at the foundry standard frames and standard covers for use by inspectors in testing fit and seating.

50-3 CONSTRUCTION DETAILS

50-3.01 REFERENCE POINTS

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 plans 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.

50-3.02 PRECAST CONCRETE MONUMENTS

Where called for on the plans or where directed by the Engineer, the Contractor shall furnish and install

Section 51—Sidewalk Drain for Building Downspouts, Sidewalk Drain and Area Drain

precast monuments. These monuments shall be set to proper line and grade upon a sound, well compacted base, and shall be backfilled and thoroughly tamped to the satisfaction of the Engineer.

50-3.03 POURED MONUMENT

Where called for on the plans, or where directed by the Engineer, the Contractor shall construct the monument by placing it in concrete mix and inserting a bronze marker plug to the required line and grade.

The Owner will furnish the bronze marker plug without charge.

Poured monuments shall be either Type A or Type B, as required in the special provisions and by the standard drawings.

50-3.04 MONUMENTS ON CEMENT CONCRETE PAVING PROJECTS

Unless otherwise provided, bronze marker plugs will be furnished by the Owner and will be placed by its own forces in the pavement surface at the time of pour. The Contractor will be required, however, to block out forms where necessary to provide for placement of monument in the subsequent adjacent pour and this work shall be considered as incidental and the costs thereof shall be included in various pay items of the work. Where conditions require other types of monuments, the Contractor shall construct them in accordance with the plans and for such payment as may be shown in the proposal or otherwise provided.

50-3.05 FURNISHING AND PLACING MONUMENT CASTINGS

Where called for on the plans or where directed by the Engineer, the Contractor shall furnish and install castings to the line and grade established by the Engineer.

50-3.06 ADJUSTMENT OF EXISTING MONUMENT CASTINGS TO GRADE

Where shown on the plans or where encountered on the project the existing monument castings shall be adjusted to the grade furnished by the Engineer. Procedure for these adjustments is described in Section 53 entitled, "Adjustment of New and Existing Utility Structures to Finish Grade."

50-4 MEASUREMENT AND PAYMENT

Payment will be made at the unit contract price for such of the following bid items as are included in any particular contract:

1. "Precast Monument," per each.
2. "Poured Monument (Type)," per each.
3. "Furnish and Place Monument Frame and Cover," each.
4. "Adjust Monument Frame and Cover," per each.

The unit contract prices for the items enumerated above shall be full compensation for all labor, tools and materials and for all incidental work required in setting the castings in accordance with the plans, drawings and specifications to the satisfaction of the Engineer.

Section 51—Sidewalk Drain for Building Downspouts, Sidewalk Drain and Area Drain

51-1 DESCRIPTION

Where shown on the plans or designated by the Engineer, the Contractor shall construct sidewalk drains of the required type which are designed to carry storm water from the building downspout, inlets or from existing pipes, under the sidewalk surface through the curb into the street gutter.

Where shown on the plans or designated by the Engineer, the Contractor shall construct area drains of the type specified in the contract. If modification becomes necessary

to meet a particular need and has not been described on the plans or special provisions, the modification shall be made by the Contractor under directions by the Engineer.

51-2 MATERIALS

The three (3) inch diameter plastic pipe used shall be Schedule 40, Type P.V.C. conduit, or equal.

All materials incorporated into the drain structure shall meet the requirements of the various applicable sections of these specifications and as outlined on the various standard drawings.

51-3 CONSTRUCTION DETAILS

General

The five types of sidewalk drains are as follows:

1. Sidewalk drain for building downspout Type I.
2. Sidewalk drain for building downspout Type II.
3. Residential sidewalk drain.
4. Commercial sidewalk drain Type 'A'.
5. Commercial sidewalk drain Type 'B'.

Sidewalk drains may be constructed simultaneous with new sidewalk construction or may be constructed where a sidewalk already exists.

The two types of area drains are as follows:

1. Area Drain, Type I.
2. Area Drain, Type II.

Sidewalk drains and area drains shall be constructed as shown on the applicable standard drawing for the type specified in the contract.

The construction of any pipe required back of the sidewalk to connect an existing pipe to the drain, any concrete sawing and any concrete removal shall be paid for by applicable bid items as listed in the proposal.

Pipe joints shall be of the type outlined in the special provisions. Trench excavation shall be made in such a manner as to provide an undisturbed base upon which the pipe and inlet shall be placed.

Backfill shall be compacted native or selected material as directed by the Engineer. Select material shall be paid for by applicable bid item.

Connection to inlet shall be mortared and made flush with inside wall.

51-4 MEASUREMENT

51-4.01 SIDEWALK DRAIN FOR BUILDING DOWNSPOUT

Measurement for sidewalk drain for building downspout will be per linear foot for the length of drain constructed.

51-4.02 RESIDENTIAL SIDEWALK DRAIN

Measurement for, "Residential Sidewalk Drain," shall be per each. Limits of construction shall be from back of walk to face of curb and between dummy joints as shown on the standard drawing.

51-4.03 COMMERCIAL SIDEWALK DRAIN, TYPE 'A'

Measurement for, "Commercial Sidewalk Drain, Type 'A,'" shall be per linear foot measured from face of curb to face of inlet.

51-4.04 INLET FOR SIDEWALK DRAIN, TYPE 'A'

Measurement for, "Inlet for Sidewalk Drain, Type 'A,'" shall be per each.

51-4.05 COMMERCIAL SIDEWALK DRAIN, TYPE 'B'

Measurement for "Commercial Sidewalk Drain, Type 'B,'" shall be per linear foot measured from face of curb to end of steel adapter and for the width shown on the standard drawing.

51-4.06 AREA DRAIN, TYPE I

Measurement for, "Area Drain, Type I," shall be per each measured from the first one-eighth (1/8) bend to the drain casting station shown on the plan.

Section 52—Removal of Existing Street Improvements

51-4.07 AREA DRAIN, TYPE II

Measurement for, "Area Drain, Type II," shall be per each.

51-5 PAYMENT

Payment will be made for such of the following bid items as are included in any particular contract:

1. "Sidewalk Drain for Building Downspout, Type I," per linear foot.
2. "Sidewalk Drain for Building Downspout, Type II," per linear foot.
3. "Residential Sidewalk Drain," per each.
4. "Commercial Sidewalk Drain, Type 'A'," per linear foot.
5. "Inlet for Commercial Sidewalk Drain, Type 'A'," per each.
6. "Commercial Sidewalk Drain, Type 'B'," per linear foot.
7. "Area Drain, Type I," per each.
8. "Area Drain, Type II," per each.

The unit contract price for each of the above items, (numbers 1 through 8) shall be full compensation for all labor, equipment, and materials including excavation, water and compaction, required to construct the drain called for in the bid proposal and the requirements of the applicable standard drawing.

Section 52—Removal of Existing Street Improvements

52-1 DESCRIPTION

The work shall consist of the removal and disposal of various existing improvements, such as pavements, structures, pipe, curb, gutter, gutter and other items necessary for the accomplishment of the improvement. Some of the items may be included in the bid proposal or covered elsewhere in the specification or special provisions.

Removal of items or things not contained in this section or in other sections of these standard specifications shall be considered as incidental to the construction and the costs thereof shall be included in other items of the contract by the Contractor, unless the special provisions and proposal specifically provide payment therefor.

52-2 CONSTRUCTION DETAILS

52-2.01 GENERAL

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

When sawing of concrete or combinations of rigid materials is called for in the plans or in the special provisions, the Contractor will be paid therefor at the unit contract price for the quantity involved. The depth of cut shall be such as will accomplish the intended purpose and will be determined in the field to the satisfaction of the Engineer.

Whenever the sawing will be performed by forces of the Owner, it will be so noted in the special provisions, otherwise, the Contractor shall perform the sawing.

52-2.02 REMOVAL OF PAVEMENT

Classification of pavement removal for concrete pavement and asphaltic concrete pavement shall be as follows:

Type I—Pavement removal shall consist of pavement removal where portions or all of existing pavements are being removed in conjunction with street construction and any other removal not described below for Type II and Type III.

Type II—Pavement removal shall be pavement removal required for the placing of utilities at greater and

varying depths, such as sewers, because of variable underground conditions, the limits of the pavement removal cannot be accurately determined prior to actual construction.

Type III—Pavement removal shall consist of the removal required for narrow and shallow utility cuts in order to install light cables, conduits and similar shallow utilities.

The Contractor shall remove existing permanent type pavement and driveway pavement shown on the plans or as directed by the Engineer. Permanent type pavements will be classified according to their composition and thickness as defined below, unless the special provisions and proposal provide otherwise.

In the event a pavement, classified as described below, shall average more than the maximum thickness specified for its class, an additional payment will be made to cover the extra thickness removed by a proportional conversion into additional square yards as extra work under Section 9.03.

-2.02A Pavement Removal, Class A

Class A pavement removal shall apply to all nonreinforced cement concrete pavement having average thickness between four (4) inches and ten (10) inches.

-2.02B Pavement Removal, Class AA

Class AA pavement removal shall apply to the removal of all cement concrete pavement which is reinforced with uniformly spaced longitudinal and transverse steel bars, or steel wire mesh, and which has pavement thickness that averages between four (4) inches and ten (10) inches.

-2.02C Pavement Removal, Class B

Class B pavement removal shall apply to all pavements which have a wearing surface of asphalt concrete upon a cement concrete pavement or cement concrete base, and for which the total combined thickness of the pavement will average between seven (7) inches and twelve (12) inches.

-2.02D Pavement Removal, Class C

Class C pavement removal shall apply to early type pavement of a cement concrete base upon which is a brick or cobblestone wearing surface (or perhaps an additional layer of asphalt concrete upon that), and for which the total combined thickness of pavement will average between ten (10) inches and twenty (20) inches.

52-2.03 REMOVAL OF ASPHALT CONCRETE PAVEMENT

Removal of existing pavements such as asphalt concrete, bituminous road mix, multiple lift bituminous surface treatments and any other combinations of above described components, placed upon an earth or granular subgrade located within the roadway excavation area shall be removed and paid for as "Common Excavation, per cubic yard." The roadway excavation area is defined as the area 1 foot back of new curbs on either side and all areas in between and as further defined in Section 13-3.04.

Where asphalt concrete pavement exists in planting strips and is to be removed, it will be paid for as "Remove Existing Asphalt Concrete Pavement," per square yard.

Where "Remove Existing Asphalt Concrete Pavement," per square yard is being paid for and a vertical meet line must be trimmed, it shall be considered incidental to the removal. However, if no removal is being paid for, and a vertical meet line is required, then a pay item for "Chipping Existing Asphalt Surface," per linear foot, shall be paid.

Removal of asphalt concrete surface from rigid pavements performed in conjunction with street paving where it is necessary to remove asphalt concrete from rigid base pavements to permit meeting of old and new pavements, the Contractor shall remove the asphalt surfaces completely from those areas designated by the Engineer. Unless otherwise directed by the Engineer, this work shall be performed immediately before placing of the new pavement and shall include the cutting of all meet lines. This work shall be paid for at the unit contract price per square yard for "Chipping Existing Asphalt Surface," per square yard.

Section 53—Adjustment of New and Existing Utility Structures To Finish Grade

Side street approaches to the project and street approaches at each end of the project paved with asphalt concrete having a depth of greater than two inches, on an earth or granular base and which are to be removed, will be paid for as "Remove Existing Asphalt Concrete Pavement," per square yard beyond the radius point of returns to the limits of construction, as directed by the Engineer. Except that asphalt pavement removed shall be paid for only on that portion where asphalt pavement must be removed beyond the point where a full depth pavement section as shown on the construction plans is to be constructed.

52-2.04 REMOVAL OF CURBS

Existing curbs shall be removed where shown on the plans or where encountered in the work and designated by the Engineer. There are several types of this work. When the integral curb is to be removed by cutting the base horizontally and thus preserve the slab or base below the curb, the removal shall be considered as Class A. When the integral curb is to be removed together with the base material by cutting vertically, it shall be considered as Class B. When pavement is being removed, the curb shall be considered as pavement removal and the measurement for payment thereof will be made to the back of the curb. Precast curbs and curbs of other materials which are to be removed will be further identified on the plans and in the proposal if payment is contemplated; otherwise, the second paragraph of Section 52-1 will apply.

52-2.05 REMOVAL OF CURB AND GUTTER

Curb and gutter to be removed may be of cement concrete, or may be a cement concrete curb with a brick gutter on a cement concrete base, or may be other combinations of rigid materials. In any event it is intended that the full section shall be removed.

Where cement concrete pavement is being removed, curb and gutter removal shall be considered as pavement removal and the measurement for payment thereof will be to the back of the curb.

52-2.06 REMOVAL OF CEMENT CONCRETE SIDEWALKS

All concrete slabs that average four (4) inches or less in thickness and which are to be removed, shall be considered as sidewalk removal. Pavement breakers used for this purpose shall meet the requirements previously outlined for pavement removal. Where concrete sawing is required, the provisions previously described shall obtain. Sidewalk aprons and private walks on street grading and paving projects shall be removed to the extent necessary to provide for construction of pavements and curbs. After the curbs and pavement have been constructed, the Contractor will be required to remove any additional sidewalk required to provide proper connections and grades, as determined by the Engineer.

52-2.07 REMOVAL OF CATCH BASINS, MANHOLES, CURB INLETS, SUMPES, ETC.

Where structures or installation of concrete, brick, blocks, etc., interfere with the construction, they shall be removed and all pipe openings shall be properly plugged watertight with Class 5 (¾) concrete, or with mortar and masonry, blocks or brick. Payment therefor will be made in accordance with bid items in the proposal. If however, there is no bid item to cover any one or more of such removals, then in that event the removal shall be considered as incidental to the construction and costs thereof shall be included in other items of the work.

Where the structures are removed, the voids shall be backfilled with suitable job excavated material and compacted as the Engineer may direct, and such compaction work shall be considered as incidental to the removal work.

If the Engineer determines the job-excavated material to be unsuitable for backfill and he, therefore, specifies or directs a backfill from another source shall be used, the payment therefor will be made at the unit contract price if same is carried in the proposal, or as extra work under Section 9.03 if not included as an item in the proposal.

The removal and disposal of wooden structures shall be considered as incidental to the work, unless payment is otherwise provided in the special provisions and proposal.

52-2.08 SALVAGE

Unless otherwise indicated in the construction plans or in the special provisions, 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.

52-2.09 WASTE DISPOSAL

Unless otherwise provided in the plans, the Contractor shall provide the waste site for disposal of materials not required for the construction, as defined in Section 4.06.

52-3 MEASUREMENT AND PAYMENT

Measurement and payment will be made for such of the following items as may be included in the proposal of any particular contract:

1. "Remove Existing Pavement, Type Class A," per square yard.
2. "Remove Existing Pavement, Type Class AA," per square yard.
3. "Remove Existing Pavement, Type Class B," per square yard.
4. "Remove Existing Pavement, Type Class C," per square yard.
5. "Remove Existing Asphalt Concrete Pavement, Type", per square yard.
6. "Remove Existing Curb Type", per linear foot.
7. "Remove Existing Curb and Gutter," per linear foot.
8. "Remove Cement Concrete Sidewalk," per square yard.
9. "Remove Catch Basin," per each.
10. "Remove Manhole," per each.
11. "Remove Inlet," per each.
12. "Remove Curb Inlets," per each.
13. "Remove Sumps," per each.
14. "Sawing Pavement," per linear foot.
15. "Chipping Existing Asphalt Surface," per linear foot.
16. "Chipping Existing Asphalt Surface," per square yard.

Section 53—Adjustment of New and Existing Utility Structures To Finish Grade

53-1 DESCRIPTION

This work consists of constructing and/or adjusting all new and existing utility structures encountered on the project to finished grade.

53-2 DIVISION OF RESPONSIBILITY

53-2.01 PRIVATELY OWNED UTILITY STRUCTURES

Privately owned utilities are generally in 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 facilities. These agencies will locate and make all adjustments to their respective structures at no charge to the Contractor.

53-2.02 PUBLICLY OWNED UTILITY STRUCTURES

Publicly owned structures that are to be adjusted to finished grade by the Contractor will be listed in the bid proposal. Where these are not shown in the proposal, the public utility will make necessary adjustments at no cost to the Contractor.

53-2.03 CONTRACTOR TO SCHEDULE WORK

The Contractor shall schedule his work and cooperate

Section 53—Adjustment of New and Existing Utility Structures To Finish Grade

to the fullest extent so that structure adjustments by others can be satisfactorily accomplished. The Contractor shall do all pavement patching which may be necessary after adjustment of structures, and the cost thereof shall be considered as incidental to the adjustment of the various structures, except as modified hereinafter, and except that private utilities shall reimburse the Contractor for such patching.

53-3 CONSTRUCTION DETAILS

53-3.01 ADJUSTING OF MANHOLES, CATCH BASINS AND SIMILAR STRUCTURES

-3.01A General

Manholes shall be brought to proper finished grade by utilizing the same methods of construction as required for manhole construction in Section 63.

-3.01B Unpaved Street Grading Projects

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 eight (8) inches below the subgrade and covered with a temporary wood cover as shown on the standard drawing. 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 manholes and manhole castings shall be constructed to the finished grade of the roadway surface. Excavation necessary for bringing manholes to grade shall center about the manhole and be held to the minimum area necessary. At the completion of the manhole adjustment, the void around the manhole shall be backfilled with materials which will result in the section required on the typical roadway section, and be thoroughly compacted.

Where bituminous surface treatment is to be placed, the manhole castings shall be installed from one-half (1/2) inch to one (1) inch higher than the roadway surface, as the Engineer may direct.

-3.01C Cement Concrete Paving Projects

Manholes, catch basins and similar structures shall be constructed or adjusted in the same manner as outlined in Section 53-3.01B 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.

-3.01D Asphalt Concrete Paving Projects

On asphalt concrete paving projects, the manholes shall not be adjusted until the pavement is completed, at which time the center of each manhole shall be carefully relocated from references previously established by the Contractor. The pavement shall be cut in a restricted area and base material be removed to permit removal of the cover. The manhole shall then be brought to proper grade utilizing the same methods of construction as for the manhole itself.

The cast iron frame shall be placed on the concrete blocks and wedged up to the desired grade. The asphalt concrete pavement shall be cut and removed to a neat circle, the diameter of which shall be equal to outside diameter of the cast iron frame plus two (2) feet. The base materials and crushed rock shall be removed and Class 5 (1 1/2) concrete shall be placed so that the entire volume of the excavation and up to within, but not to exceed one and one-half (1 1/2) inches of the finished pavement surface.

On the following day the concrete, the edges of the asphalt concrete pavement, and the outer edge of the casting shall be painted with hot asphalt cement. Asphalt concrete shall then be placed and compacted with hand tampers and a patching roller. Asphalt concrete will be paid for as "Asphalt Concrete Pavement, Class B," per ton.

The completed patch shall match the existing paved surface for texture, density, and uniformity of grade. The

joint between the patch and the existing pavement shall then be carefully painted with hot asphalt cement or asphalt emulsion and shall be immediately covered with dry paving sand before the asphalt cement solidifies.

The inside throat of the manhole shall be thoroughly mortared and plastered.

-3.01E Asphalt Resurfacing Projects

Adjustment of manholes on asphalt resurfacing projects shall meet the requirement of Section 53-3.01D. Unless adjustment rings for castings are provided for in the special provisions or bid proposal, 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.

-3.01F Storm and Sanitary Sewer or Water Projects

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.

-3.01G Establishment of Grade for Top of Manhole

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.

53-3.02 ADJUSTMENT OF INLETS

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 six (6) inches beyond the edge of the casting and shall be left one and one-half (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.

53-3.03 ADJUSTMENT OF MONUMENTS AND CAST IRON FRAME AND COVER

Monuments and monument castings shall be adjusted to grade in the same manner as for manholes.

53-3.04 ADJUSTMENT OF VALVE BOX CASTINGS

Adjustment of valve box castings shall be made in the same manner as for manholes.

53-3.05 FURNISHING CASTINGS

Where adjustment of existing manholes, catch basins, inlets, valve boxes, etc. are required and the existing castings are discarded or ordered to be salvaged by the Engineer, the Contractor shall furnish new castings of the type specified, and payment therefor will be made as specified in the proposal and will be in addition to payment for making the adjustment. Ring extensions shall be in accordance with the Standard Drawing.

53-4 MEASUREMENT AND PAYMENT

Payment will be made for such of the following applicable bid items as are included and shown in any particular contract, consistent with measurement and payment requirements contained in the specifications for each particular item.

1. "Adjust Existing Manhole, Catch Basin or Valve Chamber With (.....) Ring Extension to Grade," per each.
2. "Adjust Existing Inlet to Grade," per each.
3. "Adjust Existing Monument Frame and Cover to Grade," per each.

Section 54—Pavement Patching

4. "Adjust Existing Manhole, Catch Basin or Valve Chamber With (.....) Ring Extension to Grade," per each.
5. "Adjust Existing Inlet With (.....) Ring Extension to Grade," per each.
6. "Adjust Existing Monument Frame and Cover with (.....) Ring Extension to Grade," per each.
7. "Furnish Valve Chamber Frame and Cover," per each.
8. "Shafting (diameter)," per linear foot.
9. "Furnish Manhole Ring and Cover Casting Type (.....)," per each.
10. "Furnish Inlet Frame and Cover Castings Type (.....)," per each.
11. "Furnish Precast Concrete Manhole Reducing Slab (D to d)," per each.

53-4.01 ADJUST EXISTING MANHOLE, CATCH BASIN AND VALVE CHAMBER TO GRADE

The unit contract price for "Adjust Existing Manhole, Catch Basin and Valve Chamber to Grade," shall be full compensation for removing the cast iron frame and cover, removing necessary pavement, cutting the existing structure down where necessary, furnishing and placing temporary wood cover, rebuilding the structure, resetting the existing cast iron frame and cover to proper grade, backfilling the void around the structure, and plastering the structure throat and extension. Where manholes are to be adjusted upward or downward and it is necessary to remove the entire cone section, the entire adjustment will be paid for as specified in Section 53-3.01A.

53-4.02 ADJUST EXISTING INLET TO GRADE

The unit contract price for "Adjust Existing Inlet to Grade," shall be full compensation for removing pavements, casting, upper portion of inlet, whether it is cast iron, concrete or blocks, reconstructing the inlet to the new and proper grade, backfilling the void around the structure, and utilizing the existing cast iron frame and cover.

53-4.03 ADJUST EXISTING MONUMENT FRAME AND COVER TO GRADE

The unit contract price for "Adjust Monument Frame and Cover to Grade," shall be full compensation for removing necessary pavement, for removing and resetting the existing cast iron frame and cover to proper grade, and for backfilling the void around the structure. Where existing castings are not to be used, new ones shall be installed and will be paid for in accordance with Section 53-4.08.

53-4.04 ADJUST EXISTING VALVE BOX TO GRADE

The unit contract price for "Adjust Existing Valve Box to Grade," shall be full compensation for removing necessary pavement and for resetting the casting to proper grade, including backfilling the void around the structure, and all other work incidental thereto.

53-4.05 TYPE, OR SIZE, MANHOLE EXTRA DEPTH

The unit contract price per vertical foot for "Type.....(or size) Manhole, Extra Depth" shall be full compensation for all costs incurred in completing the construction of the new manhole in accordance with the specifications of Section 63, with measurement and payment as described in sections 63-4 and 63-5.

53-4.06 ADDITIONAL DEPTH SHAFTING FOR EXISTING MANHOLE

Additional shafting for existing manhole beyond the limits as outlined in Section 53-4.01 shall be paid for at the unit contract price per vertical foot for "Additional Depth Shafting for Existing Manhole." This shall be full compensation for all costs incurred in completing the upward adjustment of the manhole frame and grate to proper grade. Construction of the additional shafting shall comply with Section 63 of these specifications.

53-4.07 TYPE.....INLET IN PLACE

The unit contract price per each for "Type..... Inlet," shall be full compensation for furnishing all labor,

equipment and material necessary to construct inlets as shown on the standard drawing and in accordance with Section 64, including the adjustment to finished grade.

53-4.08 FURNISHING CASTINGS

Where adjustment of existing manholes, catch basins, inlets, valve boxes, etc. are required, and where the existing castings are discarded or ordered to be salvaged by the Engineer, the Contractor shall furnish new castings of the type specified. In such case, the Contractor will be paid the unit contract price for each adjustment item and also the unit contract price for each type of casting involved.

53-4.09 ASPHALT CONCRETE

Asphalt concrete or bituminous plant mix used in patching around various types of structures or casting adjustments will be paid for in accordance with the unit contract price per ton for "Asphalt Concrete, Class B" or per ton for "Class F Asphalt Concrete," whichever is used.

53-4.10 INCIDENTAL WORK

Any work required to make adjustments to manholes, catch basins, inlets, sumps, valve boxes, monuments, etc., which is not specifically mentioned in the foregoing specifications, shall be considered as incidental to the construction, and all costs thereof shall be included by the Contractor in his unit contract prices.

Section 54—Pavement Patching

54-1 DESCRIPTION

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 standard drawing.

54-2 MATERIALS

All materials shall conform to the requirements specified for material in other sections of these standard specifications, such as for instance, sections 27 and 37.

54-3 CONSTRUCTION DETAILS

54-3.01 GENERAL

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 provided for 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 proposal. Curing compound as specified in Section 37-2.09 shall be placed on the concrete immediately after finishing.

Proper signs, barricades, lights and other warning devices, as may be approved by the Engineer, shall be maintained all 24 hours of the day until the patch is completed and ready for traffic.

54-3.02 CEMENT CONCRETE PAVEMENTS

After the subgrade for the pavement has been compacted and constructed 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 39. Through and dummy joints shall be placed and edged where directed. The surface shall be finished and brushed with a fiber brush. Approved curing compound

Section 55—Top Soil

shall be placed on the finished concrete immediately after finishing.

The Contractor shall furnish, place and maintain until final settlement, to the satisfaction of the Engineer, a 2-inch thick crushed surfacing base course and a 2-inch thick cold asphalt plant mix patching over trench areas when and where directed by the Engineer. Also, such temporary crushed base and asphalt concrete pavement may be required by the Engineer at any time the roadway is needed for vehicular traffic and permanent pavement cannot be placed. Stockpile of the crushed base and plant mix shall be provided on the site by the Contractor. The Contractor shall remove the temporary base and asphalt, clean the exposed face of the existing concrete, and restore the concrete pavement herein specified at the time directed by the Engineer.

54-3.03 RIGID TYPE PAVEMENTS RESURFACED WITH ASPHALT CONCRETE

Streets which have rigid type pavements resurfaced with asphalt concrete shall be patched as shown on the standard drawing, 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 CSS-1 asphalt emulsion diluted with water as directed by the Engineer.

Asphalt concrete or bituminous plant mix shall not be placed until the day 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 hot asphalt cement or asphalt 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. The material for tacking the bottom and sides of patches for asphaltic concrete shall be an emulsion called CRS-2. For sealing the edges after placing the asphaltic concrete patch, use a light cutback called RC 70, then sand the surface to prevent tracking.

54-3.04 ASPHALT CONCRETE STREETS ON GRANULAR BASE

After the subgrade has been prepared as shown on the standard drawing, 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 two (2) inches, whichever depth is the greater, and compacted in the manner specified in Section 54-3.03.

54-3.05 OIL MAT STREETS

The existing oil mat shall be uniformly trimmed to a straight line. After the subgrade has been prepared as shown on the standard drawing, or as directed by the Engineer, a minimum of two (2) inches of asphalt concrete pavement Class B shall be placed and completed in the same manner as specified in Section 54-3.03.

54-3.06 INCIDENTAL WORK

All incidental work required to complete the patching of street surfaces as specified, including joints where required, shall be considered as incidental to the patching and the costs thereof shall be included in the items for which payment is provided.

54-3.07 RESPONSIBILITY FOR PAVEMENT PATCHING

On all public works contracts, the Contractor shall perform all work backfilling of excavations made under existing pavements, and the restoration of pavement cuts and patching, in accordance with these specifications unless otherwise provided in the special provisions of the proposals.

54-4 MEASUREMENT AND PAYMENT

Payment for pavement patching above subgrade will be made in the following items:

1. "Cement Concrete Class 6.5(1½) H.E.S. for Pavement Patch," per cubic yard.
2. "Asphalt Concrete Class B for Pavement Patch," per square yard-inch.
3. "Asphalt Concrete Class F for Pavement Patch," per square yard-inch.
4. "Cold Plant Mix for Temporary Pavement Patch," per ton.

Measurement for payment of cement concrete used in patching will be based upon computation of the neat lines of the section shown on standard drawing, and not by batch volume.

The unit contract price per cubic yard for cement concrete and per ton of asphalt concrete or bituminous plant mix as shown in the proposal shall be full compensation for all labor, tools and materials and for all incidental work required to complete the patching in accordance with the specifications and standard drawing, excepting however, that payment for selected materials will be made in accordance with applicable bid items but compaction of the materials shall be considered as incidental to the construction and no payment will be made therefor.

Section 55—Top Soil

55-1 DESCRIPTION

These specifications shall apply where the plans or special provisions require the procurement of top soil by the Contractor for the surface finishing of an area, or where the removal and replacement of existing top soil is required for the finishing of a specific construction area, generally in lawns or planting strips.

55-2 MATERIALS

55-2.01 TOP SOIL

-2.01A Top Soil, 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, rhizomes, roots; subsoil; stones and other debris. One hundred percent of the topsoil shall pass through a inch screen. Maximum Electrical Conductivity shall be 2.0 millimhos 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	65%
Silt	80%
Clay	45%

The maximum allowable percentage of gravel retained on a ¼ inch screen shall not exceed 20 percent by volume. Of the material passing the ¼ 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% to 10% except in samples containing more than 20% clay, it shall be 2% to 10%. Organic matter shall be determined by the Walkley-Black sulphuric acid dichromate digestion process. The pH shall be 5.5 to 8.0.

-2.01B Top Soil, Type B

Topsoil that is required to be furnished by the Contractor from a source other than the area upon which it will be placed shall consist of fertile, friable soil, preferably of a loamy character, typical of the top soil common to the locality, and it shall contain a normal amount of organic matter. It shall be obtained from arable land and shall be free from subsoil, refuse and other deleterious

Section 56—Lawn Removal and Replacement

substances. It shall be reasonably free from brush, roots, heavy clay, sticks, roots of noxious weeds or grasses and other litter, and shall contain no stones or gravel larger than one-half (½) inch in diameter. It shall be free of toxic amounts of either acid or alkaline elements and be capable of sustaining healthy plant life. A sample of the top soil shall be submitted to the Engineer for approval prior to placement.

55-3 CONSTRUCTION DETAILS

55-3.01 PLACEMENT OF TOP SOIL

Immediately prior to placing top soil, the surface area upon which it is to be placed shall be cleaned of objectionable matter and the area be smoothed and compacted.

Top soil shall be placed where shown on the construction plans and to depths provided for in the special provisions, or direction of the Engineer. It shall be leveled, raked, and compacted so as to provide a well-shaped and uniform appearance.

55-3.02 REMOVAL AND REPLACEMENT OF TOP SOIL

Whenever it is necessary to remove top soil with the purpose of later replacing it in the same area, the Engineer will direct the limits of the area and the depth of top soil to be removed. The top soil shall be removed in a uniform depth and be stored in such manner that it will not become mixed with unsatisfactory soils. After the trench has been backfilled, the stored top soil shall be replaced at a uniform depth in its original area. The top soil shall then be shaped, leveled, and compacted to blend with the contour of adjacent ground.

In the event that additional top soil is required and is procured from a source other than the construction area, the Contractor shall furnish and place it in compliance with Section 55-3.01 and the intent of this subsection.

55-4 MEASUREMENT

55-4.01 TOP SOIL

Measurement of top soil will be made by the cubic yard in net volume of truck loads at point of delivery.

55-4.02 REMOVAL AND REPLACEMENT OF TOP SOIL

Top soil removed and later replaced in original area will be measured by the cubic yard calculated upon the square footage of the area by the depth of soil removed.

55-5 PAYMENT

Payment will be made for such of the following items as are included in the proposal of any particular contract:

1. "Top Soil, Type A" per cubic yard.
2. "Top Soil, Type B" per cubic yard.
3. "Remove and Replace Top Soil" per cubic yard.

The unit contract price per cubic yard for "Top Soil" shall be full compensation for the furnishing, hauling and placing of the soil in accordance with the specifications, whether it be for the full depth upon any area or an additional quantity required where removal and replacement of top soil resulted in a deficiency.

The unit contract price per cubic yard for "Remove and Replace Top Soil" shall be full compensation for all work and costs of scalping the original soil from an area, transporting it to storage, and then replacing it in the area in accordance with the specifications.

Section 56—Lawn Removal and Replacement

56-1 DESCRIPTION

56-1.01 SOD REMOVAL AND REPLACEMENT BY SEEDING

In many areas the existing lawn is such that the re-

moval and replacement of existing sod is not feasible. In these areas, where lawn repair is a part of the project and is included in the bid proposal, the Contractor shall replace all lawn areas which are damaged during construction and plant lawn where shown on the construction plans and/or as directed by the Engineer.

Where lawn repair is required in the bid proposal and the existing sod is not suitable for replacement, the Contractor may at his option use sod brought in from an outside source in lieu of reseeding. If the Contractor so elects to use sod from an outside source, this source of supply must be approved by the Engineer.

56-1.02 SOD REMOVAL AND REPLACEMENT

The work shall consist of the removal and replacement of existing lawn turf by cutting the sod to be replaced into convenient sized squares or strips, cutting to uniform thickness, piling and storing in a dampened condition, and finally replacing the sod in its original position. This work will be performed where the special provisions provide for such work.

The Contractor may at his option use sod brought in from an outside source in lieu of replacing existing sod. If the Contractor so elects to use sod from an outside source, this source of supply must be approved by the Engineer.

56-1.03 SOD REMOVAL AND REPLACEMENT BY NEW SOD

In many areas the existing lawn is such that the removal and replacement of existing sod is not feasible. In these areas, where lawn repair, using new sod, is part of the project and is included in the bid proposal, the Contractor shall replace all lawn areas which are damaged during construction with new sod where shown on the construction plans and/or as directed by the Engineer.

56-2 MATERIALS

56-2.01 TOP SOIL

The soil material shall conform to the requirements of Section 55-2.01A.

56-2.02 SOD REMOVAL AND REPLACEMENT BY SEEDING

All materials to be furnished under this section shall conform to the requirements of Section 47-2.

56-2.03 SOD REMOVAL AND REPLACEMENT BY NEW SOD

All sod shall comply with the State and Federal laws, including quarantines, 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 infested areas. All sod shipments shall contain a "State of Washington Nursery Inspection" sticker issued by the Washington State Department of Agriculture, Division of Plant Industries.

All sod shall be guaranteed to survive in a healthy condition through an establishment period of ninety (90) days. The establishment period shall commence on the date of acceptance of placed sod by the Engineer. All sod which, in the opinion of the Engineer, is not in a healthy growing condition at the end of the establishment period, shall be removed and replaced by the Contractor at his own expense. Sod that is replaced shall be of the same mixture and grade as the surviving sod.

Sod shall be mature, densely-rooted grass and shall possess the following characteristics:

- a. Uniformity.
- b. Acceptable color.
- c. Freedom from serious weeds and weed seeds.
- d. Adequate sod strength for handling.
- e. A minimum amount of thatch.

56-3 CONSTRUCTION DETAILS

56-3.01 SOD REMOVAL AND REPLACEMENT BY SEEDING

Construction details for replacement by seeding shall conform to the requirements of Section 47-3.

Section 57—Finishing and Cleanup

56-3.02 SOD REMOVAL AND REPLACEMENT

The sod shall be removed to a uniform depth of approximately two (2) inches with an approved type of sod cutter. This operation shall be performed in such manner as to insure uniform thickness of sod throughout the operation.

As the sod scalping proceeds, the sod strips shall be placed in neat piles at convenient locations and from then on they shall be maintained in a damp condition continuously until the sod strips are replaced on the lawn. In no case shall the sod remain in piles longer than ten (10) days before replacement on the lawn.

Prior to replacing the strips of sod, the scalped area shall be carefully shaped to proper grade, rototilled to a depth of six (6) inches and lightly compacted.

After rototilling, shaping and lightly compacting the finished grade, the top soil shall be thoroughly dampened and fertilized prior to and immediately before replacing the sod. The sod shall be replaced to the required grade, taking care to butt each piece tightly against the adjacent one. Upon completion, the sod shall be dampened and rolled with a lawn roller.

All tools used shall be of the type specially designed for the work and be satisfactory to the Engineer. In no case shall sod be removed by the use of a mattock or other tool which will not meet requirements specified herein.

Wherever the construction operations have resulted in the placement or exposure of unsuitable or poorer soils in the area to be resodded, the surface shall be left low and covered with top soil meeting all requirements of Section 55-2.01A. Top soil placement and replacement of the existing sod shall then be performed in the same manner as that set forth in Section 56-3.03.

56-3.03 SOD REMOVAL AND REPLACEMENT WITH NEW SOD

-3.03A Grading

-3.03A1 Existing Subsoil Suitable for Sod Installation

Areas to receive sod shall be cleared, grubbed and leveled to a depth of four (4) inches below grade. Two (2) inches of top soil shall be evenly spread over and cultivated into the top six (6) inches of existing subsoil and compacted so that the compacted surface is two (2) inches below finished grade. Topsoil shall be placed according to Section 47-3.01 through 3.03 and Section 55.

-3.03A2 Existing Subsoil is Poor

Areas to receive sod shall be cleared, grubbed and leveled to a depth of six (6) inches below grade. Four (4) inches of topsoil shall be evenly spread over the existing subsoil and compacted so that the compacted surface is two (2) inches below finished grade. Topsoil shall be placed according to Section 47-3.01 through 3.03 and Section 55.

-3.03B Fertilizer

A 10-2-10 fertilizer shall be rototilled into the top four (4) inches of the soil at a rate of four (4) pounds of available nitrogen per 1000 square feet.

-3.03C Sod Placement

Sod shall be placed in accordance with standard horticultural practices. Dry soil shall be moistened by sprinkling. All butt joints shall be staggered. On sloped areas the sod shall be laid with the long dimension parallel to the toe or top of slope. After placing, the sod shall be rolled and heavily watered by sprinkling.

-3.03D Establishment

The Contractor shall be responsible for watering and fertilizing the sod during the establishment period of 90 days per Section 56-2.03. Watering shall be scheduled to prevent drying of joints between sod strips. 6-2-4 fertilizer shall be applied at six (6) week intervals at the rate of one (1) to one and one-half (1½) pounds of available nitrogen per 1000 square feet per application.

56-4 MEASUREMENT

56-4.01 TOP SOIL

Measurement for furnishing, hauling, placing and leveling will be made by the cubic yard.

56-4.02 SOD REMOVAL AND REPLACEMENT BY SEEDING

Measurement for grade preparation, top soil compaction, fertilizing, seeding, and water will be made by the square yard on the plane of surface planted.

56-4.03 SOD REMOVAL AND REPLACEMENT

Measurement for cutting, removing, storing, grade preparation, top soil compaction, fertilizing, water and the placing of sod will be made by the square yard on the plane of surface scalped and resodded.

56-4.04 SOD REMOVAL AND REPLACEMENT WITH NEW SOD

Measurement for grade preparation, top soil compaction, fertilizing, water and placing of new sod will be made by the square yard on the plane of surface scalped and resodded.

56-5 PAYMENT

Payment will be made for such of the following items as are included in the proposal of any particular contract:

1. "Top Soil" per cubic yard.
2. "Sod Removal and Replacement by Seeding" per square yard.
3. "Sod Removal and Replacement" per square yard.
4. "Sod Removal and Replacement with New Sod" per square yard.

The unit contract price per cubic yard for "Top Soil" shall be full compensation for furnishing, hauling, placing and leveling of the top soil as required.

The unit contract price per square yard for "Sod Removal and Replacement by Seeding" shall be full compensation for the complete operation of sod removal, grade preparation, top soil compaction, fertilizing, seeding, and watering, as specified.

The unit contract price per square yard for "Sod Removal and Replacement" shall be full compensation for the complete operation of cutting, removing, storing, grade preparation, top soil compaction, fertilizing, replacing of the sod, and watering, as specified.

The unit contract price per square yard for "Sod Removal and Replacement with New Sod" shall be full compensation for the complete operation of sod removal, grade preparation, top soil compaction, fertilizing, furnishing and placing of new sod, and watering, as specified.

Section 57—Finishing and Cleanup

57-1 DESCRIPTION

After all other work embraced in the contract is completed and before final acceptance of the contract, the entire roadway including the roadbed, planting, sidewalk areas, shoulders, driveways, alley and side street approaches, slopes, ditches, utility trenches, and construction areas shall be neatly finished to the lines, grades, and cross sections shown on the plans and as hereinafter specified.

57-2 CONSTRUCTION DETAILS

Slopes, sidewalk areas, planting areas, and roadway shall be smoothed and finished to the required cross section and grade by means of a grading machine insofar as it is possible to do so without damaging existing improvements, trees, and shrubs. Machine dressing shall be supplemented by hand work to meet requirements outlined herein, to the satisfaction of the Engineer.

Upon completion of the cleaning and dressing the project shall appear uniform in all respects. All graded areas shall be true to line and grade as shown on the typical sections and as required by the Engineer. Where the existing planting is below sidewalk and curb, the area shall be filled and dressed out to the walk regardless of limits shown on the plans. Wherever fill material is required in the planting area it shall be left enough higher to allow for final settlement but, nevertheless, the raised surface shall present a uniform appearance.

Section 58—Chain Link Fence and Wire Fence

Section 58—Chain Link Fence and Wire Fence

58-1 DESCRIPTION

This work shall consist of furnishing and constructing chain link fence and wire fence of the types specified in accordance with the plans, these specifications and standard plan, at the locations shown on the plans and in reasonably close conformity with the lines as staked by the Engineer.

Chain link fence shall be of diamond woven wire mesh mounted on steel posts.

Wire fence shall be barbed wire or barbed wire combined with wire mesh fastened to posts. Steel posts and steel braces, or wood posts and wood braces may be used, provided one type only shall be selected for use in any one contract.

Gates shall consist of a steel frame or frames covered with chain link or wire mesh.

58-2 MATERIALS

58-2.01 CHAIN LINK FENCE AND GATES

-2.01A General

All material used in the construction of chain link fence and gates shall be new. Iron or steel material shall be galvanized except as hereinafter provided. Imperfectly galvanized material, or material upon which serious abrasions of galvanizing occur, will not be acceptable.

The base material for the manufacture of steel pipes used for posts, braces, top rails and gate frames 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 306.

All posts, braces, top rails, and gate frames shall be hot-dipped galvanized. They shall have a minimum average of 1.8 oz. zinc coating per sq. ft. of surface area, with no individual test being below 1.6 oz. zinc coating per sq. ft. of surface area. In the case of members made from pipe, this area is defined as the total area inside and outside. A sample for computing the average of weight of coating is defined as a 12-in. piece cut from each end of the galvanized member. Fittings, attachments and hardware shall be galvanized in accordance with the requirements of ASTM Designation A 153. Other materials shall be galvanized as specified hereinafter.

-2.01B Posts

All posts for chain link fence shall be of the shape, size, and weight per foot shown on the standard plan. Roll formed posts shall be made from 0.1345 inch thick sheet steel. Two sides of roll formed posts shall have integral fastening loops to connect to the fabric for the full length of each post.

Posts provided for chain link fence will have an acceptance tolerance on the weight per linear foot, as specified on the standard plan, equal to plus or minus five percent for tubular and H-section posts and plus or minus six percent for roll-form sections. This tolerance will apply to each individual post.

All posts for chain link fence Type Nos. 1 and 6 shall be fitted with an approved top so designed as to fit securely over the post and carry the top rail. All round posts for chain link fence Type Nos. 2, 3, 4 and 5 shall have approved tops fastened securely to the posts. The base of the top fitting for round posts shall carry an apron around the outside of the post.

-2.01C Top Rail Braces and Trusses

Top rail and compression braces shall be of the type and size shown on the standard plan. Tension truss rods shall be ¾ inch round galvanized rods with drop forged turnbuckles, or other approved type of adjustment. Couplings for tubular sections shall be outside sleeve type and at least 7 inches long. Roll-formed top and brace rails shall be made from 0.0747 inch thick sheet steel and shall be an open rectangular section with internal flanges. The acceptable thickness tolerance for sheet steel members shall be plus or minus 0.006 of an inch.

All rocks in excess of one (1) inch diameter shall be removed from the entire construction area and shall be disposed of the same as required for other waste material. In no instance shall the rock be thrown onto private property. Overhang on slopes shall be removed and slopes dressed neatly so as to present a uniform well sloped surface.

All windrows of earth at the outer lateral limits of the project shall be removed entirely. Trash of all kinds resulting from clearing and grubbing or grading operations shall be removed and not placed in areas adjacent to the project. Where machine operations have broken down brush and trees beyond the lateral limits of the project, the Contractor shall remove and dispose of same at his own expense.

Drainage facilities such as inlets, catch basins, culverts, and open ditches shall be cleaned of all debris which is the result of the Contractor's operations, unless the specifications of any particular section or the special provisions provide otherwise.

Where, by permission, spoil is dumped on private property, the Contractor will not be required to perform any work beyond that described in the special provisions.

The Contractor shall remove and dispose of all construction stakes.

All pavements and oil mat surfaces, whether new or old, shall be thoroughly cleaned. Existing improvements such as portland cement concrete curbs, curb and gutters, walls, sidewalks, and other facilities which have been sprayed by the asphalt cement shall be cleaned to the satisfaction of the Engineer. Castings for manholes, monuments, water gates, lamp poles, vaults, and other similar installations which have been sprayed with the asphalt material shall be cleaned to the satisfaction of the Engineer.

The Contractor shall flush the street at the conclusion of the work unless otherwise provided in the special provisions. Flusher shall be of a pressure type and approved by the Engineer. The Contractor shall furnish the water required and will be paid therefor at the unit contract price per M gallons for "Water." Sidewalks shall be hand broomed.

On sewer and water distribution projects where all or portions of the construction is in undeveloped areas, the entire area which has been disturbed by the construction shall be shaped so that upon completion the area will present a uniform appearance, blending into the contour of the adjacent properties. All other requirements outlined previously shall be met, except that it will not be necessary to pick up rocks unless so provided in the special provisions.

57-3 MEASUREMENT AND PAYMENT

Measurement for finishing and cleanup will be based upon a lump sum contract price, or upon a per station (100-foot) unit contract price, whichever is shown in the proposal.

Payment will be made for such of the following bid items as are included in any particular contract:

1. "Finishing and Cleanup," per lump sum.
2. "Finishing and Cleanup," per station (100-foot).
3. "Water," per M gallons.

Regardless of whether payment is made by lump sum or upon measurement by stations, it shall include the finishing and cleaning of all side street approaches. Where payment is based upon the station unit, measurement will be along the center line of the project and the finishing and cleaning of side street approaches will not be included in the station quantities. Finishing and cleaning of side street approaches shall be considered as incidental to the construction and all costs thereof shall be included in the lump sum, or in the unit contract price per station as measured along center line of the project.

Water used for flushing will be measured and paid for by the unit of one thousand (M) gallons in accordance with provisions of Section 16.

In event the proposal does not include a bid item for "Finishing and Cleanup," the work thereof, including water for flushing, shall be considered as incidental to the construction of the project and all costs thereof shall be included by the Contractor in other items of work.

Section 58—Chain Link Fence and Wire Fence

-2.01D Tension Wire and Attachments

Top and bottom wire shall be 7 gage coil spring steel wire of good commercial quality and shall have a zinc coating averaging 0.8 ounces per square foot of surface area. All tension wire attachments shall be hot-dipped galvanized steel unless otherwise specified. Eye bolts shall be $\frac{3}{8}$ inch diameter and of sufficient length to fasten to the type of posts used.

-2.01E Fittings

All fittings, bolts and miscellaneous hardware shall be malleable cast iron or pressed steel. Galvanizing shall be in conformance with ASTM Designation A 153. Fittings for any particular fence shall be those furnished by the manufacturer of the fence.

-2.01F Chain Link Fence Fabric

Chain link fabric shall consist of 11 gage wire (0.120 inch diameter) for Type Nos. 3, 4, 5 and 6 fence; and 9 gage wire (0.148 inch diameter) for Type Nos. 1 and 2 fence. The fabric wire may be one of the following materials provided that only one type shall be selected for use in any one contract:

Galvanized steel wire conforming to ASTM Designation A 392.

Galvanizing shall be Class I performed by the hot-dip process.

Class II aluminum coated steel wire conforming to ASTM Designation A 491.

Class II aluminum wire conforming to 6061-T94 alloy.

The wire shall be woven into approximately 2 inch diamond mesh. The width and top and bottom finish of the fabric shall be as shown on the plans.

-2.01G Fabric Bands and Stretcher Bars

Fabric bands shall be $\frac{1}{4}$ inch by $\frac{3}{4}$ inch nominal and stretcher bars $\frac{1}{4}$ inch by $\frac{3}{4}$ inch nominal. Nominal shall be construed to be the area of the cross section of the shape obtained by multiplying the specified width by thickness. A variation of plus or minus 5 percent from this theoretical area shall be construed as "nominal" size. Both shall be hot-dip galvanized.

-2.01H Tie Wire

Tie wire shall be 9 gage aluminum wire complying with the ASTM Designation B 211 or 9 gage galvanized wire meeting the requirements of ASTM Designation A 116. Galvanizing shall be Class 1. Hog Rings shall meet the requirements of ASTM Designation A 116. Galvanizing shall be Class 1.

Gate frames shall be constructed of not less than $1\frac{1}{2}$ inch hot-dip galvanized pipe with nominal weight of 2.72 pounds per linear foot. The corners of the gate frame shall be fastened together and reinforced with a malleable iron or pressed steel fitting designed for the purpose, or they may be welded. Welding shall conform to the requirements of Section 9-06.54. All welds shall be ground smooth and painted with a high zinc dust content paint meeting the requirements of MIL-P-21035. The paint shall be applied in one or more coats to provide a dry film thickness of 3.5 mils minimum.

Cross trussing shall be $\frac{3}{8}$ inch galvanized steel adjustable rods.

Chain link fence fabric for filling the gate frame shall meet the fabric requirement specified for chain link fence of the type being furnished.

Each gate shall be furnished complete with necessary hinges, latch, and drop bar locking device designed for the type of gate posts and gate used on the project. Gates shall have positive type latching devices with provisions for padlocking.

Gate frames constructed of steel sections, other than pipe, that are fabricated in such a manner as to form a gate of equal or better rigidity, may be used provided they are approved by the Engineer.

58-2.02 WIRE FENCE AND GATES

-2.02A General

All materials used in the construction of the wire fence shall be new. All iron or steel material shall be galvanized. Imperfectly galvanized material, or material upon which serious abrasions of galvanizing occur, shall not be used.

-2.02B Steel Fence Posts and Braces

Steel fence posts and braces shall be of good commercial quality iron or steel and shall be approved by the Engineer prior to construction. Posts shall be not less than 7 feet in length.

Line posts may be channel, T, U, Y, or other approved shape, manufactured solely for use as fence posts. One type of line post shall be used throughout the project. Line posts shall be studded, slotted, or properly adapted for attaching either wire or mesh in a manner that will not damage the galvanizing of posts, wire, or mesh during the fastening. Line posts shall weigh not less than 1.3 pounds per linear foot and shall be provided with a tapered 8 gage steel anchor plate attached securely thereto, weighing not less than 0.67 pound.

End, corner, gate, and pull posts shall meet the requirements specified hereinbefore for line posts, except that the posts shall weigh not less than 3.1 pounds per linear foot and anchor plates and special studs, slots, or adaptors for the attachment of wires will not be required.

Braces shall weigh not less than 3.1 pounds per linear foot.

All posts, braces, anchor plates and fittings shall be galvanized in accordance with the requirements of ASTM Designation A 128, or A 153.

A tolerance of minus 4% on the weight per linear foot of individual posts will be permitted provided that any 3 posts selected at random from the stock proposed for use on the project have an average weight meeting the minimum specified on the standard plan.

-2.02C Brace Wire

Brace wire shall be 9 gage galvanized wire meeting the requirements of ASTM Designation A 116, galvanizing Class 3.

-2.02D Staples and Wire Clamps

The staples used to attach the wire fencing to wood posts shall be galvanized 9 gage, $1\frac{1}{2}$ inches long meeting the requirements of ASTM Designation A 116, galvanizing Class 1.

The wire clamps used to attach the wire fencing to steel posts shall be galvanized 11 gage wire meeting the requirements of ASTM Designation A 116, galvanizing Class 1.

-2.02E Barbed Wire

Barbed wire shall conform to the requirements of ASTM Designation A 121, and shall consist of 2 strands of $12\frac{1}{2}$ gage wire, twisted with 4 point 14 gage barbs with the barbs spaced an average of 5 inches apart. Galvanizing shall be Class 3.

-2.02F Wire Mesh

Wire mesh shall conform to the requirements of ASTM Designation A 116, and shall consist of 7 horizontal wires with vertical stays spaced 6 inches apart. The top and bottom wires shall be 10 gage and the intermediate wires and vertical stays shall be $12\frac{1}{2}$ gage. The mesh shall have a total width of 26 inches (Design No. 726-6-12- $\frac{1}{2}$). Galvanizing shall be Class 3. The zinc-coated wire as represented by the test specimens shall be capable of being wrapped in a close helix at a rate not exceeding 15 turns/min. around a cylindrical steel mandrel having a diameter the same as the specimen being tested, without cracking or flaking the zinc coating to such an extent that any zinc can be removed by rubbing with the bare fingers.

-2.02G Vertical Cinch Stays

Vertical cinch stays shall be $9\frac{1}{2}$ gage galvanized wire meeting the requirements of ASTM Designation A 116 except that the minimum weight of zinc coating shall be 0.3 ounces per square foot of uncoated wire surface.

-2.02H Wire Gates

Gate frames shall be constructed of galvanized standard weight pipe with a nominal diameter of not less than 1 inch. The pipe shall conform to the requirements of ASTM Designation A 120. Wire gates shall be not less than 48 inches in height and shall be designed to fit openings of the widths called for on the plans or as indicated by the bid items. Each gate shall be provided with 2 upright braces of the same material as the frame, spaced at $\frac{1}{4}$ points in the gate. All gates shall be provided with adjust-

able $\frac{3}{8}$ inch diameter diagonal truss rods, from corner to corner.

The gate frame shall be provided with wire mesh conforming to the requirements hereinbefore specified under "Wire Mesh", except that it shall consist of 10 horizontal wires and have a total width of 47 inches (Design No. 1047-6-12- $\frac{1}{2}$).

Each gate shall be furnished complete with necessary hinges and latch designed for use with the type of gate posts used on the project. The hinges shall be so designed as to be securely attached to the gate post and to enable the gate to be swung back against the fence.

Double gates shall be hinged in the same manner as single gates and shall be provided with an approved drop bar locking device.

-2.02I Miscellaneous

Bolts, nuts and all fittings, including hinges and all metal parts used in the construction of fence and gates, shall be galvanized in accordance with ASTM Designation A 153.

58-3 CONSTRUCTION DETAILS

58-3.01 CHAIN LINK FENCE AND GATES

-3.01A Posts

Posts shall be placed in a vertical position and except where otherwise directed by the Engineer, shall be spaced at 10-foot centers. Spacing shall be measured parallel to the slope of the ground.

All posts, except line posts for Type No. 3 fence shall be set in concrete to the dimensions shown on the plans. All concrete footings shall be crowned so as to shed water. Line posts on Type No. 3 fence shall be set in undisturbed earth either by driving or drilling, except as herein specified. Driving shall be accomplished in such a manner as not to damage the post. Any voids around the post shall be backfilled with suitable material and thoroughly tamped.

Concrete footings shall be constructed to embed the line posts on Type No. 3 fence at grade depressions where the tension on the fence will tend to pull the post from the ground.

Where solid rock is encountered without an overburden of soil, line posts shall be set a minimum depth of 14 inches, and end, corner, gate, brace and pull posts a minimum of 20 inches into the solid rock. The holes shall have a minimum width 1 inch greater than the largest dimension of the post section to be set. The posts shall be cut before installation to lengths which will give the required length of post above ground, or if the Contractor so elects he may use an even length of post set at greater depth into the solid rock.

After the post is set and plumbed, the hole shall be filled with grout consisting of one part portland cement and three parts clean, well graded sand. The grout shall be thoroughly worked into the hole so as to leave no voids. The grout shall be crowned to carry water from the post.

Where solid rock is covered by an overburden of soil or loose rock, the posts shall be set to the full depth shown on the plans unless penetration into solid rock reaches the minimum depths specified above, in which case the depth of penetration may be terminated. Concrete footings shall be constructed from the solid rock to the top of the ground. Grouting, as hereinbefore specified, will be required on the portion of the post in solid rock.

Pull posts, as shown on the standard plan, shall be braced to adjacent line posts and spaced at 1000 foot maximum intervals for Type Nos. 1, 2, 3 and 6 fence and at 500 foot maximum intervals for Type Nos. 4 and 5 fence.

End, gate, corner and pull posts shall be braced to the adjacent brace post, or posts in the manner shown on the standard plan. Changes in line amounting to 2 foot tangent offset or more between posts shall be considered as corners for all types of fence.

Steep slopes and/or abrupt topography may require changes in various elements of the fence. It will be the responsibility of the Contractor to provide all posts of sufficient length to accommodate the chain link fabric and ornamental tops adapted to receive the top rail.

-3.01B Top Rail

Top rails shall pass through the ornamental tops of the line posts, forming a continuous brace from end to end of

each stretch of fence. Lengths of tubular top rail shall be joined by sleeve couplings. Top rails shall be securely fastened to terminal posts by pressed steel fittings or other appropriate means.

-3.01C Tension Wire

One continuous length of tension wire shall be used between pull posts. Sufficient tension shall be applied to avoid excess sag between the posts. Tension wires shall be tied or otherwise fastened to end, gate, corner or pull posts by methods approved by the Engineer.

-3.01D Chain Link Fabric

Chain link fabric on Type Nos. 1, 2, 3, 4 and 6 fence shall be placed on the face of the post away from the highway, except on horizontal curves; it shall be placed on the side as designated by the Engineer. The fabric of Type 5 fence shall be placed on the face of the post as designated by the Engineer.

The chain link fabric on Type Nos. 1, 2, 3, 4 and 6 fences shall be placed approximately 1 inch above the ground and on a straight grade between posts by excavating high point of ground. Filling of depressions will be permitted only upon approval of the Engineer. The fabric on Type No. 5 fence shall be placed a maximum of 12 inches above the ground.

The fabric shall be stretched taut and securely fastened to the posts. Fastening to end, gate, corner, and pull posts shall be with stretcher bars and fabric bands spaced at intervals of one foot or less or by weaving the fabric into the fastening loops of roll-formed posts. Fastening to line posts shall be with tie wire, metal bands or other approved method, attached at 14-inch intervals. The top and bottom edge of the fabric shall be fastened with the wires spaced at 24-inch intervals, to the top rail, or top and bottom tension wires as may be applicable.

Rolls of wire fabric shall be joined by weaving a single strand into the ends of the rolls to form a continuous mesh.

-3.01E Chain Link Gates

Chain link fabric shall be fastened to the end bars of the gate frame by stretcher bars and fabric bands, and to the top and bottom bars of the gate frames by tie wires in the same manner as specified for the chain link fence fabric, or by other standard methods if approved by the Engineer.

Welded connections on gate frames where the spelter coating has been burned shall be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked spelter removed. The clean areas shall then be painted with two coats of zinc oxide-zinc dust paint compounded in a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.

The drop bar locking device for the wire gates shall be provided with a 12-inch round by 18-inch deep footing of Class C concrete, crowned at the top and provided with a hole to receive the locking bar. The depth of the penetration of the locking bar into the footing shall be as specified by the manufacturer of the locking device.

58-3.02 WIRE FENCE AND GATES

-3.02A Posts

Line posts shall be spaced at intervals not to exceed 14 feet. All intervals shall be measured center to center of posts. In general, in determining the spacing of posts, measurements will be made parallel to the slope of the existing ground, and all posts shall be placed in a vertical position except where otherwise directed by the Engineer.

Line posts may be driven in place provided the method of driving does not damage the post. Steel corner, gate and pull posts shall be set in Class C concrete footings to the dimensions shown on the plans and crowned at the top to shed water.

Class C concrete footings shall be constructed to embed the lower part of steel line posts, and wood anchors shall be placed on wood posts at grade depressions wherever the tension on the line wires will tend to pull the post from the ground. The concrete footings shall be 3 feet deep, by 12 inches in diameter and crowned at the top.

Where solid rock is encountered without an overburden of soil line posts shall be set a minimum depth of 14 inches and end, corner, gate, and pull posts a minimum depth of

20 inches into the solid rock. The hole shall have a minimum dimension one (1) inch greater than the largest dimension of the post section to be set. The posts shall be cut before installation to lengths which will give 4½ feet of post above ground, or if the Contractor so elects he may use 6-foot posts set 18 inches into the solid rock.

After the post is set and plumbed the hole shall be filled with grout consisting of one part portland cement and three parts clean, well graded sand. The grout shall be thoroughly worked into the hole so as to leave no voids. The post shall be crowned to carry water away from the post. Where posts are set in the above manner, anchor plates, and concrete footings will not be required.

Where solid rock is covered by an overburden of soil or loose rock, the posts shall be set to the full depth of 2½ feet unless the penetration into solid rock reaches the minimum depths specified above, in which case the depth of penetration may be terminated. When the depth of the overburden is greater than 12 inches, anchor plates will be required on the steel line posts, and concrete footings shall be constructed from the solid rock to the top of the ground on steel end, gate, corner and pull posts. When the depth of overburden is 12 inches or less, anchor plates and concrete footings will not be required. Grouting will be required on the portion of the post in solid rock.

Steel braces shall be anchored to soil or loose rock with a Class C concrete footing not less than 18 inches on any one side, and set in solid rock to a minimum depth of 10 inches in the same manner as specified above for posts. The braces shall be set on the diagonal as shown on the plans and connected to the post with an approved connection.

Wood braces shall be dapped ¼ inch into the posts and shall be fastened to each post with three 20d galvanized nails.

Wire braces shall consist of a 9-gage wire passed around the wood posts to form a double wire. The wire shall be fastened to each post with two staples and fastened together to form a continuous wire. The wires shall then be twisted together until the wire is in tension.

Where the new fence joins an existing fence the two shall be attached in a manner satisfactory to the Engineer, end or corner posts being set as necessary.

Pull posts shall be spaced not more than one thousand (1000) feet apart, but spacing shall be such as to use standard rolls of wire mesh with a minimum of cutting and waste.

Changes in alignment of 30 degrees or more shall be considered as corners, and corner posts shall be installed. Where it is deemed by the Engineer that a change in alignment of less than 30 degrees will materially lessen the strength of the fence, the line post at the angle shall be supported by the addition of braces and/or wires in a manner satisfactory to the Engineer.

-3.02B Barbed Wire and Wire Mesh

After the pull posts have been placed and securely braced, the barbed wire and mesh shall be pulled taut to the satisfaction of the Engineer, and each longitudinal wire shall be cut and securely fastened to the pull post with devices customarily used for the purpose. Wire or mesh shall not be carried past a pull post, but shall be cut and fastened to the pull post independently for the adjacent spans.

After the tensioning of the wire or mesh between two pull posts, all longitudinal wires shall be properly fastened at proper height to each intervening line post.

Wire mesh and barbed wire shall be placed on the face of the post which is away from the highway, except that on horizontal curves the mesh and wires shall be fastened to the face on the outside of the curve, unless otherwise directed by the Engineer.

Where unusual ground depressions occur between posts, the fence shall be guyed to the ground by means of a 9-gage galvanized wire attached to a deadman of approximately 100 pounds buried two feet in the ground. The guy wire shall be securely attached to each strand of barbed wire and to the top and bottom wires of the wire mesh fabric in a manner to maintain the entire fence in its normal shape. If necessary to guy the fence in solid rock, the guy wire shall be grouted in a hole 2 inches in diameter and 10 inches deep. The operation of guying shall leave the fence snug with the ground.

-3.02C Vertical Cinch Stays

Vertical cinch stays shall be installed midway between posts on both types of fence. The wire shall be twisted in such a manner as to permit weaving into the horizontal fence wires to provide rigid spacing. All barbed wires and the top, middle and bottom wire of the wire mesh shall be woven into the stay.

-3.02D Wire Gates

The wire mesh fabric shall be taut and securely tied to the frame and stays in accordance with recognized standard practice for wire gate construction.

Welded connections on gate frames, shall be treated as specified for chain link fence gates.

The drop bar locking device for double wire gates shall be provided with a footing of Class C concrete 12 inches in diameter and 12 inches deep, crowned on top and provided with a hole to receive the locking bar. The diameter and depth of the hole in the footing shall be as specified by the manufacturer of the locking device.

58-4 MEASUREMENT

Chain link fence and wire fence will be measured by the linear foot of completed fence, along the ground line, exclusive of openings.

End, Corner and Pull Posts for Chain Link Fence will be measured per each for the posts furnished and installed complete in place.

Gates will be measured by the unit for each type of gate furnished and installed complete in place.

Clearing of the fence line will be measured by the linear foot measured along the fence line for the areas actually requiring clearing as staked by the Engineer.

58-5 PAYMENT

Payment will be made for such of the following bid items as are included in the proposal and payment will be made under:

1. "Chain Link Fence Type No.," per linear foot.
2. "End, Corner and Pull Posts for Chain Link Fence," per each.
3. "Double 14' Chain Link Gate," per each.
4. "Double 20' Chain Link Gate," per each.
5. "Single 6' Chain Link Gate," per each.
6. "Wire Fence Type No.," per linear foot.
7. "Single 14 Wire Gate," per each.
8. "Double 20' Wire Gate," per each.

The unit contract price per linear foot for Chain Link Fence and per each for End, Corner and Pull Posts for Chain Link Fence shall be full compensation for furnishing all labor, materials, tools and equipment necessary or incidental to the construction of the completed fence as specified.

The unit contract price per each for Chain Link Gates shall be full compensation for furnishing all labor, materials, tools and equipment necessary or incidental to the construction of the completed gates, including the extra materials and costs of constructing the gate posts, as specified.

The unit contract price per linear foot for Wire Fence and per each for Wire Gates shall be full compensation for furnishing all labor, materials, tools, and equipment necessary or incidental to the construction of the completed fence as specified.

When a payment item for clearing the fence line is not included in the project, the Contractor shall perform the work required and, all costs therefor shall be considered incidental to and included in the unit contract price per linear foot for the fence to be constructed.

Section 59—Beam Guard Rail

59-1 DESCRIPTION

Beam guard rail complying with the requirements of these specifications shall be constructed in accordance with the standard plans and where indicated on the plans, or where directed by the Engineer.

Beam guard rail shall consist of a steel plate mounted on one or both sides of reinforced concrete or wood posts. Terminal sections of rail, as detailed on the plans, shall be installed at both ends of a complete guard rail section unless their omission is authorized by the Engineer.

59-2 MATERIALS

59-2.01 RAIL ELEMENT

The rail element and terminal sections shall consist of twelve-gauge (12-gauge) steel formed into a beam not less than twelve (12) inches wide and three (3) inches deep. The rail element and terminal sections shall be formed from open hearth or electric furnace steel. The physical property of the steel shall conform to the following minimum requirements:

	Rail Element	Terminal Sections
Ultimate tensile strength	70,000 p.s.i.	
Yield point strength	50,000 p.s.i.	25,000 p.s.i.
Elongation in two inches	12 per cent	

The rail splices shall have a minimum total ultimate strength of 80,000 pounds at each joint.

The holes in the plate shall be slotted to facilitate erection and to permit expansion and contraction. The edges of the rail shall be rolled or rounded so they will present no sharp edges. Where the rail is on a curve, the plates at the splice shall make contact throughout the area of the splice. When the radius of curvature is less than one hundred fifty (150) feet, the rail shall be shaped in the shop.

-2.01A Inspection

The Contractor shall give ample notice to the Engineer before the rail elements are fabricated in order that inspection may be provided. The Contractor shall arrange for all facilities necessary for the inspection of material and workmanship at the point of fabrication of the rail element, and inspectors shall be allowed free access to the necessary parts of the premises.

The inspector shall have the authority to reject materials or workmanship which do not fulfill the requirements of these specifications. In cases of dispute the Contractor may appeal to the Engineer, whose decision shall be final.

The inspector may accept a mill test report certifying that the steel used in fabricating the rail elements meets the requirements of the specifications. The City reserves the right, however, to require the Contractor to furnish samples of the steel proposed for use and to determine to its satisfaction that the steel meets the specification requirements.

It is the intent of these specifications that the inspection will be performed at the point of fabrication. Plant inspection is intended as a means of facilitating the work and avoiding error. It is expressly understood that inspection at the fabricating plant will not relieve the Contractor from responsibility from material and workmanship meeting the specifications, nor from his obligation to replace material found to be defective in any particular after delivery to the site of the work.

59-2.02 POSTS

Posts for beam guard rail, unless concrete posts are specified in the special provisions, may be creosote treated or pentachlorophenol treated wood posts or reinforced concrete posts, whichever kind the Contractor may elect to use; provided, however, that only one type of post shall be used on any one project. Posts shall be of the dimensions shown on the plans and shall meet the requirements of these specifications.

-2.02A Treated Timber Posts

Timber posts shall be square, eight (8) inches by eight (8) inches S4S and shall conform to the grade specified in Division V. The posts shall be shaped as shown on the plans before being treated.

Timber posts shall be pressure treated by the empty cell process to provide a minimum retention of eight (8) pounds of creosote oil or four-tenth (0.4) pounds of pentachlorophenol per cubic foot of timber in accordance with Division V.

-2.02B Precast Reinforced Concrete Posts

Precast concrete posts shall be round, reinforced con-

crete posts eight-inch (8") minimum to nine-inch (9") maximum diameter. The post may be tapered from nine-inch (9") diameter at the bottom to eight-inch (8") diameter at the top to allow for vertical stripping of the forms. If a tapered post is furnished, the larger end will be at the bottom of the post.

Portland cement and water shall comply with the requirements of the standard specifications for the materials. Aggregates shall meet all requirements of specifications except for grading. The maximum size of aggregate shall be appropriate for the dimension of the post and the combined aggregate shall be well graded from coarse to fine.

The materials used in the concrete shall develop on test not less than thirty-five hundred (3,500) pounds per square inch compressive strength at the age of twenty-eight (28) days.

Reinforcement shall consist of either one of the following:

- (a) Wire meeting the requirement of ASTM Designation A 82, Cold Drawn Steel Wire for Concrete Reinforcement.
- (b) Intermediate grade steel bars, deformed type, meeting the requirements of ASTM Designation A 15, Billet-Steel Bars for Concrete Reinforcement, and ASTM Designation A 305, Minimum Requirements for the Deformed Steel Bars for Concrete Reinforcement.

The metal reinforcement in Type A posts shall be spaced and arranged to provide not less than sixty percent (60%) nor more than seventy percent (70%) of the total cross sectional area of the reinforcement in the one-half of the post which will face the roadway when installed. Except at the bottom of the post, metal reinforcing shall be placed no closer than one (1) inch from the outer surface of the post. When deformed bars are used for reinforcement, there shall be not less than two (2) bars of the roadway face of the post. The reinforcement shall be supported in such a manner that the minimum cover of concrete will be secured.

Each type A post shall be marked by suitable means to identify the center of the heavier reinforced (roadway) face of the post. Centered and tapered bolt holes will be acceptable identification. Tapered holes shall taper from seven-eighths (¾) inch to one and one-eighth (1½) inch in diameter and shall have the larger opening on the roadway face of the post.

Metal reinforcement in Type B posts shall be spaced to provide equal cross-sectional area of reinforcement in each roadway face of the post. When deformed bars are used, there shall be not less than two (2) bars in each roadway face.

Type B posts shall be plainly marked with the letter B on top of each post.

-2.02B1 Finish

Precast reinforced concrete posts will not be painted. The concrete may be placed in the form and compacted in any manner desired by the manufacturer (temped, vibrated, spun, etc.) provided the finished post is true in form and shape, is free of fractures, cracks, honeycomb and other serious defects, and meets the requirements for strength. The presence of web after stripping the fresh concrete, or of surface holes up to one-half (½) inch in diameter and three-sixteenth (3/16) inch in depth, will not be considered defects sufficient for rejection. It is the intent of these specifications to provide a post manufactured in a careful and workmanlike manner with a surface that is reasonably dense and uniform in color, but without the more refined surface finish usually required when the product is to be painted.

-2.02B2 Strength Requirements

When subjected to testing as a simple beam of twenty-four (24) inch span and center loading applied to either roadway face of the post, the reinforced post, when twenty-eight (28) days old, shall withstand a total load of not less than thirty thousand (30,000) pounds at failure.

-2.02B3 Testing

The Contractor shall be obligated to furnish the Engineer without charge for testing purposes, upon request, a minimum of two (2) representative reinforced concrete posts for any one (1) contract or a maximum of one per-

Section 59—Beam Guard Rail

cent (1%) of the number of posts specified for any one (1) contract, whichever option the Engineer may determine to be necessary.

59-2.03 GALVANIZING

All rail elements shall be galvanized in accordance with ASTM Designation A 93, Coating Class 2.5. Bolts, nuts and washers shall be galvanized in accordance with the requirements of ASTM Designation A 153, Zinc Coating on Hardware, Iron and Steel.

59-2.04 HARDWARE

Bolts shall be made from commercial bolt stock having tensile strength of not less than fifty thousand (50,000) pounds per square inch. Washers shall be malleable iron, or shall be cut from medium steel or wrought iron plate.

59-3 CONSTRUCTION DETAILS

59-3.01 ERECTION OF POSTS

The posts shall be set to the true line and grade of the highway and spaced as shown on the plans. When the plans require that the ends of a section of guard rail be splayed out, the posts shall be set to accommodate the splaying.

The post holes shall be of sufficient dimension to allow placement and thorough compaction of selected backfill material completely around the post.

In general, all post holes shall be dug or drilled. Ramming or driving will be permitted only if approved by the Engineer and if no damage to the shoulders and adjacent slopes results therefrom.

59-3.02 ERECTION OF RAIL

All metal work shall be fabricated in the shop. No punching, cutting or welding shall be done in the field, except that holes for special details in exceptional cases may be drilled in the field, when approved by the Engi-

neer. The rail shall be erected so bolts at expansion joints will be located at the centers of the slotted holes.

Rail plates shall be fastened to the posts with galvanized bolts, washers and nuts of the size and kind shown on the plans.

All bolts, except where otherwise required at expansion joints, shall be drawn tight. Bolts through expansion joints shall be drawn up as tight as possible without being tight enough to prevent the rail elements from sliding past one another longitudinally. Bolts shall be sufficiently long to extend at least one-fourth ($\frac{1}{4}$) inch beyond the nuts. Except where required for adjustments, bolts shall not extend more than one-half ($\frac{1}{2}$) inch beyond the nuts. Bolts through posts of variable thickness shall be cut off one-fourth ($\frac{1}{4}$) inch beyond the nuts, and burred.

59-3.03 PLANS

The Contractor shall submit for approval of the Engineer such additional detailed plans and shop drawings of rail punchings, fittings and assemblies as may be required by the Engineer. The Contractor shall cooperate with the Engineer in working out any detail in connection with the guard rail required to complete the work satisfactorily.

59-4 MEASUREMENT

Measurement of beam guard rail shall be by the linear foot measured along the line of the completed guard rail from end to end of terminal sections, or from end to end rail sections if terminal sections are not installed.

59-5 PAYMENT

The unit contract prices per linear foot for "Single Beam Guard Rail," "Double Beam Guard Rail," or "Temporary Beam Guard Rail" shall be full compensation for furnishing all labor, tools, material and equipment, and for all other costs and expenses necessary to complete the work as specified.

Section 59—Beam Guard Rail

cent (1%) of the number of posts specified for any one (1) contract, whichever option the Engineer may determine to be necessary.

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The posts shall be set to the true line and grade of the highway and spaced as shown on the plans. When the plans require that the ends of a section of guard rail be splayed out, the posts shall be set to accommodate the splaying.

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All metal work shall be fabricated in the shop. No punching, cutting or welding shall be done in the field, except that holes for special details in exceptional cases may be drilled in the field, when approved by the Engineer.

The rail shall be erected so bolts at expansion joints will be located at the centers of the slotted holes.

Rail plates shall be fastened to the posts with galvanized bolts, washers and nuts of the size and kind shown on the plans.

All bolts, except where otherwise required at expansion joints, shall be drawn tight. Bolts through expansion joints shall be drawn up as tight as possible without being tight enough to prevent the rail elements from sliding past one another longitudinally. Bolts shall be sufficiently long to extend at least one-fourth ($\frac{1}{4}$) inch beyond the nuts. Except where required for adjustments, bolts shall not extend more than one-half ($\frac{1}{2}$) inch beyond the nuts. Bolts through posts of variable thickness shall be cut off one-fourth ($\frac{1}{4}$) inch beyond the nuts, and burred.

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The Contractor shall submit for approval of the Engineer such additional detailed plans and shop drawings of rail punchings, fittings and assemblies as may be required by the Engineer. The Contractor shall cooperate with the Engineer in working out any detail in connection with the guard rail required to complete the work satisfactorily.

59-4 MEASUREMENT

Measurement of beam guard rail shall be by the linear foot measured along the line of the completed guard rail from end to end of terminal sections, or from end to end rail sections if terminal sections are not installed.

59-5 PAYMENT

The unit contract prices per linear foot for "Single Beam Guard Rail," "Double Beam Guard Rail," or "Temporary Beam Guard Rail" shall be full compensation for furnishing all labor, tools, material and equipment, and for all other costs and expenses necessary to complete the work as specified.

STANDARD
SPECIFICATIONS
FOR
MUNICIPAL PUBLIC WORKS
CONSTRUCTION



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DIVISION III. SANITARY SEWER AND STORM DRAINS

Section 60—Pipe, Materials, and Testing For Sewers, Drains and Culverts

60-1 DESCRIPTION

Pipe used in sanitary sewer construction may be:

RIGID	FLEXIBLE
Concrete	ABS Composite
Vitrified Clay	PVC (Polyvinyl Chloride)
Asbestos Cement	Asbestos Bonded Corrugated Steel
Cast Iron	
Ductile Iron	

Pipe used in storm drains and culvert pipe may be:

Concrete	Corrugated Steel Pipe
Vitrified Clay	Corrugated Aluminum Pipe
Asbestos Cement	ABS Composite
Cast Iron	PVC
Ductile Iron	Asbestos Bonded Corrugated Steel

All sanitary sewer and storm drain pipe shall have flexible gasketed joints as outlined in Section 60-3.02 unless otherwise specified. Culvert pipe shall be jointed as specified.

It is not intended that materials listed herein are to be necessarily considered equal or generally interchangeable for all applications. The Engineer shall determine from the materials listed those suitable for the project and he shall so specify in the specifications and/or the plans.

Note:

The type and gradation of the material used in bedding, haunching, and initial backfilling, as well as the manner and care with which it is installed, are important factors in achieving satisfactory installation of the pipe. The amount of deflection that can be anticipated during installation is related to the pipe stiffness and gradation of the embedment material as well as the care with which it is placed under, around, and over the pipe and the use and removal of the trench supports.

60-2 GENERAL

Where reference is made to an ASTM, ANSI or AASHTO designation, it shall be the latest revision at the time of call for bids, except as noted on the plans or in the special provisions.

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.

60-3 MATERIALS AND TESTING

60-3.01 PIPE

-3.01A Concrete Pipe, Nonreinforced

Nonreinforced concrete pipe shall conform to ASTM Designation C14 Class 2 except as otherwise provided and except that the 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 two percent (2%) but in no case shall less than (5) pipes of each size be tested.

-3.01B Concrete Pipe, Reinforced

Reinforced concrete pipe shall conform to ASTM Designation C76, and shall be of the class noted on the plans 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 thirty (30) inches or more in diameter.

-3.01C Vitrified Clay Pipe

Vitrified clay pipe shall conform to ASTM Designation C700, Extra Strength, unless otherwise provided.

-3.01D Asbestos-Cement Pipe

Asbestos-cement pipe shall conform to ASTM Designation C428, Class 2400 unless otherwise provided in the plans or in the special provisions.

-3.01E Cast Iron Pipe

Cast iron pipe shall conform to AWWA C106 or C108, or ANSI Specification A21.6, with Type II Push-on Joint or Type III Mechanical Joints, manufactured in accordance with Federal Specification WW-P-421c.

The cast iron pipe shall be lined with 3/32-inch thin cement mortar and seal coated in accordance with ANSI Standard A21.4 and AWWA C104, except thickness of lining and except as otherwise specified in WW-P-421c. The Contractor shall provide all foundry records of pipe as described in Section 6-6 of ANSI A21.6, when requested by the Engineer.

Unless otherwise specified the minimum thickness class for cast iron pipe shall be Class 22 for 4-inch pipe, Class 21 for 6-inch and Class 20 for 8-inch and larger for 21/45 iron strength; and for 18/40 iron strength the minimum acceptable thickness shall be Class 22 for pipes up to 12-inch diameter.

-3.01F Ductile Iron Pipe

Ductile iron pipe shall conform to ANSI A21.51 or AWWA C151 and shall be cement lined, push-on joint, unless otherwise specified. The minimum thickness class shall be Class 2 up through 12-inch diameter pipe and Class 1 for 14-inch diameter and larger pipe unless specified otherwise by the Engineer.

-3.01G ABS Composite Pipe

ABS composite pipe shall conform with the provisions of ASTM D2680, Type SC Joints (solvent welded).

-3.01H PVC Pipe

PVC pipe shall conform with the provisions of ASTM D3033 or D3034 unless otherwise specified.

-3.01I Galvanized Corrugated Steel Pipe

Galvanized corrugated steel pipe as specified in the plans or special provisions shall conform to the material, fabrication and inspection requirements of AASHTO Designation M36 or M167 as applicable, except that thickness and types shall be as noted on the plans.

-3.01II Protective Treatment

Steel pipe and pipe arch culverts and sewers shall be coated by one of the following protective treatments when such treatment is specified.

Treatment 1—Coated uniformly inside and out with asphalt.

Treatment 2—Coated uniformly inside and out with asphalt and with an asphalt paved invert.

Treatment 3—Coated inside and out with asbestos fibers embedded in the spelter coating and then covered on both sides with asphalt.

Treatment 4—Coated as in Treatment 3 with an asphalt paved invert.

Treatment 5—Coated inside and out with asphalt and a 100% periphery inside spun asphalt lining (100% paved).

Treatment 6—Coated as in Treatment 3 and with a 100% periphery inside spun asphalt lining (100% paved).

-3.01II Asphalt Coatings and Paved Inverts

Asphalt for asphalt coatings and paved inverts shall meet the requirements of AASHTO Designation M190, Section 4. The coatings for Treatments 1, 2 and 5 shall be uniform, inside and out, and applied in accordance with the following requirements.

The metal shall be free from grease, dirt, dust, moisture or other deleterious contaminants. Either process described below may be used for application.

Section 60—Pipe Materials and Testing for Sewers, Drains and Culverts

1. Pipe Not Preheated

The temperature of the asphalt at the time of pipe immersion shall be 400°F (±5°) and the duration of the immersion shall conform to the following:

Thickness	Minimum Immersion Time—Minutes	
	Steel	Aluminum
.064	.060	2.5
.079	.075	3.0
.109	.105	5.0
.138	.135	6.5
.168	.164	8.0

2. Pipe Preheated

The asphalt shall have a temperature of 380°F (±5°) and the pipe shall be brought to a temperature of 300°F to 350°F before immersion.

Paved inverts for Treatments 2 and 4 shall consist of bituminous material applied in such a manner that one or more smooth pavements shall be formed in the invert filling the corrugations for at least 40% of the circumference. The pavement shall have a minimum thickness of 1/4 inch above the crest of the corrugations except where the upper edges intercept the corrugation. The pavements shall be applied following the coating with asphalt or fiber bonding.

Treatment 5 may be substituted for Treatment 2; and Treatment 6 for Treatment 4 at the option of the Engineer.

-3.01I3 Spun Asphalt Lining

Asphalt for spun lining over 100% periphery shall conform to AASHTO Designation M190, Section 4. Asphalt spun linings shall provide a smooth surface for the full interior of the pipe by completely filling the corrugations to a minimum thickness of 1/4 inch above the crests. The interior lining shall be applied by centrifugal or other approved methods. The interior shall be free from sags or runs but slight residual corrugations due to cooling or shrinkage of the lining will not be cause for rejection. At the 3-sheet laps an interior non-uniformity equal to the thickness of the sheet is allowable. The thickness of the lining shall be maintained to the ends of the pipe.

The thickness of the lining over the crest of the corrugation shall not vary by an amount in excess of 1/2 inch over the entire area of the spun lining.

In the case of helical corrugated pipe manufactured with a continuous lock seam, an interior non-uniformity over the lock seam equal to the thickness of two culvert sheets is allowable.

-3.01I4 Asbestos Impregnated Galvanized Corrugated Steel Pipe

Asbestos impregnated galvanized corrugated steel sewer pipe shall be fabricated from asbestos bonded corrugated sheets. Both sides of the metal sheets shall be coated with a layer of asbestos fibers applied in a sheet form by pressing into a molten metallic bonding medium. Immediately after the metallic bond has solidified, the asbestos fibers shall be thoroughly saturated with a bituminous saturant. The finished sheets shall be of a first-class commercial quality, free from blisters or unsaturated spots and with the fibers adhering tightly to the metal. In addition, the pipe shall be coated inside and out with a bituminous coating which will meet the requirements as described in Section 60-3.01I1, Treatment 1.

-3.01I5 Galvanized Steel End Sections

Galvanized steel end sections shall be flared, beveled shop-assembled units to serve as structural, hydraulic and esthetic end treatment to corrugated steel culverts. They may be attached to corrugated steel culverts by threaded rods, by riveting or bolting per manufacturer's standard procedure. End sections shall have a turned-down lip or toe plate at the wide end to act as a cut-off and toe plate extensions shall be available at extra cost.

The material for the end section shall be galvanized steel meeting the requirements of AASHTO M36. The thickness shall be as follows:

.064 inch (16 gage) through 24" round or 29"x18" Pipe-arch
.079 inch (14 gage) for 30" round and 36"x22" Pipe-arch
36" round and 43"x27" Pipe-arch

.109 inch (12 gage) over 36" round and 43"x27" Pipe-arch (except that the center panels of 60" round and larger, and 72"x44" Pipe-arch and larger, shall be 10 gage (138 inch)

Galvanized stiffener angles shall supplement the usual reinforced side edges for 60" round and larger, and 79"x49" Pipe-arch and larger.

If the end section is shop attached to a stub of pipe (manufacturer's standard Type No. 3 connection), the pipe stub shall not be lighter in gage than the end section.

-3.01J Corrugated Aluminum Alloy Culvert Pipe

Corrugated aluminum alloy culvert pipe and coupling bands, as specified in the plans or special provisions, shall conform to the material, fabrication and inspection requirements of AASHTO Designations M196, M197, M211 and M219, except that gauges and types shall be as noted on the plans.

-3.01J1 Protective Treatment

Aluminum pipe and pipe-arch culverts and sewers shall be protective coated, when such treatment is specified, to comply with the applicable provisions of Section 60-3.01I1.

-3.01J2 Aluminum Alloy End Sections

Material shall comply with the provisions of AASHTO Designation M196 and fabrication shall comply with the requirements of Section 60-3.01I5.

60-3.02 JOINTING MATERIALS

-3.02A Concrete Pipe

Rubber gaskets for concrete sewer pipe shall meet the physical requirements of ASTM C443, plus such other specifications as may be claimed for the particular brand of gasket furnished.

-3.02B Clay Pipe

Rubber gaskets for clay pipe shall be factory manufactured joints in accordance with ASTM Designation C425.

-3.02C Asbestos Cement

Rubber gaskets for asbestos-cement sewer pipe shall conform to the requirements of ASTM Designation D1869, Rubber Rings for asbestos-cement pipe.

-3.02D Cast Iron

Rubber gaskets for cast iron pipe shall conform to the requirements of ANSI A21.11.

-3.02E Ductile Iron

Rubber gaskets for cast iron pipe shall conform to the requirements for ANSI A21.11.

-3.02F Solvent Welded Joints for ABS Composite Pipe

Solvent welded joints shall be made with solvent and cement meeting the provisions of ASTM D2680.

-3.02G PVC

Rubber gaskets for PVC pipe shall conform to the requirements of ASTM D 1869.

-3.02H1 Corrugated Metal Pipe

Gaskets used with corrugated metal pipe bands type B, C, D, and E shall be made of three-eighths (3/8) inch thick by twelve (12) inch minimum width closed cell synthetic sponge rubber, per ASTM Designation D1058-59T, grade SCE-43, fabricated in the form of a cylinder with a diameter of approximately ten (10) percent less than the nominal pipe size. The gasket shall be centered under the band and lapped an equal distance on the ends of the adjoining pipe sections.

Where gaskets are specified, the exterior rivet heads the last (12) inches of longitudinal seam at both ends of each pipe section shall be kept from projecting past the outside of the pipe. This may be accomplished by the use of countersunk rivets or by welding the last twelve (12) inches of seam.

Gaskets used with corrugated metal pipe band type F shall be O-ring gaskets (2 per joint) of material meeting ASTM C443 of thirteen-sixteenth (13/16) inch minimum cross sectional diameter. A mastic sealant Chemsco TC-40 or equal, 1/8 inch x 1 1/2 inch x 5 inch shall be used between the lapped ends of the band.

Section 60—Pipe Materials and Testing for Sewers, Drains and Culverts

When specified on the plans or special specifications, heat shrinkable thermoplastic couplings shall be used in place of a gasket at each joint or corrugated metal pipe.

-3.02H2 Coupling Bands for Corrugated Metal Pipe

Coupling bands for corrugated metal pipe shall be as detailed in the standard drawing, and for corrugated steel pipe shall meet the requirements of AASHTO M36, and for corrugated aluminum pipe shall meet the requirements of AASHTO M196 and M197. Coupling bands for corrugated metal pipe shall be made by the same manufacturer as the pipe and shall be made of the same base material as the pipe which it connects. Asphalt coating on bands will only be required for asbestos impregnated galvanized corrugated steel bands. The coupling bands shall also be so constructed as to lap on an equal portion of each end of the pipe sections to be connected.

Where required and noted on the plans, gaskets shall be as described in 60-3.02H1.

Corrugated metal coupling bands, Types B, C, D, and E may be made in two halves, and one half riveted or welded to one end of one pipe section. These bands may be made from metal two gages lighter than the pipe.

Band Type F shall be made from 16 gage material to mesh into the inside corrugation of 2 3/4 inch x 1/2 inch adjacent to the end corrugation of 2 inches by 1/2 inch formed on each end of helical pipe.

Corrugated metal coupling bands shall be one of the types as detailed in the standard drawing and as noted on the plans for all sewer pipe and drain and culvert pipe except that nongasketed bands used on drain and culvert pipe may be connected with an approved band in accordance with M36 or M196.

60-4 FITTINGS

Unless otherwise specified, tee fittings shall be provided in the sewer main for side sewer, catch basin or inlet connections. Tees shall be six (6) inches inside diameter, unless otherwise specified or noted. 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. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface.

60-4.01 CAP FOR FITTINGS

All fittings shall be capped or plugged with a plug of an approved material, gasketed with the same gasket material as the pipe joint; 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.

60-5 "PROOF TESTS" (Prequalification)

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.

-5.01A Concrete Pipe

Pipe and joint assembly shall be subject to the following proof-tests at the discretion of the engineer:

A. *Pipe in Straight Alignment.* Not less than three nor more than five pipes selected from stock by the Engineer shall be assembled according to the manufacturer's installation instructions, and with the ends suitably plugged and restrained against internal pressure shall be subjected to 10 psi hydrostatic pressure for 10 minutes. There shall be no visible leakage at the joints.

B. *Pipe in Maximum Deflected Position.* Upon completion of the test for pipe in straight alignment, the test section shall be deflected to create a position 1/2" wider than the fully compressed position, on one side of the outside perimeter. While thus deflected there shall be no visible leakage at the joint when the assembly is subjected to 10 psi hydrostatic pressure for 10 minutes.

C. *Joints under Differential Load.* The test section shall be supported on blocks, or otherwise, so that one of the pipes is suspended freely between adjacent pipe, bearing only on the joints. A force as per the following table shall be applied along a longitudinal distance of 12", immediately adjacent to one of the joints.

4" — 600#	15" — 3700#
6" — 900#	18" — 4400#
8" — 1200#	21" — 5000#
10" — 1500#	24" up — 5500#
12" — 1800#	

There shall be no visible leakage when the stressed joint is subjected to 10 psi internal hydrostatic pressure for 10 minutes.

-5.01B Clay Pipe

Pipe and joint assembly shall be subject to the following proof tests at the discretion of the Engineer:

A. *Pipe in Straight Alignment.* Not less than three nor more than five pipes selected from stock by the Engineer shall be assembled according to the manufacturer's installation instructions, and with the ends suitably plugged and restrained against internal pressure shall be subjected to 10 psi hydrostatic pressure for 10 minutes. There shall be no visible leakage at the joints.

B. *Pipe in Maximum Deflected Position.* Upon completion of the test for pipe in straight alignment, one joint shall be deflected 1/2" per foot of pipe length for pipe 12" in diameter, or less, or 3/8" per foot of pipe length for pipe 15" to 24" in diameter. There shall be no visible leakage when the assembly is subjected to 10 psi hydrostatic pressure for 10 minutes.

C. *Joints under Differential Load.* The test section shall be supported on blocks, or otherwise, so that one of the pipes is suspended freely between adjacent pipe, bearing only on the joints. A force of 150 pounds per inch diameter shall be applied over an arc of not less than 120 degrees and along a longitudinal distance of 12 inches, immediately adjacent to one of the joints. There shall be no visible leakage when the stressed joint is subjected to 5 psi internal hydrostatic pressure for 10 minutes.

-5.01C Asbestos-Cement Pipe

Pipe and joint assembly shall be subject to the following proof-tests at the discretion of the Engineer:

A. *Pipe in Straight Alignment.* Not less than three nor more than five pipes selected from stock by the Engineer shall be assembled according to the manufacturer's installation instructions, and with the ends suitably plugged and restrained against internal pressure shall be subjected to 10 psi hydrostatic pressure for 10 minutes. There shall be no visible leakage at the joints.

B. *Pipe in Maximum Deflected Position.* Upon completion of the test for pipe in straight alignment, one joint shall be deflected 5 degrees (one inch offset per foot of pipe) for diameters 12" and under, or 3 degrees (3/4 inches offset per foot of pipe) for diameters 14" and larger (one half the deflection between each pipe and the coupling). There shall be no visible leakage when the assembly is subjected to 5 psi hydrostatic pressure for 10 minutes.

C. *Joints under Differential Load.* The test section shall be supported on blocks, or otherwise, so that one of the pipes is suspended freely between adjacent pipe, bearing only on the couplings. A force of 150 pounds per inch diameter shall be applied over an arc of not less than 120 degrees and along a longitudinal distance of 12 inches, immediately adjacent to one of the couplings. There shall be no visible leakage when the stressed joint is subjected to 10 psi hydrostatic pressure for 10 minutes.

-5.01D Cast Iron Pipe and Ductile Iron Pipe

Cast iron and ductile iron pipe which are manufactured in accordance with ANSI Standard A21.11 shall be considered adequate to prequalify under these specifications and separate "proof-tests" will not be required; otherwise, the pipe and joints shall be subject to the following proof-tests at the discretion of the Engineer:

A. *Pipe in Straight Alignment.* Not less than three nor more than five pipes selected from stock by the Engineer shall be assembled according to the manufacturer's installation instructions and with the ends suitably plugged and restrained against internal pressure shall be sub-

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jected to 10 psi hydrostatic pressure for 10 minutes. There shall be no visible leakage at the joints.

B. *Pipe in Maximum Deflected Position.* Upon completion of the test for pipe in straight alignment, the test section shall be deflected to create a position 1/2" wider than the fully compressed section, on one side of the outside perimeter. While thus deflected there shall be no visible leakage at the joint when the assembly is subjected to 10 psi hydrostatic pressure for 10 minutes.

C. *Joints under Differential Load.* The test section shall be supported on blocks, or otherwise, so that one of the pipes is suspended freely between adjacent pipe, bearing only on the joints. A force as per the following table shall be applied along a longitudinal distance of 12", immediately adjacent to one of the joints.

4" — 600 #	15" — 3700 #
6" — 900 #	18" — 4400 #
8" — 1200 #	21" — 5000 #
10" — 1500 #	24" up — 5500 #
12" — 1800 #	

There shall be no visible leakage when the stressed joint is subjected to 5 psi internal hydrostatic pressure for 10 minutes.

-5.01E ABS Composite Plastic Pipe

Solvent welded joints shall be made with solvent and cement conforming to ASTM D2680. Pipe and joint assembly shall be subjected to the following proof-tests at the discretion of the Engineer:

A. *Pipe in Straight Alignment.* Not less than three nor more than five pipes selected from stock by the Engineer shall be assembled according to the manufacturer's installation instructions, and with the ends suitably plugged and restrained against internal pressure shall be subjected to 10 psi hydrostatic pressure for 10 minutes. There shall be no visible leakage at the joints.

B. *Pipe in Maximum Deflected Position.* Two 12 1/2 foot lengths shall be joined and then deflected along an arc of 720 ft. radius (0.11 ft. offset at the end of each length, from a tangent at the joint). There shall be no visible leakage when the deflected joint is subjected to 10 psi hydrostatic pressure for 10 minutes.

C. *Joints under Differential Load.* The test section shall be supported on blocks, or otherwise, so that one of the pipes is suspended freely between adjacent pipe, bearing only on the joints. A force of 150 pounds per inch diameter shall be applied over an arc of not less than 120 degrees and along a longitudinal distance of 12 inches, immediately adjacent to one of the joints. There shall be no visible leakage when the stressed joint is subjected to 5 psi internal hydrostatic pressure for 10 minutes.

-5.01F PVC Pipe

Rubber gaskets for PVC pipe shall conform to ASTM D1869, Rubber Gaskets for Asbestos-Cement Pipe, pending publication of an ASTM standard for rubber gaskets for PVC pipe. Pipe and joint assembly shall be subjected to the following proof tests at the discretion of the Engineer:

A. *Pipe in Straight Alignment.* Not less than three nor more than five pipes selected from stock by the Engineer shall be assembled according to the manufacturer's installation instructions, and with the ends suitably plugged and restrained against internal pressure shall be subjected to 10 psi hydrostatic pressure for 10 minutes. There shall be no visible leakage at the joints.

B. *Pipe in Maximum Deflected Position.* Two 12 1/2 ft. lengths shall be joined and then deflected along an arc of 720 ft radius (0.11 ft. offset at the end of each length, from a tangent at the joint). There shall be no visible leakage when the deflected joint is subjected to 10 psi hydrostatic pressure for 10 minutes.

C. *Pipe Diameter Deflected to its Maximum Position.* Two lengths shall be joined and uniformly supported for at least 2 feet on both sides of the joint with vertical load applied sufficient to deflect the joint and adjacent pipe to 95% of its initial vertical diameter. There shall be no visible leakage when the stressed assembly is subjected to 5 psi hydrostatic pressure for 10 minutes.

-5.01G CMP Pipe

Pipe and joint assembly shall be subjected to the following proof tests at the discretion of the Engineer:

A. *Pipe in Straight Alignment.* Not less than three nor more than five pipes selected from stock by the Engineer shall be assembled according to the manufacturer's installation instructions, and with the ends suitably plugged and restrained against internal pressure shall be subjected to 10 psi hydrostatic pressure for 10 minutes. There shall be no visible leakage at the joints.

B. *Pipe in Maximum Deflected Position.* The 12 1/2 ft. lengths shall be joined and then deflected along an arc of 720 ft. radius (0.11 ft. offset at the end of each length, from a tangent at the joint). There shall be no visible leakage when the deflected joint is subjected to 10 psi hydrostatic pressure for 10 minutes.

C. *Pipe Diameter Deflected to its Maximum Position.* Two lengths shall be joined and uniformly supported for at least 2 feet on both sides of the joint with vertical load applied sufficient to deflect the joint and adjacent pipe to 95% of its initial vertical diameter. There shall be no visible leakage when the stressed assembly is subjected to 5 psi hydrostatic pressure for 10 minutes.

60-6 MATERIAL CERTIFICATION

The intent of this requirement is that the pipe manufacturer or fabricator shall furnish appropriate certification, based on manufacturer's routine quality control tests, that the materials in the pipe meet the requirements of the pertinent ASTM or ANSI Specification.

60-7 MEASUREMENT AND PAYMENT

Measurement and payment for pipe and incidental accessories, and for the testing as has been specified herein, will be included in such other of the sewer and culvert sections as their use is related to. Accessories and testing shall be considered as incidental to the materials affected and the costs thereof shall be included in the unit contract prices of applicable bid items in the proposals.

Where corrugated pipe is used. The end section including the pipe stub where applicable will be paid for separately from the pipe.

Section 61—Trench Excavation, Backfill, Foundation and Bedding for Sewers, Drains and Culverts

61-1 DESCRIPTION

Trench excavation and backfill shall include all excavation, backfilling, disposal of surplus and unsuitable material, and all other work incidental to the construction of trenches, including any additional excavation which may be required for manholes or other structures forming a part of the pipe line and not otherwise classified as "Structure Excavation".

61-2—CLASSIFICATION

Trench excavation and backfill shall be classified as Class A or Class B for earth excavation, Class C for rock excavation, and Class D for excavation in unsuitable earth below grade. The approximate limits and quantities for Classes A, B, and C will be shown on the construction plans except for those projects where it is contemplated that all trench excavation and backfill will be Class A in which case no classification will appear on the construction plan.

Classes A, B, and C excavation and backfill, where ordered by the Engineer, shall extend to a depth not more than one foot below the invert elevation. Beyond this depth, Class D excavation will be paid for.

The Engineer shall have the authority to change classifications and the limits thereof as he may deem necessary, consistent with requirements outlined under definitions of the classifications.

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61-2.01 TRENCH EXCAVATION AND BACKFILL, CLASS A

Class A shall be trench excavation where the excavated material is piled beside the trench as it is removed and backfilled from this position, or wasted immediately adjacent to the excavation. The disposal of excess material resulting from pipe volume shall be considered as incidental to Class A, unless otherwise provided for in the special provisions.

61-2.02 TRENCH EXCAVATION AND BACKFILL, CLASS B

Class B shall cover all cases of trench excavation where the excavated material, instead of being piled beside the trench, is transported to another site for wasting, or is transported to another point on the trench for backfill, or to another site for storage, as a result of confined operational conditions where no space is available for storage beside the trench.

Where the excavated material is transported to another site for storage all the cost including that of returning the material to the trench site for backfill shall be considered as incidental to this item and no additional payment will be made therefor.

The Contractor shall secure and maintain all necessary waste and storage sites unless otherwise designated on the plans or in the special provisions.

Where the Engineer directs that a blanket of select material be placed over the upper portions of the trench, the excavated material which is displaced by the select material shall be disposed of elsewhere, and shall be considered as Class B.

61-2.03 TRENCH EXCAVATION AND BACKFILL, CLASS C

Class C shall cover the removal and disposal of solid rock, i. e. ledge rock that requires systematic drilling and blasting for its removal, and also boulders exceeding one-half cubic yard in volume. All ledge rock, boulders, or stones shall be removed to provide a minimum clearance of six inches under the pipe.

Hard pan, hard clay or glacial till will not be classified as solid rock excavation. Sandstone, siltstone, shale or other sedimentary rocks which are soft, weathered or extensively fissured will 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 or which has a compressive strength at field moisture content of less than 2,000 psi.

All materials removed shall be replaced with satisfactory waste materials from adjacent trenches or from imported bedding or backfill, as determined by the Engineer. All costs for backfilling not requiring haul shall be considered as incidental to this item. Payment for imported materials, where required, shall be in accordance with applicable bid items in the proposal.

61-2.04 TRENCH EXCAVATION AND BACKFILL, CLASS D

Class D shall apply to the excavation of unsuitable material which lies in excess of one foot below the invert elevation, the removal of which may be ordered by the Engineer. Excavated materials shall be disposed of at an approved waste site and all costs involved in the excavating and wasting of this material shall be considered as incidental to this item. The imported material for foundations required for backfill will be paid for in accordance with the applicable bid items in the proposal.

61-3 CONSTRUCTION DETAILS

61-3.01 EXCAVATION

The length of trench excavated in advance of the pipe laying shall be kept to a minimum, and in no case shall it exceed three hundred (300) feet unless otherwise specifically authorized by the Engineer.

The maximum permissible trench width from the bottom of the trench to the crown of the pipe, shall be as follows:

- 15-inch diameter and smaller 40 inches
- 18-inch diameter
- and larger 1 1/2 x inside diameter + 18 inches

In all cases, trenches must be of sufficient width to permit proper jointing of the pipe and backfilling of material along the sides of the pipe. Trench width at the surface of the ground shall be kept to the minimum amount necessary to install the pipe in a safe manner. If the maximum trench width is exceeded by the Contractor without the written authorization of the Engineer, the Contractor will be required at his own expense to provide pipe of higher strength classification, or to provide a higher class of bedding, as may be deemed necessary by the Engineer.

Wherever a trench is excavated in paved roadway, sidewalk, or other improved area, a vertical trench section, unless otherwise specified, will be required with the maximum trench width at the surface of the ground not to exceed the width called for below the crown of the pipe as specified above. If the Contractor exceeds this width, he will be required to pay for any additional select backfill material, if required, and any additional surface and sub-surface improvements.

Excavation for manholes and other structures shall be sufficient to provide a minimum of twelve (12) inches between their surfaces and the sides of the excavation. All 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 two (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 provision shall be made for merging traffic where such is necessary. Free access shall be provided to all fire hydrants, water valves and meters, and clearance shall be left to enable free flow of storm water in all gutters, other conduits, and natural watercourses.

Excavation for manholes and other structures shall be sufficient to provide a minimum of twelve (12) inches between their surfaces and the sides of the excavation. All 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 two (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 provision shall be made for merging traffic where such is necessary. Free access shall be provided to all fire hydrants, water valves and meters, and clearance shall be left to enable free flow of storm water in all gutters, other conduits, and natural watercourses.

61-3.02 CONTROL OF WATER

The Contractor shall furnish, install and operate all necessary machinery, appliances and equipment to keep excavations free from water during construction, and shall dewater and dispose of the water so as to not cause injury to public or private property or to cause a nuisance or a menace to the public. He shall at all times have on hand sufficient pumping equipment and machinery in good working condition for all ordinary emergencies, including power outage, and shall have available at all times competent workmen for the operation of the pumping equipment.

The control of ground water shall be such that softening of the bottom of excavations, or formation 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 excavating, construction of structures, installing of pipelines and sewers, placing of structure and trench backfill and the placing and setting of concrete, excavations shall be kept free of water except as specified. 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 one 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.

Dewatering of the trench shall be considered as incidental to the construction and all costs thereof shall be included in various unit contract prices in the proposal, unless otherwise provided in the special provisions.

61-3.03 FOUNDATIONS AND BEDDING FOR SEWER & DRAINS

-3.03A Foundation Preparation

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Prior to installation of bedding and pipe, the trench bottom shall be brought to grade as indicated for the type of bedding specified, and stabilized if necessary, by one of the following methods to provide a foundation capable of supporting the pipe in its proper position. 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.

Method 1. Subsoil Modification. Crushed rock, gravel, sand, or other durable inert material, 100% passing a 3" screen, shall be worked into the subsoil to the extent necessary to accomplish the required stabilization. Tight sheeting may be driven below the grade of the trench bottom in order to limit the quantity of subsoil to be stabilized, and if called for will be a pay item. Such sheeting shall be left in place below the elevation of the top of the bedding material. Unless the aggregate is well graded from coarse to fine as specified under method 2, the completed trench bottom shall not contain a top layer more than 2" thick containing aggregate unmixed with native material.

Method 2. Ballasting. A ballast layer of crushed rock, gravel, sand or other durable inert material, well graded from coarse to fine is required. The maximum size of ballast shall not exceed one inch per foot of pipe diameter up to a maximum of three inches. The material shall be placed to a minimum depth of four inches or as may be necessary to provide the required stabilization. Note that bedding material described in 61-3.03B may be used as ballast, and that ballast material as herein described may be used as bedding, up to the bottom of the pipe. Tight sheeting may be driven below the grade of the trench bottom in order to increase the effectiveness of the ballasting, and if called for will be a pay item. Such sheeting shall be left in place below the top of the bedding material.

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 foundation material is required, all costs for its procurement and placement shall be included in the unit contract price per cubic yard for "Foundation Material".

-3.03B Pipe Bedding in Solid Rock Excavation

In solid rock excavation, all ledge rock, boulders, or stones shall be removed to provide a minimum clearance of six (6) inches under the pipe. All materials thus removed shall be replaced with the classification of bedding noted on the plans, or directed by the Engineer.

-3.03C Bedding for Rigid Conduits

Bedding procedures shall be classified as Class A, Class B, Class C, and Class D. The approximate limits for the various classes of bedding will be indicated on the construction plans where it is feasible to do so.

Where no special reference is made to the classification of bedding on the plans or in the specifications, it shall be construed that all bedding procedures shall be as described for Class D.

The Engineer shall have the authority to change bedding classifications and the limits thereof as he may deem necessary during the progress of the construction, consistent with the requirements outlined under the definitions and requirements of the various classifications contained herein. Classification of bedding will not constitute a pay item in itself, with the exception of Class A bedding, but the materials used will be paid for in accordance with applicable bid items in the proposal.

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.

-3.03C1 Class A Bedding. Class A bedding shall consist of a pipe cradle constructed of Class 4 (1½) portland cement concrete as specified in Section 37-3.04. The bottom of the trench shall be fully compacted before placement of pipe or cradle. Cradle construction shall conform to the details on standard drawing.

The unit contract price per linear foot for Class A bedding shall be full compensation for furnishing all labor, equipment, and materials necessary to construct the con-

crete cradle. Any trench excavation, furnishing and placing of select bedding material and compaction of same will be paid for in accordance with applicable bid items in the proposal.

-3.03C2 Class B Bedding. Class B bedding shall consist of leveling the bottom of the trench or the top of the foundation material at such elevations as the Engineer may direct, and furnishing and placing bedding material under the pipe including the joint and along the sides to the springline.

Bedding shall be placed in at least two lifts: The first lift, to provide at least 4" thickness under any portion of pipe 27" diameter and smaller, or 6" thickness under any portion of pipe 30" 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" thickness, shall be installed up to the springline. 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.

No bedding material shall be used unless accepted by Engineer. Samples of the material shall be submitted by the Contractor a sufficient time in advance of intended use to enable its inspection and testing.

-3.03C3 Class C Bedding. Class C bedding shall meet the requirements outlined for Class B bedding except that bedding material need be placed only to approximately the lower quadrant of the pipe.

-3.03C4 Class D Bedding. Class D bedding shall consist of carefully excavating the trench to proper grade and placing select native material around the pipe and backfilling in accordance with Section 61-3.05. Class D bedding, as described, shall be considered as incidental to the construction and all costs thereof shall be included in other unit contract items of the proposal.

3.03C5 Materials. Bedding material for Class B or Class C bedding shall be one of the following, at the Contractor's option unless otherwise provided in the special provisions.

Sand. Sand bedding shall be a clean sand-gravel mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D422.

U.S. Standard Sieve Size	Per Cent Passing, by Wt.
¾"	100
⅝"	70-100
#4	55-100
#10	35-95
#20	20-80
#40	10-55
#100	0-10
#200	0-3

Pea Gravel: Pea gravel bedding shall be a clean mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D422.

U.S. Standard Sieve Size	Per Cent Passing, by Wt.
¾"	100
⅝"	95-100
#8	0-10
#200	0-3

Gravel: Gravel bedding shall be a clean mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D422.

U.S. Standard Sieve Size	Per Cent Passing, by Wt.
1-½"	100
¾"	30-75
½"	15-55
¼"	0-5

Gravel-Sand:

U.S. Standard Sieve Size	Per Cent Passing, by Wt.
1-½"	100
¾"	30-75
½"	15-55
¼"	0-40
#200	0-3

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Crushed Rock: Crushed rock bedding shall be a clean mixture free from organic material and conforming to the following gradation when tested in accordance with ASTM D422.

U.S. Standard Sieve Size	Per Cent Passing, by Wt.
¾"	100
⅝"	50-65
#40	8-23
#200	0-10

Native Material: Native material will be acceptable as Class B or Class C bedding material provided it meets the requirements for any one of the above listed materials.

The cost of bedding material, where required, shall be included in the unit Contract price for "Bedding Material", per linear foot for each size of pipe. Payment will be made in accordance with applicable bid items in the contract.

-3.03D Bedding for Flexible Conduits

-3.03D1 Bedding for PVC and ABS Composite Materials

Material to be used for bedding of these Flexible Conduits shall conform to material listed under 3.03C5. Bedding shall be placed in more than one lift: The first lift, to provide at least 4" 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" 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" lift of moderately compacted material shall be placed over the crown of the pipe.

-3.03D2 Bedding for Corrugated Metal Pipe

Material for sidefill around and to the crown elevation of corrugated metal pipe shall be selected and shall not contain stones larger than 3 inches in greatest dimension, frozen lumps, roots, or moisture in excess of that permitting thorough compaction. Material placed within the pipe compaction zone shall be brought up simultaneously on each side of the pipe to the top of the pipe and compacted to 90% density as defined by Section ASTM D 698 Method D.

61-3.04 CRIBBING AND SHEETING—SHORING

Unless otherwise provided in the special provisions the Contractor shall provide all materials, labor and equipment necessary to 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. If the Contractor elects he may use a combination of shoring and overbreak, tunneling, boring, sliding trench shields or other methods of accomplishing the work provided the method meets with the approval of all applicable local, state and federal safety codes.

Removal of any cribbing and sheeting from the trench shall be accomplished in such a manner as to fulfill the above requirements.

Damages resulting from improper cribbing or from failure to crib shall be the sole responsibility of the Contractor. Cribbing will not be a pay item and the cost thereof shall be included in the unit contract price for "Trench Excavation" of the particular class of trench excavation required, unless otherwise provided in the special provisions.

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 or 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.

61-3.05 BACKFILLING FOR SEWERS & DRAINS

As the pipe is installed, it shall be backfilled with select native materials up to an elevation six (6) inches above crown, taking care that the backfill is in contact with the entire periphery of the pipe. The backfill shall be carefully placed so that subsequent backfilling operations will not disturb the pipe in any way.

In backfilling the trench, the Contractor shall take all necessary precautions to protect the pipe from any damage or shifting of the pipe. In general, backfilling shall be performed by pushing the material from the end of the trench into, along and directly over the pipe so that the material is applied in the form of a rolling slope rather than by side filling which will damage the pipe. Backfilling from the sides of the trench will be permitted after sufficient material has first been carefully placed over the pipe to such a depth as the Engineer may approve.

During all phases of the backfilling operations and testing as outlined herein, the Contractor shall protect the sewer installation, provide for the maintenance of traffic as may be necessary, and provide for the safety of property and persons.

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 plans, or as the Engineer may direct, and shall be leveled to provide for a uniform thickness of the borrow material. Where compaction is required, it shall be performed prior to placing the borrow material.

The cost of backfilling and compacting shall be included in the unit contract price per linear foot for the particular class of trench excavation and backfill unless otherwise specified.

61-3.06 COMPACTION OF TRENCH BACKFILL

Unless otherwise provided in the Special Provisions, compaction of trench backfill material is required. One of the following methods or combination thereof as set forth in the special provisions shall be used and payment will be made in accordance therewith. The Engineer shall have the right to change methods and limits to better accommodate field conditions. The density of backfilled material shall meet requirements outlined in the special provisions.

-3.06A Water Settling

Water settling, when permitted, shall be performed and payment will be made therefor as specified in Section 16, entitled "Water".

-3.06A1 Water for Uses Other Than Trench Backfill

Water required for dust control and uses other than described in this section shall be used and paid for in accordance with the requirements of Section 16, "Water".

-3.06B Mechanical Compaction

When mechanical compaction is specified, backfill shall be placed in lifts and each lift shall be compacted to the density specified in the Special Provisions. Compaction control tests shall be as specified in Section 13-3.10E5.

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. Contractor shall take any necessary steps to keep excavated material from becoming saturated beyond the critical moisture limits and will be required to replace any such saturated material with Class A Bank Run Gravel as specified in Section 26-2 or such other material as the Engineer may accept at Contractors own cost and expense.

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. At the option of 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 test shall be considered as incidental to the backfill and shall be included in the unit prices bid for the various items involved.

If the required compaction density has not been ob-

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tained, 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 re-establish his compaction procedure. In no case will excavation and pipelaying operations be allowed to proceed until the specified compaction is attained.

61-3.07 BANK RUN GRAVEL FOR TRENCH BACKFILL

Wherever a trench is excavated in paved roadway, sidewalk or other area where minor settlement would be detrimental and where the native excavated material is not suitable for compaction as backfill, the trench shall be backfilled to such depth as the Engineer may direct with Bank Run Gravel, Class A or Class B as specified in Section 26-2, excepting that 100 percent of the material shall pass the 3 inch square opening.

61-3.08 CULVERT BEDDING AND BACKFILL

Placement of materials around and over culverts shall be performed in accordance with requirements specified herein within a defined pipe compaction zone as shown on the standard plan.

Material placed within the pipe compaction zone shall be selected and shall not contain stones larger than 3 inches in greatest dimension, frozen lumps, roots, or moisture in excess of that permitting thorough compaction. Material placed within the pipe compaction zone shall be brought up simultaneously on each side of the culvert to the top of the culvert.

In either trench or embankment installations the material within the pipe compaction zone and up to the top of the pipe shall be placed in layers of not more than 0.5 feet in loose thickness and compacted to 95% maximum dry density as defined in section 13-3.10 E5 of these specifications, placement of materials within the pipe compaction zone above the top of the pipe shall be in accordance with the standard plan.

The contractor shall not operate tractors or other heavy equipment over the culvert until it has been backfilled as provided above, or until the embankment has reached a height of 2 feet above the top of the culvert, or as provided in Section 61-3.09 if the site of the culvert is at a location where legal highway load limitations are not in effect.

For culverts placed under farm, residential or light traffic county road approaches where the approach fill is normally low, backfill material of selected material free from stones, frozen lumps, etc., shall be placed under and around the culvert and thoroughly compacted in place. The trench shall be completely filled equally on each side of the culvert and the culvert covered to a depth of at least 1 foot with hand placed and compacted materials before the construction of the embankment over the culvert is permitted to proceed in the usual manner.

61-3.09 LOAD LIMITS

After the culvert has been constructed and backfilled in accordance with the specifications, and the embankment has reached a height of 2 feet above the top of the pipe, when the pipe is installed in accordance with installation Design A, as shown on the standard plan and 2 feet above the top of the backfilled zone, when the pipe is installed in accordance with installation Design C, as shown on the standard plan, the Contractor may operate across those pipes with equipment having an axle weight on single axles of not more than 24,000 pounds, or an axle weight of not more than 16,000 pounds each for tandem axles having an axle spacing of less than 10 feet in accordance with the standard plans.

After the embankment has reached a height of 5 feet above the top of the pipe, the Contractor may operate across those pipes with equipment having an axle weight on single axles of not more than 100,000 pounds if the outside wheel spacing is a minimum of 7 feet on centers

on the axle with the following exceptions:

Class III reinforced concrete pipes shall have a minimum height of embankment above the top of the pipe of 6 feet for Design A installation and 7 feet for Design C installation.

Class II reinforced concrete pipes shall have the ability to withstand a maximum axle load of 80,000 pounds if the outside wheel spacing is a minimum of 7 feet on centers on the axle and the minimum height of embankment above the top of the pipe shall be 6 feet for Design A installation and 10 feet for Design C installation.

61-3.10 PRESERVATION OF EXISTING TREES

Preservation of existing trees shall be performed in accordance with sub Section 12-4.

61-3.11 TOP SOIL REMOVAL AND REPLACEMENT

Removal of top soil and replacement of it shall be performed in accordance with the provisions of Section 55 and payment will be made at the unit contract price per cubic yard as specified therein.

61-3.12 LAWN REMOVAL AND REPLACEMENT

Removal of lawn and the replacement of it shall be performed in accordance with the provisions of Section 56 and payment will be made at the unit contract price per square yard as specified therein.

61-4 MEASUREMENT AND PAYMENT

61-4.01 TRENCH EXCAVATION AND BACKFILL

When the proposal contains a bid item of "Trench Excavation and Backfill", the measurement for payment therefor will be made on the basis of one or both of the units described in sections 61-4.01A and 61-4.01B, as they apply to the proposal and special provisions.

When no bid item for "Trench Excavation and Backfill" is included in the proposal, all work and costs for excavating trenches to the grades shown on the proposal plans and for backfilling with excavated materials shall be considered as incidental to the construction, and shall be included in other items of the contract.

-4.01A Measurement by the Linear Foot

When measurement and payment is called for by a unit contract price per linear foot, the trench shall be measured continuously along center line from the beginning point to the terminus and including the distances through structures, excepting however, that if excavation for structures is a bid item in connection with the structures, the allowable distance along center line through the structure excavation shall be deducted from the total length of trench.

The unit contract price per linear foot for "Trench Excavation and Backfill, Class" shall be full compensation for all labor, materials, tools and equipment required to excavate, backfill and compact the trench in accordance with the plans and specifications. The unit contract price does not, however, include the work and expense of bank run gravel, foundation material and bedding material, if required, will become separate bid items in the proposal.

-4.01B Measurement by the Cubic Yard

When measurement and payment is called for by a unit contract price per cubic yard, the volume shall be computed upon the following basis for length, width and depth of trench:

Length. The entire horizontal distance in feet along the center line of the trench, including measurement through manhole or structure locations, excepting however, that the measurement through such structures will be deducted if the proposal carries a separate item of structure excavation that is applicable to the structures.

Width. For 24-inch pipe and smaller, the width upon which excavation will be calculated will be the inside diameter of the pipe plus 24 inches. For pipes with inside diameter greater than 24 inches, the calculated width will be the inside diameter plus 36 inches.

Depth. The vertical measurement shall be whichever is the lesser dimension arrived at from the following possible cases: (a) the vertical measurement from invert

Section 62—Pipe Laying, Jointing and Testing

of pipe to original ground or paved surface, (b) the vertical measurement from invert of pipe to scalped surface after removal of top soil or lawn, and (c) the measurement from invert of pipe to roadway excavation subgrade in cases where it is intended that sewer and street construction are to be performed in conjunction with each other. In cases where a blanket of bank run gravel is placed upon a lower layer of compacted native backfill, the vertical measurement of the "Bank Run Gravel, Class B" will be from the top of the compacted native backfill to the completed surface of the bank run gravel.

Measurement will be made at intervals of not more than 50 feet along the center line of the trench, and closer if the terrain justifies.

The unit contract price per cubic yard for "Trench Excavation and Backfill, Class" shall be full compensation for all labor, material, tools and equipment required to excavate backfill, and compact the trench in accordance with the plans and specifications. The unit contract price does not, however, include the work and expense of bank run gravel, foundation material and bedding material, which, if required, will become separate bid items in the proposal.

-4.01C Unexpected Objects

Where unexpected objects, such as stumps, railroad ties, buried pavement, etc., are encountered in the trench excavation, they shall be removed and disposed of by the contractor. In cases where they can be removed by the same equipment or method at hand for excavation, and where it is unnecessary to employ special equipment, install shoring or bracing, or to increase the trench width or depth more than two feet for any one object, then in that event the removal of such obstructions shall be considered as an incidental part of the contractor's work and no additional payment will be made therefor.

Where such unexpected objects require extra work beyond the scope of the work outlined above, or extra equipment for their removal, additional payment will be made as specified in Section 9-1.03 or 9-1.04.

61-4.02 BANK RUN GRAVEL FOR TRENCH BACKFILL

Bank run gravel of class specified will be measured by cubic yard in the trucks at the point of delivery.

61-4.03 PIPE BEDDING CLASS A

Measurement will be for the actual number of linear feet of concrete cradle constructed for each pipe size.

61-4.04 FOUNDATION MATERIAL

Foundation material will be measured by the cubic yard in trucks at the point of delivery.

61-4.05 PIPE BEDDING MATERIAL CLASS B AND CLASS C

Measurement will be for the actual linear feet of bedding placed for each size of pipe.

61-4.06 DESIGN C CULVERT CONSTRUCTION

Design C trench construction shall be measured by the cubic yard to the neat lines of the specific loose zone directly above the pipe as shown on the Standard Plans. The length of measurement for Design C trench construction will be as stated by the Engineer.

61-4.07 COMPACTING EQUIPMENT

Measurement will be to the nearest one-half (1/2) hour of actual time compacting equipment is used for compacting backfill. No payment will be made of time consumed in making repairs to compacting equipment or for moving equipment to and from areas where compaction is required.

61-4.08 SHORING

When the proposal contains a bid item for shoring, the measurement for payment therefore will be made on actual "square foot" quantities as measured in the field. The length and depth measurements shall be as defined in section 61-4.01B. The square foot area will be determined by average depth measurement at the center of the trench times the length, which will be full compensation for both sides of the trench.

The unit contract price for "shoring for trenches feet to feet in depth" shall be full compensation for all labor, equipment and materials necessary to shore trenches in accordance with these specifications and all applicable local, state and federal requirements.

When no bid item for cribbing and sheeting or shoring is included in the proposal, all work and costs shall be included in the unit contract price for trench excavation, unless otherwise specified.

61-5 PAYMENT

Payment will be made for such of the following items as are listed as pay item and shown on any particular contract:

1. "Trench Excavation and Backfill Class A", per linear foot.
2. "Trench Excavation and Backfill Class B", per linear foot.
3. "Trench Excavation and Backfill Class C", per linear foot.
4. "Trench Excavation and Backfill Class D", per linear foot.
5. "Trench Excavation and Backfill Class A", per cubic yard.
6. "Trench Excavation and Backfill Class B", per cubic yard.
7. "Trench Excavation and Backfill Class C", per cubic yard.
8. "Trench Excavation and Backfill Class D", per cubic yard.
9. "Bank Run Gravel Class A", per cubic yard.
10. "Bank Run Gravel Class B", per cubic yard.
11. "Pipe Bedding Class A for (size) Pipe", per linear foot.
12. "Pipe Bedding Class B for (size) Pipe", per linear foot.
13. "Pipe Bedding Class C for (size) Pipe", per linear foot.
14. "Foundation Material" per cubic yard.
15. Compacting Equipment.
16. "Hydrant Settling Water", per 1,000 gallons.
17. "Haul Settling Water", per 1,000 gallons.
18. "Water", per 1,000 gallons.
19. "Top Soil Removal and Replacement", per cubic yard.
20. "Lawn Removal and Replacement", per square yard.
21. Design C Culvert Construction, per cubic yard.
22. "Shoring for trenches—4 to 10 feet in depth," per square foot.
23. "Shoring for trenches—10 to 15 feet in depth," per square foot.
24. "Shoring for trenches—15 to 20 feet in depth," per square foot.
25. "Shoring for trenches—over 20 feet in depth," per square foot.

If the owner has specified the unit price for Items 22, 23, 24 and 25 in the proposal, the unit price specified shall be considered full compensation for the shoring as actually measured during construction. The Contractor shall include in the unit bid price for trench excavation any cost for shoring over that which is stated by the Owner.

Section 62—Pipe Laying, Jointing and Testing

62-1 DESCRIPTION

This section covers the pipe laying and jointing of sewers, drains and culverts and the testing of sanitary sewers and storm drains. The construction of these lines shall meet the requirements herein and as shown on the plans, special provisions and standard drawings.

Any pipe or appurtenance which inadvertently or otherwise has been laid or jointed in non-accordance with the specifications and special provisions shall, upon direction of the Engineer at any time before final acceptance of the contract or before expiration of the guaranty period, be repaired or be removed and replaced at the expense of the Contractor, and to the satisfaction of the Engineer.

Section 62—Pipe Laying, Jointing and Testing

62-2 MATERIALS

The materials shall conform to requirements outlined in the various applicable sections of the specifications.

62-3 CONSTRUCTION DETAILS

62-3.01 SURVEY LINE AND GRADE

Survey line and grade control hubs will be provided by the Engineer in a manner consistent with accepted practices.

The Contractor shall constantly check line and grade and in the event they do not meet specified limits described hereinafter, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the work.

62-3.02 SEWER PIPE LAYING

Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the foundation and/or bedding has been prepared in accordance with Section 61. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surfaces.

All pipe laid shall be retained in position by mechanical means or otherwise, as approved by the Engineer, so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the plans, within the limits that follow.

Variance from established line and grade shall not be greater than one thirty-second (1/32) of an inch per inch of pipe diameter and not to exceed one-half (1/2) inch, provided that such variation does not result in a level or reverse sloping invert; provided also, that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed one sixty-fourth (1/64) per inch of pipe diameter, or one-half (1/2) inch maximum.

The sewer pipe, unless otherwise approved by the Engineer, shall be laid up grade from point of connection on the existing sewer or from a designated starting point. The sewer pipe shall be installed with the bell end forward or upgrade, unless approved otherwise. When pipe laying is not in progress the forward end of the pipe shall be kept tightly closed with an approved temporary plug.

Where pipelines are to be laid on specified curves of sufficiently short radius to deflect the pipe joints in an amount greater than recommended by the manufacturer, the curves shall be achieved with a series of tangents and shop-fabricated bends, subject to the approval of the Engineer. The pipe lines laid on curved alignment will be measured for payment along the center line of the pipe, and no additional compensation will be allowed for shop fabrication.

62-3.03 CULVERT PIPE

Laying of culvert pipe shall conform to the requirements of Section 62-3.02 except that variation from established line and grade, measured at each joint, shall not exceed one thirty-second (1/32) inch per inch of pipe diameter, and provided that resulting level or back-sloping length of pipe does not occur.

62-3.04 CONTROL OF WATER

See Sec. 61-3.02

62-3.05 BEDDING

The pipe bedding shall be placed so that the entire length of the pipe will have full bearing. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bell holes shall be dug as required to assure uniform support along the pipe barrel.

62-3.06 PLUGS AND CONNECTIONS

Pipe branches, stubs or other open ends which are not to be immediately connected shall be capped or plugged as described in Section 60-4.01.

62-3.07 PIPE MARKINGS

Elliptically reinforced concrete pipe shall be placed so that the top and bottom markings, indicating the minor

axis of the reinforcement, are positioned within five (5) degrees of a vertical plane through the center of the pipe.

62-3.08 PIPE JOINTING

All sanitary sewer and storm drain pipe shall have flexible gasketed joints unless otherwise specified.

All sanitary sewers, storm drains and side sewers shall be subject to tests described in Section 62-3.10.

-3.08A Gasket Type Joints

Flexible gasketed joints shall be assembled in strict accordance with the instructions furnished by the pipe manufacturer, and shall be in accordance with other provisions described below except in any case where they may be inconsistent with the manufacturer's instructions.

Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing the gasket and knocking it out of position, or loading it with dirt or other foreign material. Any gaskets so disturbed shall be removed and replaced, cleaned and lubricated if required, before the jointing is attempted.

Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most flexible gasketed joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.

Sufficient pressure shall be applied in making the joint to assure that it is home, as described in the installation instructions provided by the pipe manufacturer. Sufficient restraint as specified in Section 62-3.02 shall be applied to the line to assure that joints once home are held so, until fill material under and alongside the pipe has been sufficiently compacted. At the end of the work day, the last pipe laid shall be blocked in an effective way to prevent creep during "down time."

-3.08B Joints of Dissimilar Pipes

For dissimilar pipes where suitable adaptor couplings such as Calder type couplings are not available, the jointing shall be accomplished with a special fabricated coupling or concrete encasement expansion block, as approved by the Engineer.

-3.08C Solvent Welded Joints

Solvent welded joints shall be made in accordance with manufacturers instructions, generally as follows:

1. Wipe the bell of inside of sleeve coupling and the spigot end clean.
2. Apply primer liberally to the inside of the sleeve coupling and the outside of the spigot end.
3. Immediately apply the cement over the primer to the inside of the sleeve coupling and the outside of the spigot end.
4. Immediately insert the spigot end into the sleeve coupling with a slight circumferential twist.

62-3.09 SEWER LINE CONNECTIONS

Sewer line connections to trunks, mains, laterals or side sewers shall be left uncovered until after an acceptance inspection has been made. After approval of the connection, the trench shall be backfilled as specified in Section 61-3.05, after first covering the bare pipe with select material compacted to a depth of six (6) inches above crown of pipe.

-3.09A Side Sewer Connections

Where a side sewer is larger than the trunk, main, or lateral to which it is to be connected, the connection shall be made only at a standard manhole unless otherwise provided in the plans or special provisions, or unless otherwise authorized by the Engineer.

-3.09B Manhole Connections

Connection to a manhole shall be made in accordance with the provisions of Section 63-3.12.

62-3.10 TESTING FOR ACCEPTANCE

All sanitary sewers and storm drains shall be cleaned

Section 62—Pipe Laying, Jointing and Testing

prior to testing and shall be tested after backfill by the exfiltration method, or by the low pressure air method, unless otherwise provided in the special provisions. However, where the natural groundwater table is such as to preclude a proper exfiltration test, the Engineer may require infiltration tests.

All work involved in cleaning and testing sewer lines between manholes and/or rodding inlets as required herein shall be completed within 15 working days after backfilling of sewer lines and structures. Any further delay will require the written consent of the Engineer. The Contractor shall furnish all labor, materials, tools and equipment necessary to make the test, clean the lines and to perform all work incidental thereto. Precautions shall be taken to prevent joints from drawing during tests, and any damage resulting from tests shall be repaired by the Contractor at his own expense.

The manner and time of testing shall be subject to approval of the Engineer, provided that the Engineer may limit pipe footage to be laid prior to testing.

All wyes, tees and stubs shall be plugged with flexible jointed caps, or acceptable alternate, securely fastened to withstand the internal test pressure. Such plugs or caps shall be readily removable, and for their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

In the event that the Contractor elects to test large diameter pipe one joint at a time, leakage allowances shall be converted from GPM per 100 feet to GPM per joint by dividing by the number of joints occurring in 100 feet.

If leakage exceeds the allowable amount, corrective measures shall be taken and the line then retested to the satisfaction of the engineer.

Testing of storm drains shall be the same as for sanitary sewers.

-3.10A Exfiltration Test

Prior to making exfiltration leakage tests, the Contractor may fill the pipe with clear water to permit normal absorption into the pipe walls provided, however, that after so filling the pipe he shall complete the leakage test within 24 hours after filling. When under test, the leakage allowable shall be limited according to the provisions that follow. Specified allowances assume pre-wetted pipe.

Leakage shall be no more than five-tenths (0.5) gallon per hour per inch of diameter per one hundred (100) feet of sewer pipe, with a minimum test pressure of six (6) feet of water column above the crown at the upper end of the pipe or above the active ground water table, whichever is higher as determined by the Engineer. The length of pipe tested shall be limited so that the pressure on the invert of the lower end of the section tested shall not exceed sixteen (16) feet of water column, and in no case shall be greater than 700 feet or the distance between manholes when greater than 700 feet. For each increase in pressure of two (2) feet above a basic six (6) feet measured above the crown at the lower end of the test station, the allowable leakage shall be increased by 10 percent, tabulated in the table which follows.

ALLOWABLE LEAKAGE IN GALS. / 100 LINEAR FEET / HR.

Pipe Size (Inches)	6 Ft.	8 Ft.	10 Ft.	12 Ft.	14 Ft.	16 Ft.
4	2.0	2.2	2.4	2.6	2.8	3.0
6	3.0	3.3	3.6	3.9	4.2	4.5
8	4.0	4.4	4.8	5.2	5.6	6.0
10	5.0	5.5	6.0	6.5	7.0	7.5
12	6.0	6.6	7.2	7.8	8.4	9.0
15	7.5	8.2	9.0	9.8	10.5	11.2
18	9.0	9.9	10.8	11.7	12.6	13.5
21	10.5	11.6	12.6	13.6	14.7	15.8
24	12.0	13.2	14.4	15.6	16.8	18.0
27	13.5	14.9	16.2	17.6	18.9	20.2
30	15.0	16.5	18.0	19.5	21.0	22.5
36	18.0	19.8	21.6	23.4	25.2	27.0
42	21.0	23.1	25.2	27.3	29.4	31.5
48	24.0	26.4	28.8	31.2	33.6	36.0
54	27.0	29.7	32.4	35.1	37.8	40.5
60	30.0	33.0	36.0	39.0	42.0	45.0
72	36.0	39.6	43.2	46.8	50.4	54.0

In any case where the measured leakage is exceeded but is not more than one hundred and forty percent (140%) of the allowable leakage, the Contractor will be permitted, at his option and at his own expense, to repair the defective section without removing and relaying the pipe. Such repairs shall satisfactorily comply with requirements of the leakage test.

In event the measured leakage should be more than one hundred forty percent (140%) of the allowable, the Contractor, at his own expense, shall remove and discard all defective pipe and relay new pipe to conform with the requirements of the leakage test.

The Contractor shall furnish all equipment, materials and labor necessary for making the leakage tests. Any arrangement of test equipment which will provide accurate means of measurement will be approved by the Engineer. The leakage test will be made by the Contractor in the presence of the Engineer.

-3.10B Infiltration Test

When the natural ground water table is above the crown of the higher end of the test section, the maximum allowable limit for infiltration shall be four tenths (0.4) gallon per hour per inch of internal diameter per 100 feet of length, with no allowance for external hydrostatic head.

-3.10C Other Test Allowances

All lateral or side sewer branches included in the test section shall be taken into account in computing allowable leakage. An allowance of 0.2 GPH per foot of head above invert shall be made for each manhole included in a test section or tested separately.

-3.10D Air Pressure Test for Sewers and Storm Drains Constructed of Air-Premeable Materials

1. Pipelines may be tested with low pressure air in lieu of water exfiltration, by either the constant pressure method or the pressure drop method. Constant pressure shall be 3 psig greater than the average back pressure of groundwater above the centerline of the pipe, and pressure drop shall be from 3 1/2 to 2 1/2 psig greater than the average back pressure of groundwater above the center of the pipe. At the contractor's option, pipe may be tested without pre-wetting; however, test allowances following assume pre-wetted pipe.
2. The rate of air loss shall not exceed 0.003 CFM per sq. ft. of interior pipe surface, except that when the computed rate for a test section is less than 2 CFM, the allowable rate shall be 2 CFM. In the event that the contractor should elect to test air-permeable pipe without pre-wetting, during dry pipe and/or dry ground conditions, alternate air loss allowances may be substituted as may be approved by the engineer, provided it can be demonstrated that the alternate criteria correlates with the standard criteria for wetted pipe.
3. The test equipment to be used with either method of air testing shall be furnished by the contractor and shall be inspected and approved by the engineer prior to use. The inspector may at any time require a calibration test of gauges or other instrumentation that is incorporated in the test equipment.
4. SAFETY PROVISIONS. Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug which can become a high velocity projectile. Gauges, air piping manifolds and valves shall be located at the top of the ground. No one shall be permitted to enter a manhole where a plugged pipe is under pressure. Four pounds (gauge) air pressure develops a force against the plug in a 12-inch diameter pipe of approximately 450 lbs. Air testing apparatus shall be equipped with a pressure release device such as a rupture disk or a pressure relief valve designed to relieve pressure in the pipe under test at 6 p.s.i.
5. Recommended procedure for Conducting Acceptance Test by the Constant Pressure Method.
 - 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.

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63-1.0E Air Pressure Test for Sewers and Drains Constructed of Non-Air-Permeable Materials

When non-air-permeable pipelines are subjected to the low pressure air test, all of the provisions of 62-3.10D shall apply except as follows:

1. When the constant pressure method is used, the allowable rate of air loss shall be one-fourth of that computed as specified under 62-3.10D.
2. When the pressure drop method is used, the pressure drop shall be from 3.5 to 3.0 psig greater than the average back pressure above the center of the pipe, and the minimum time shall be twice that computed as specified under 62-3.10D.

62-3.11 DEFLECTION TEST FOR PVC AND ABS PIPE

When required by the Engineer, all sanitary sewers, storm drains and culverts constructed of PVC or ABS pipe shall be deflection tested not less than 30 days after the trench backfill and compaction has been completed. The test shall be conducted by pulling a solid pointed mandrel through the completed pipeline. The diameter of the mandrel shall be 95% of the pipe diameter unless otherwise specified by the Engineer. Testing shall be conducted on a manhole to manhole basis and shall be done after the line has been completely flushed out with water. The Contractor will be required, at his expense, to locate and repair any sections failing to pass the test and to retest the section.

62-3.12 TELEVISION INSPECTION

The Owner may at his option require any or all sewer, sanitary or storm, to be inspected by the use of a television camera before final acceptance. The costs incurred in making the initial inspection shall be borne by the owner unless otherwise noted in the special provisions.

The contractor shall bear all costs incurred in correcting any deficiencies found during television inspection including the cost of any additional television inspection that may be required by the owner to verify the correction of said deficiency.

The contractor shall be responsible for all costs incurred in any television inspection performed solely for the benefit of the contractor.

62-3.13 PAYMENT FOR TESTS

The work of cleaning and testing, except TV inspection, and the furnishing caps and plugs for the tests shall be considered as incidental to the construction and all costs incurred therefore shall be included in the unit contract price of pay items in the proposal.

The Contractor shall arrange for and provide all necessary water at his own expense, unless otherwise provided in the special provisions.

If the Contractor shall purchase water from a water utility at a fire hydrant on or near the project, he shall make all arrangements at his own expense and shall pay the utility on basis of actual quantity of water metered.

62-4 MEASUREMENT

Measurement or payment shall be by the linear foot of pipe laid and tested and shall be along the pipe through the tees and fittings. Measurements shall be from center to center of standard types of manholes or to the inside face of structures, or to the end of pipe where dead ends project beyond manholes, and shall be taken to the nearest 0.1 foot.

Measurement for tees and fittings shall be per each for each size as constructed.

62-5 PAYMENT

Payment for all pipe shall be the unit contract price "per linear foot" for each class, size and type of pipe laid and satisfactorily tested in accordance with the specifications. No additional compensation will be allowed for testing.

Payment for tees and fittings shall be the unit contract price "per each" for each size, including caps or plugs laid and tested. No additional compensation will be allowed for testing or providing the cap or plug.

Section 63—Manholes for Storm and Sanitary Sewers

63-1 DESCRIPTION

Standard manholes may be constructed of precast units, concrete masonry units or concrete or clay brick cast-in-place concrete, or shop-fabricated corrugated metal when used with corrugated metal pipe, all in accordance with the standard plans and these specifications; excepting, however, that the contractor's choice of alternatives may be limited in the special provisions.

63-2 MATERIALS

-2.01 REINFORCED CONCRETE

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.

-2.01A Cement

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.

-2.01B Steel Reinforcement

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 40 steel conforming to ASTM A 615 or of bars of Grade 80 steel conforming to ASTM A 306.

-2.01C Aggregates

Aggregates shall conform to ASTM C 33, except that the requirement for gradation shall not apply to precast items.

-2.01D Mixture

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.

-2.01E Curing

Upon completion of casting, the precast manhole 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 manhole components continuously moist during the curing period. Cast-in-place manhole components shall be moist cured for a period not less than seven days, except that when high-early-strength cement is used the curing shall be not less than three 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 @ 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.

63-2.02 STEPS

Unless otherwise specified, manhole steps may be either of the following, at option of the contractor or option of the manufacturer of the manhole.

-2.02A Aluminum Steps

Aluminum steps shall be forged of 6005-T5 alloy having a minimum tensile strength of 38,000 psi. The cross

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section shall be not less than ¼" wide by ⅞" deep with two non-skid grooves not to exceed ⅛" deep and ¼" wide. Pattern and dimensions shall conform to the standard drawings.

-2.02B Galvanized Deformed Bar Steps

Galvanized deformed bar steps shall be 1" diameter deformed bar conforming to ASTM A 615, intermediate or standard grade, hot bent and galvanized after bending. For bending, the temperature shall be at least 1600°F. Galvanizing shall conform to ASTM A 123. Step dimensions and pattern shall conform to the standard drawings.

63-2.03 LADDERS

Except as otherwise provided in the special provisions, base sections of precast manholes more than three feet in height shall be provided with a ladder as detailed on the standard plans, made of aluminum or steel galvanized after fabrication, conforming to the requirements for steps given in sections 63-2.02A and 63-2.03B. Base sections three feet or less in height require no steps or ladder.

63-2.04 MORTAR

-2.04A Mortar for Jointing

Mortar for jointing precast manhole sections or masonry manhole 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.

-2.04B Mortar for Plaster-Coating

Mortar for plaster-coating masonry unit manholes shall be proportioned according to either of the two alternatives 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 2½ and not more than 3 times the sum of volumes of cement and lime.
Alt. 2	1	0	¼	

63-2.05 CONCRETE MASONRY UNITS

Concrete manhole 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" measured radially, and blocks shall have semicircular mortar grooves approximately 1" radius at the ends.

63-2.06 CONCRETE BRICK

Concrete brick shall conform to the Specifications for Concrete Building Brick ASTM C55 Grade A.

63-2.07 CLAY BRICK

Clay brick shall conform to ASTM C 32, Grade NA unless otherwise provided in the special provisions.

63-2.08 CAST IRON FRAMES AND COVERS

Cast iron frames and covers shall conform to the standard drawings. Castings shall conform to the requirements of ASTM A 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 "smooth-on" or similar material will not be permitted. The manufacturer shall provide test bars as per ASTM A 48 for all orders of 200 or more units when called for in the special provisions and, upon request of the Owner, shall certify that the product conforms to the requirements of these specifications.

A bituminous coating equivalent to Preservation Paint Co. No. 25-22 Black Dip Paint shall be applied to all surfaces. The Owner shall have the right to require inspection and approval of all castings prior to painting. Manhole rings and covers shall be machine finished or ground on seating surfaces so as to assure non-rocking fit in any position, and interchangeability. At the request of the Owner, there shall be made available at the foundry

standard rings and standard covers for use by inspectors in testing fit and seating.

Where lock-type castings are called for, the locking device shall be such that the cover may be readily released from the ring, and all movable parts shall be made of non-corrosive metals and otherwise arranged to avoid possible binding. At the request of the Owner there shall be made available at the foundry a testing device suitable for providing the capacity of the assembly to resist an uplift pressure on the lid equal to 20-ft. head.

Nodular iron covers, when specified shall conform to ASTM Designation A-339, Grade 60-45-10.

63-2.09 PRECAST MANHOLE COMPONENTS

Precast manhole components shall conform to ASTM C 478 except as modified herein.

-2.09A Base Sections

Base sections for Type 1 construction shall conform to the requirements for precast manhole sections in Section 63-2.09B herein, 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 plans. The base slab shall be not less than 6" in thickness 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 consist of No. 4 (½") steel on twelve inch centers, both directions (90°) or welded wire fabric of equivalent steel area. The steel shall be placed not less than 2" nor more than 4" from the top, and shall extend into the wall to the manhole section and be tied to the longitudinal steel. 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. Openings for pipe up to 21" diameter may be provided in 48" base sections. Openings for pipe up to 36" diameter may be provided in 54" base sections. Openings for pipe up to 42" diameter may be provided in 72" base sections. Openings for pipe up to 60" diameter may be provided in 96" base sections. When runs are straight through or angles are slight, larger pipe diameters may be accommodated than indicated herein. Where pipe of diameters larger than 54" are to be accommodated, "T-Top" pipe manholes as described in 63-2.09F, or precast base sections larger than 96" or monolithic base structures as described in 63-3.04 may be provided.

-2.09B Precast Manhole Sections

Standard precast sections shall consist of circular sections in standard nominal inside diameters of 36", 48", 54", 72", and 96". Heights of 36" and 48" sections shall be multiples of 12", at the option of the manufacturer. Heights of 72" and 96" sections shall be as required to fit site conditions. Reinforcement for standard sections shall be as designed by the manufacturer. Joints shall be made with mortar, mastic, or flexible gaskets unless otherwise provided in the special conditions, and shall conform to ASTM C 478, paragraph 7.

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".

Steps shall project uniformly from the inside wall of the manhole as per the standard drawings, 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.

-2.09C Precast Cones

Standard precast cones shall provide reduction from 36" to 24", 48" to 24" and 54" to 36" and shall be not less than 17" 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" wide, radially, to receive adjustment block brick. Wall thickness shall be 4" 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" to 24" and the 36" to 24" concentric cones

Section 63—Manholes for Storm and Sanitary Sewers

opposite the ladder steps and about midway in elevation, as shown on the standard drawings. 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.

-2.09D Flat Slab Covers

Standard flat slab covers shall be a minimum of 8" thick and shall conform to the outer dimension of the standard sections upon which they are to be placed. The 24" diameter opening shall be eccentrically located as shown on the standard plans so as to provide at least 6" minimum radial distance from edge of the 24" opening to outer edge of slab, but not more than 2 1/4" offset distance from edge of the 24" opening to the inside face of the standard section below. Reinforcing shall be shown on the standard plans.

-2.09E Flat Slab Reduction Sections

Reductions to 48" or 36" shall be made by means of a flat slab reducing sections as shown on the standard plans. The section shall be a minimum of 8" thick and shall conform to the outer dimension of the section upon which it is to be placed. The 48" or 36" opening shall be located as shown on the plans or noted in the special provisions. Reinforcing shall be as shown on the standard plans.

-2.09F T-Top Pipe Manholes

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.

63-2.10 SHOP FABRICATED CORRUGATED METAL MANHOLES

Where corrugated metal manholes are specified, they shall be as shown on the plans and shall conform to the details as shown in the standard drawing. The base material and gage, and coating if required, shall be as shown on the plans. All pipe connections to the manhole stubs shall be made with a standard band type as shown in the standard drawing.

63-2.11 MONOLITHIC CONCRETE MANHOLES

Drawings for concrete manholes shall be submitted to the Engineer by the Contractor for approval prior to their construction. Walls of monolithic concrete manholes shall be six inches (6") minimum thickness, and the base shall be eight inches (8") minimum thickness, and steps shall be spaced twelve inches (12").

63-3 CONSTRUCTION DETAILS

63-3.01 FOUNDATION PREPARATION

-3.01A Dewatering

Dewatering of the site shall conform to the requirements for sewer trench dewatering in Section 61-3.02.

-3.01B Sub-Base Preparation

Adequate foundation for all manhole structures shall be obtained by removal and replacement of unsuitable material with well graded granular material; or by tightening 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 at the site, 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.

63-3.02 BEDDING

Precast base sections shall be placed on a well graded granular bedding course conforming to the requirements for sewer bedding in Section 61-3.03, but not less than 4" in thickness and extending either to the limits of the excavation or to a minimum of 12" outside the outside limits of the base section. In the latter case, the balance of the excavated area shall be filled with select material well tamped to the level of the top of the bedding to positively prevent any lateral movement of the bedding when the weight of the manhole is placed upon it. The bedding course shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast elements.

63-3.03 CAST-IN-PLACE BASE

Cast-in-place concrete base for supporting manhole structures shall be constructed in accordance with the standard plans.

63-3.04 MANHOLE WITH MONOLITHIC BASE

Monolithic concrete base manholes shall be constructed as shown on the standard plans. The manhole base sections shall be formed and cast in place around the existing large diameter pipe.

63-3.05 MANHOLE DIMENSIONS

Manhole dimensions for the numbered types of manhole specified on the contract plans shall conform in all respects to the applicable requirements therefor on the corresponding standard plan for each type specified.

63-3.06 PRECAST MANHOLES

-3.06A Precast Base

The base section shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment, and making sure that all entering pipes can be inserted on proper grade.

All lift holes and all joints between precast elements shall be thoroughly wetted and then completely filled with mortar, smoothed and pointed both inside and out, to ensure watertightness, except that rubber-gasketed joints need not be mortared.

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 protrusions 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.

-3.06B Cast in Place Base

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 joints between precast elements, and all connections between precast elements and cast-in-place bases or structures shall be thoroughly wetted and completely filled with mortar, smoothed and pointed both inside and out to ensure watertightness, except that rubber-gasketed joints need not be mortared.

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.

63-3.07 MONOLITHIC CONCRETE MANHOLES

Monolithic concrete manholes, Type IV shall be constructed in accordance with the provisions of the Section 63, and applicable provisions of Sections 37 and 39 where not in conflict.

63-3.08 SHOP FABRICATED CORRUGATED METAL MANHOLES

Shop fabricated corrugated metal manholes, shall be constructed in strict accordance with the detailed plans approved by the Engineer, and shall conform to all applicable provisions of these specifications.

63-3.10 GRADE ADJUSTMENT

The Contractor shall initially construct manholes of the type specified on the project plans so as to provide adjustment space for setting cover fastenings to a finished grade, as hereinafter specified. The manhole grade sheet furnished by the Engineer for manhole construction shows the approximate top grade for the manhole plus or minus two-tenths (0.2) foot, and the final grade will be set by the Engineer after backfilling has been completed to the grade established by the Engineer. No separate payment

Section 64—Catch Basins and Inlets

for final adjustment of the cover castings for new construction will be made and all costs thereof shall be considered as incidental and be included in the unit contract price for the manhole, except as provided in Section 63-5.

-3.10A Streets at Grade

Where work is in paved streets or areas which have been brought to grade, not less than 8" or more than 20" shall be provided between the top of the cone or slab and the underside of the manhole casting ring for adjustment of the casting ring to street grade.

-3.10B Streets with no Established Grade

Where work is in streets or other areas which have not been brought to grade, the top of cone or slab shall be constructed so as to provide clearance not less than 24" or more than 36" below the surface to be restored, unless otherwise directed by the Engineer.

63-3.11 CHANNELS

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.

63-3.12 PIPE CONNECTIONS

All rigid pipes entering or leaving the manhole shall be provided with flexible joints within 1 1/2 pipe diameters 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 structure are completely and firmly rammed full of mortar to ensure watertightness. All flexible pipe shall be connected to manhole according to the manufacturers' recommendations.

63-3.13 BACKFILL

Backfill around the manhole and extending at least one pipe length into each trench shall be hand placed and tamped with selected native material up to an elevation of six (6) inches above the crown of all entering pipes. Work shall conform to the applicable provisions of sections 61-3.05, 61-3.06 and 61-3.07, as required by the Engineer.

63-3.14 DROP MANHOLES

Drop manholes, wherever shown on the plans, shall conform in all respects to the requirements for standard manholes of the type or types used on the project except for the additional drop detail as shown on the standard drawing.

63-3.15 ABANDON EXISTING MANHOLE

Work shall include removal and salvage of ring and cover, breaking down the existing structure to a depth of two feet below the ground elevation, plugging all abandoned connections, and disposing of all debris and surplus material. The abandoned manhole shall be filled with sand and compacted as directed by the Engineer.

Payment will be made at the unit price bid each for "Abandon Existing Manhole," which price shall be full compensation for all labor and material in relation therewith.

63-3.16 MANHOLE TESTING FOR LEAKAGE

When manholes are to be tested for leakage, the provisions of Section 62-3.10C shall apply. Normal sweating on the manhole walls shall not be cause for rejection. Defects which result in leaks in excess of allowances specified in 62-3.10C shall be repaired.

63-4 MEASUREMENT

Each manhole will be measured to the nearest one-tenth (0.10) of a foot, from invert of the outlet pipe vertically to the top of the casting. Drop connections will be measured vertically from invert to invert.

63-5 PAYMENT

Payment for each manhole shall consist of a basic price for each, plus a unit price per foot for all depth in

excess of ten (10) feet, plus a unit price per linear foot for drop connections where they occur.

Where more than one type or size designation is shown on the drawings or called for in the special provisions, each shall be covered by a separate bid item of the following form:

1. "Manhole Type (No.), Basic Price" per each.
2. "Extra Depth Manhole Type (No.)," per vertical foot.

3. "Drop Connection (size)," per vertical foot.

Where an existing manhole is encountered in the work and it is required that it must be adjusted to new grade, the work and payment therefore shall be as extra work provided in Section 53-4.01, Adjust Existing Manhole or Catch Basin to Grade.

Where a new constructed manhole 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 for as provided in Section 9-1.03, Extra Work.

4. "Adjust Existing Manhole or Catch Basin to Grade," per each.

The unit contract prices shall be full compensation for furnishing and constructing manholes complete and connected to the sewers, excepting however, that excavation, backfill, gravel bedding or foundation material or additional connection not shown on the plans will be paid for in accordance with the applicable bid items for other sections.

Section 64—Catch Basins and Inlets

64-1 DESCRIPTION

Standard catch basins and inlets may be constructed of precast units, concrete masonry units, or of concrete or clay brick, or cast-in-place concrete, all in accordance with the standard drawings and specifications; excepting however, that the Contractor's choice of alternatives may be limited in the special provisions.

64-2 MATERIALS

Materials for catch basins and inlets shall conform to the applicable provisions of Sections 63-2 except as specified in subsections that follow.

64-2.01 FRAME AND GRATE

The frame and grate shall conform to the standard drawings.

The frame may be made of cast iron, ASTM A-48 Class 30, cast steel, ASTM A-27, Grade 70-36, or nodular cast iron, ASTM A-339, Grade 60-45-10, at the manufacturer's option. The grate may be cast steel or nodular cast iron only, at the manufacturer's option. Other applicable provisions of Section 63-2.08 shall apply.

64-2.02 TRAPS

Where traps are required they shall be of the type specified in the special provisions.

64-2.03 MORTAR

Mortar for jointing catch basins and inlets shall be one part portland cement and not less than one part nor more than two parts plaster sand, mixed with the least amount of water necessary to provide a workable mortar. Mortar for plaster coating shall conform to Section 63-2.04B.

64-3 CONSTRUCTION DETAILS

Construction details for catch basins and inlets shall follow all applicable provisions of Section 63-3, Construction Details. Sections 63-3.10, Grade Adjustment, and 63-3.12, Pipe Connections, will not be applicable, but shall be replaced by the subsections which follow.

Backfill around catch basins shall be adequate as a foundation to support shallow outlet connection pipe. The backfill material placed around the catch basins shall be compacted into place with mechanical tampers in accordance with Section 61-306B.

Section 65—Subsurface Drains

64-3.01 GRADE ADJUSTMENT

The inlet frame may be either cast into a concrete collar or set flange down on concrete adjustment blocks and mortared, as directed by the Engineer. 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 grout the casting in place. Location of catch basins will be staked by the Engineer.

64-3.02 PIPE CONNECTIONS

All openings in the walls of catch basins constructed with precast sections for the insertion of pipe connections and outlet trap castings shall, after pipe or castings have been placed to their final position, be grouted tight in place in a workmanlike manner to present an inside and outside surface conforming to the standard plans. Pipe placed through walls to which connections will be made shall be so placed that the socket end of the pipe is backed against the outside surface of the catch basin as closely as practicable for the angle of entrance. The spigot end of the pipe shall be cut square with the last point of contact with the inside wall surface.

64-3.03 SEEPAGE STRUCTURE

Catch basin inlets may be specified with perforated side walls, as detailed in the special provisions or supplementary drawings, in lieu of outlet pipes. Where called for, the excavation shall be carefully made so that clean filter material, as described in the special provisions, can be packed around the structure to a thickness of not less than 12 inches at any point and more if specified, and extending up from the base of the structure to not less than 6 inches above the highest perforation. Plugged outlet pipes may be stubbed out for future connection to sewers, where specified.

64-3.04 TRAPS

Traps shall be installed where shown on the construction plans.

64-4 MEASUREMENT AND PAYMENT

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

1. "Catch Basin Type (.....)," per each.
2. "Inlets Type (.....)," per each.
3. "Mineral Aggregate for Trench Backfill, Type No. (.....)," per cubic yard.
4. "Catch Basin Trap (type, size)," per each.
5. "Furnish metal frame and grate for catch basin or inlet, Type (.....)," per each.
6. "Adjust existing catch basins (or inlet) to grade," per each.

The above unit bid contract prices shall be payment in full for all labor, materials, tools, and any other work necessary of whatsoever nature it may be to complete the work item as described in accordance with the construction plans and these standard specifications.

64-4.01 CATCH BASIN AND INLET

Payment for catch basins and inlets will be made on a per each basis for the type of catch basin or inlet constructed, as shown on the standard plans.

No measurement for excavation and backfill for catch basins will be made. All costs therefor shall be incidental to their construction, except where classified backfill materials are authorized. Such items shall be paid for by appropriate bid items in the proposal, as described in other sections pertaining thereto.

No measurement for excavation for inlets will be made; all costs therefor shall be incidental to the construction.

Payment for catch basins shall not include compensation for pipe connections outside the catch basin walls for connecting inlets located entirely away and separate from the catch basin, or the pipe connection between the catch basin outlet casting spigot and the sewer to which it is connected. These items will be paid for as separate contract bid items in the proposal as specified in Section 69.

64-4.02 TRAP

Traps where required will be paid for at the unit contract price bid per each in place for each size required.

64-4.03 CATCH BASIN OR INLET FRAME AND GRATE

Catch basin frame and grate casting shall be considered as incidental to the unit contract price for the particular type of catch basin inlet designated in the proposal. Where existing catch basin inlets are encountered and where new castings are to be placed thereon, the cost of furnishing and placing new castings will be paid for at the unit contract price per each for "Furnish Metal Frame and Grate for Catch Basin or Inlet."

The unit contract price per each shall include the furnishing of the frame and grate on the job site, and shall be full compensation for materials and all costs incurred in placing the casting.

64-4.04 ADJUSTMENT OF EXISTING CATCH BASIN AND INLET

Payment for adjustment of existing catch basin and inlet will be made in accordance with Section 53-4.02 when and if the proposal carries an item of "Adjust Existing Catch Basin (or Inlet) to Grade," per each.

Section 65—Subsurface Drains

65-1 DESCRIPTION

This section is intended to cover only the collection and control of subsurface water and does not apply beyond the point at which the water is discharged into the storm sewer or other outlet.

65-2 MATERIALS AND TESTING

65-2.01 PERFORATED CORRUGATED METAL PIPE
Perforated corrugated metal pipe for underdrains shall meet the requirements of AASHO M36 or M197 as hereinafter supplemented.

65-2.02 PERFORATED CLAY PIPE

Perforated clay pipe shall meet the requirements of ASTM Designation C278 for extra strength pipe and shall be perforated in accordance with ASTM Designation C211.

65-2.03 PERFORATED CONCRETE PIPE

Perforated concrete pipe and fittings shall meet the requirements of ASTM Designation C444.

The class of pipe furnished shall be as specified or as shown on the plans.

Perforated concrete pipe may be either bell and spigot or tongue and groove pattern unless otherwise specified.

65-2.04 PERFORATED ASBESTOS-CEMENT PIPE

Perforated asbestos-cement pipe and fittings shall meet the requirements of ASTM C-508.

65-2.05 PERFORATED ABS PIPE

Perforated ABS pipe and fittings shall meet the requirements of the appropriate sections of Section 66. In addition, the pipe shall be Perforated with 3/8" holes, 3" on center along the pipe. Four inch (4") pipe shall have one row on each side approximately 45° above bottom centerline. Six inch (6") pipe shall have two rows on each side approximately 45° above bottom centerline.

65-2.06 INSPECTION

-2.06A Inspection at Factory

If requested in writing by the Engineer, all pipe shall be inspected by the Engineer or his representative at the manufacturer's plant before shipment.

-2.06B Disposition of Defective Material

All material found to be defective at time of delivery or at any time during the progress of the work will be rejected by the Engineer. Rejected material shall be promptly removed from the site of the work by the Contractor.

-2.06C Material Furnished by Contractor

The Contractor shall be responsible for all material furnished by him and shall replace at his own expense any pipe or other material which is found defective.

Section 65—Subsurface Drains

-2.06D Material Furnished by Owner

The Contractor shall inspect all pipe or other materials furnished by the Owner at time of delivery to him, and shall at that time reject any material found defective. Once accepted by the Contractor, any damaged or otherwise defective material found prior to final acceptance of the work shall be replaced at the expense of the Contractor and the cost of all labor, equipment and incidental expense necessary for its replacement and incorporation in the work to the satisfaction of the Engineer shall be borne by the Contractor.

65-3 CONSTRUCTION DETAILS

65-3.01 EXCAVATION

-3.01A General

The 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 unsheltered or sheeted trench measured at the horizontal diameter of the pipe in place shall be 18 inches, or one (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 back-filled 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 and excavated material in such condition that there will be no mixing of excavated material with the filter material to be used for backfilling. All excess excavated material not required for construction shall be disposed of by the Contractor, unless otherwise provided in the special provisions.

-3.01B Protection of Existing Utilities (Vacated)

Covered in Section 5-1.09.

-3.01C Braced and Sheeted Trench

Whenever necessary, sheeting, bracing, or cribbing shall be provided in accordance with the provisions of Section 61-3.04.

65-3.02 PIPE LAYING

-3.02A General

Pipe laying shall conform to the requirements of Section 62, "Pipe Laying, Jointing and Testing", except as hereinafter supplemented.

-3.02B Bedding

Prior to laying any pipe, a 6-inch layer of filter material, as hereinafter described, shall be placed uniformly in the bottom of the trench. This material shall be placed immediately prior to laying the pipe and shall be uniformly spread to true grade and be properly compacted. Should any of this filter material become contaminated by slough of the trench, by storm water or from other cause, it shall be immediately removed and be replaced with acceptable filter material at the expense of the Contractor.

-3.02C Inspection

All pipe shall be inspected prior to lowering into the trench and, if necessary, cleaned of any material tending to plug the perforations of the pipe.

-3.02D Lowering Pipe and Fittings into Trench

The Contractor shall have available the proper tools, men and equipment for efficient execution of the work. All pipe and fittings shall be carefully lowered into the trench to avoid any contamination of the filter bedding material. Pipe or fittings shall not be dumped into the trench. Pipe shall be laid with perforations down, unless otherwise specified or directed by the Engineer.

65-3.03 PIPE JOINTING

-3.03A Corrugated Pipe

Corrugated metal pipe and fittings, shall be connected with an approved band provided by the manufacturer.

-3.03B Asbestos-Cement Pipe

Asbestos-cement pipe shall be supplied with plain ends or with ends machined for tapered couplings. Couplings furnished shall be of asbestos cement or polyethylene plastic and shall be compatible with the end machining of the pipe furnished. Couplings shall also comply with the requirements of ASTM C-508.

lene plastic and shall be compatible with the end machining of the pipe furnished. Couplings shall also comply with the requirements of ASTM C-508.

-3.03C Clay Pipe

Clay pipe shall be butted up tight and centered so as to provide a continuous and uniform line of pipe with a smooth and regular interior surface. Pipe shall be laid without joint closure unless otherwise provided in the special provisions. Clay pipe joints, if specified, may be cement mortar, hot-pour compounds, or bituminous or coal tar base as approved by the Clay Pipe Institute, or factory applied resilient joints per ASTM Designation C425, depending on the service intended.

-3.03D Concrete Pipe

Concrete pipe shall be butted up tight and centered so as to provide a continuous and uniform line of pipe with a smooth and regular interior surface. Pipe shall be laid without joint closure unless otherwise provided in the special provisions. Where joint closure is specified, jointing shall conform to the requirements of Section 62-3.08 except that the dimensional requirements for rubber gaskets and annular spaces will not apply.

-3.03E ABS Pipe

ABS Pipe shall be centered to provide a continuous and uniform line of pipe with a smooth and regular interior surface. Pipe shall be laid without solvent welding unless otherwise provided in the plans or special provisions by pushing the pipe home in the sleeve couplings with a slight circumferential twist. Where maximum joint closure is desired and specified, jointing shall conform to the requirements of Section 62-3.08D for solvent welded joints.

65-3.04 BACKFILLING WITH FILTER MATERIAL

-3.04A Filter Material

Filter material used as backfill shall comply with the following requirements:

GRADING (% by weight)

% Passing 3/4" square sieve	100
% Passing 1/4" square sieve	30-60
% Passing No. 8 sieve	20-50
% Passing No. 30 sieve	8-30
% Passing No. 50 sieve	3-12
% Passing No. 200 sieve (wet sieve)	0-1

Filter materials shall be crushed or natural granular material and shall contain not more than 1% by weight of clay lumps.

-3.04B Placing Filter Material

The filter material 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 horizontal diameter of the full length 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 filter material shall be deposited in 8-inch layers and be thoroughly compacted to the depth shown on the plans, or as specified.

65-3.05 RESTORATION, FINISHING AND CLEANUP

The Contractor shall restore and/or replace all paved surfaces, curbing, sidewalks, or other disturbed surfaces to their original condition in such manner as to meet the requirements of applicable sections. All surplus excavation 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, as specified in Section 57.

65-4 MEASUREMENT AND PAYMENT

65-4.01 GENERAL

Except as otherwise specified herein, no direct payment will be made for the various miscellaneous and incidental items of work to be performed, nor for accessories to be furnished and installed. All costs in connection therewith shall be considered as incidental to the construction and shall be included in the unit contract prices of items in the proposal affected thereby.

65-4.02 PIPE

Pipe of each kind and size shall be measured by the linear foot for the pipe in place and accepted. The unit

Section 66—Side Sewers

Contract price per linear foot shall be full compensation for the kind and size specified in place, including connecting accessories, all fittings such as elbows, tees, wyes, etc., and the price shall be full compensation for the furnishing of all material, labor and equipment necessary to complete the pipe laying and jointing as specified, and to the satisfaction of the Engineer.

65-4.03 EXCAVATION AND BACKFILL
Excavation and backfill shall be measured and compensation be made as provided in Section 61.

65-4.04 FILTER MATERIAL
Filter material in place will be paid for at the unit contract price per linear foot. Filter material will be placed in accordance with the limits shown on standard drawings, as described in the special provisions or as shown on the plans.

65-4.05 COMPACTION EQUIPMENT
Measurement and payment for compaction equipment shall be in accordance with Section 61-4.07 and 61-5.

Section 66—Side Sewers

66-1 DESCRIPTION

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 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.

66-2 MATERIALS

66-2.01 PIPE

Approved pipe materials shall be cast iron, concrete, vitrified clay, asbestos-cement ABS or PVC. Pipe materials other than these shall not be used, unless otherwise specified in the special provisions or unless authorized by the Engineer.

-2.01A Concrete Pipe

Concrete pipe shall conform to ASTM Designation C14 Class 2 except as otherwise provided and except that the permeability test shall be conducted as specified in Section 60-3.01A.

-2.01B Vitrified Clay Pipe

Vitrified Clay Pipe shall conform to ASTM Designation C700, extra strength unless otherwise noted on plans or in special provisions.

-2.01C Asbestos-Cement Pipe

Asbestos-Cement pipe shall conform to ASTM Designation C428, Class 1500 unless otherwise noted on the plans or in the special provisions.

-2.01D Cast Iron Pipe

Cast Iron Pipe shall conform to AWWA C106 or C108, or ANSI Specification A21.6, with Type II Push-On Joint or Type III Mechanical Joints, manufactured in accordance with Federal Specification WW-P-421C.

-2.01E Ductile Iron Pipe

Ductile Iron Pipe shall conform to ANSI A21.51 or AWWA C151 and shall be cement lined, push-on joint, unless otherwise specified. The minimum thickness class shall be Class 2 unless specified otherwise by the Engineer.

-2.01F ABS Pipe

ABS Pipe wall shall be virgin rigid ABS plastic and shall conform to the requirements of ASTM D-1788, Type I and Type IV, except that the minimum heat deflection temperature (ASTM D-648) shall be 180° F. Wall thickness shall be not less than 0.140" for 4" diameter and 0.200" for 6" diameter.

-2.01G PVC Pipe

PVC Pipe shall conform with the provisions of ASTM D3033 or D3034 unless otherwise specified.

66-2.02 JOINTS

Approved jointing shall use flexible gasketing, lead, or solvent welding.

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. Physical properties of flexible joints shall conform to that defined in Section 60-3.02A.

66-2.03 FITTINGS

Tees, wyes, bends, couplers, adapters, hubs and transition sections shall conform to the requirements of Sections 66-2.01 and 66-2.02.

66-3 CONSTRUCTION DETAILS

66-3.01 GENERAL

Side sewer construction shall conform to all applicable ordinances or regulations with respect to equipment, methods to be used, protective measures, size of pipe, depth of cover, number of users per pipe, permissible connections, inspection, and testing.

Permits, if necessary, shall be obtained by the Contractor before work of constructing side sewers is started.

Side sewer locations shown on the plans shall be subject to relocation in the field after construction starts. Regardless of the plan location, the Contractor shall place the tee or wye branch in the main sewer line at any other 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.

-3.01A Side Sewers Not Shown on the Plans

In cases where side sewers are not shown on the plans 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 shall elect 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.

66-3.02 EXCAVATION AND BACKFILL

Excavation and backfilling for side sewers shall conform to the requirements of Section 61, excepting that no backfill in excess of that required to hold the pipe in true alignment shall be placed prior to inspection.

66-3.03 PIPE LAYING AND JOINTING

Pipe laying and jointing, except as hereinafter provided, shall conform to the requirements of Section 62.

-3.03A Line and Grade

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:

1. 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 (1) foot higher than the elevation of the crown of the main sewer at the location of its tee or wye branch.
2. Where an occupied property is higher than the street grade and where the slope will be greater than

Section 66—Side Sewers

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. Where a storm drain pipe exists, the clearance between the crown of one and the bottom of the other shall be not less than six (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 two and one-half (2½) feet below the established street grade.

3. 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 one-fourth (¼) 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 one-eighth (⅛) 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.

-3.03B Pipe Laying

Belled pipe shall be laid with the bell end up grade and, in general, 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.

-3.03C Jointing

Jointing shall conform to Section 62-3.08.

66-3.04 FITTINGS

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 that tees, wyes, and bends for use with asbestos-cement pipe may be cast iron.

The maximum deflection permissible at any one fitting shall not exceed 45 degrees (45°) (one-eighth (⅛) bend). The maximum deflection of any combination of two adjacent fittings shall not exceed 45 degrees (45°) (one-eighth (⅛) bend) unless straight pipe of not less than two and one-half (2½) 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 machine-made tap and suitable saddle, or otherwise as approved by the Engineer.

66-3.05 CLEANOUTS

Not less than one cleanout shall be provided for each side sewer and/or each total change of 90 degrees (90°) 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 six (6) inches nor more than twelve (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. A one-eighth (⅛) bend shall be used to deflect the side sewer upward as a cleanout where the terminal end of the side sewer lies upstream from the last point of connection.

66-3.06 INSPECTION AND TESTING

-3.06A Inspection

Excavation and backfilling for side sewers shall conform to the requirements of Section 61, 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.

-3.06B Testing

All side sewers shall be tested after backfill.

All side sewers constructed in conjunction with the main sewer shall, for purpose of testing as specified in Section 62-3.10, have a six (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 side sewers are not tested simultaneously with the test of the main sewer, the Contractor at his own cost shall furnish and place an additional tee in the first pipe out of the main sewer tee or wye branch, so that an inflatable rubber ball can be inserted for sealing off the side sewer and thus permit separate tests.

The ends of side sewers or test tee openings, as required, shall be plugged watertight with materials and by method acceptable to the Engineer.

Payment for one test tee in each side sewer will be made the Contractor on a per each basis, same being additional to the payment for side sewer pipe.

66-3.07 MISCELLANEOUS REQUIREMENTS

-3.07A Requirements

1. **Pipe and Connections:** Side sewer in public right-of-way or utility easement shall be not less than six (6) inches in diameter unless otherwise specified. Side sewers on private property shall be not less than four (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.

2. **Proximity to Water Supply Lines:** Any side sewer which at any point will lie within ten (10) feet of a water supply line shall be constructed so that it will be at least six (6) inches in elevation below the water supply line. If this requirement will prohibit a connection of the side sewer, the Contractor shall proceed under such method and with such materials as may be detailed on the plans, or as directed by the Engineer.

Under circumstances where side sewers must cross over the watermain, the sewer pipe shall be cast iron pipe with no joint within nine (9) feet of the watermain.

3. **Plugs:** Any unused openings to the side sewer shall be closed with a watertight stopper fastened in place.

4. **Septic Tanks and Cesspools:** 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.

66-3.08 RESTORATION, FINISHING AND CLEANUP

The Contractor shall restore and/or place all paved surfaces, curbing, sidewalks, or other disturbed surfaces to their original condition in such manner as to meet the requirements of applicable sections. All surplus material 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, as specified in Section 57.

66-3.09 EXTENDING SIDE SEWERS INTO PRIVATE PROPERTY

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

Section 69—Miscellaneous Pipe Connections

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.

66-3.10 END PIPE MARKER

Location of side sewers shall be marked by the Contractor at the property line by a 2 x 4 wooden stake four 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 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 4-foot stake, but shall not be fastened to it.

66-4 MEASUREMENT

Measurement 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 one-tenth (0.10) foot.

66-5 PAYMENT

Payment for side sewers will be made for such of the following bid items as are included in any particular contract:

1. "(size) (class) Side Sewer Pipe in Place," per linear foot.
 2. "Tee or Wye, (size)," per each.
 3. "Mechanical Tamper," per hour.
 4. "Foundation Material, Type _____," per cubic yard.
 5. "Pipe Bedding (class) (size) Pipe," per linear foot.
- The unit contract prices shall be payment in full for all labor, materials, tools and other necessary things as may be required to complete the items of work in accordance with the plans and the specifications.

Section 67—Pipe Covering and Embankment for Sewer Construction

67-1 DESCRIPTION

This section of the specification applies to the construction of pipe covering and embankment. Pipe covering shall be constructed where the invert of the pipe is so shallow that placing of earth over the pipe becomes necessary to provide a minimum depth of cover. Pipe cover and embankment shall be constructed where the invert of the pipe is above existing ground and it becomes necessary to construct an embankment upon which the pipe and pipe covering is to be placed. The embankment and cover shall be constructed to lines shown on the standard drawing.

67-2 CONSTRUCTION DETAILS

67-2.01 PIPE BED

The area upon which the embankment for the pipe bed is to be placed shall be stripped to the extent the Engineer directs, and the cost thereof will be paid for by force account as defined in Section 9.04.

The embankment upon which the pipe is to be installed shall be constructed in accordance with requirements outlined in Section 13-3.10E3 Method B, up to a point equal to the spring line of the pipe. The material used in constructing the embankment shall be as specified in the special provisions. The Contractor may use any type of compacting equipment he wishes provided it meets the requirements of Section 13-3.10E3, Method B, and provided no damage occurs to surface or subsurface improvements.

67-2.02 PIPE COVER

The pipe cover material above the compacted embankment shall be placed without compaction unless specified otherwise in the special provisions and shall be shaped to the required section.

67-2.03 SOURCE OF MATERIAL

The source of material shall be that which is specified in the special provisions.

67-3 MEASUREMENT

Measurement will be by the cubic yard as calculated from cross sections based on elevations of the ground surface and the neat lines of the section conforming to the standard drawing, from which will be deducted the volume in cubic yards displaced by pipe larger than twenty-four (24) inches I.D.

67-4 PAYMENT

Payment will be made at the unit contract price per cubic yard for "Pipe Covering and Embankment," which price shall be full compensation for furnishing all labor, equipment, and materials necessary to construct and compact the embankment and cover.

Section 68—Finishing and Cleanup for Underground Conduits

68-1 CLEANUP

Before acceptance of sewer line construction, all pipes, manholes, catch basins, and other appurtenances shall be cleaned of all debris and foreign material.

After all backfill has been completed, the ground surface shall be shaped to conform to the contour of adjacent surfaces. General cleanup of the entire construction area shall otherwise conform to applicable requirements specified in Section 57.

Section 69—Miscellaneous Pipe Connections

69-1 DESCRIPTION

This section covers miscellaneous sewer and storm drain connections other than those described in sections 62 and 66, for the purpose of connecting various sewer appurtenances.

69-2 MATERIALS

Pipe, for connections as herein described shall conform to the applicable requirements in Section 60.

69-3 CONSTRUCTION DETAILS

69-3.01 EXCAVATION AND BACKFILL

All costs for trench excavation, backfill, and disposal of surplus excavation shall be considered as incidental to the construction of the pipe connections, unless the proposal contains a unit contract price for "Sewer Excavation and Backfill". When the proposal contains such a bid unit, payment therefor will be made on the basis shown in the proposal and will be additional to the unit contract price for pipe connections.

-3.01A Connections to Existing Storm and Sanitary Sewers

When making a connection to an existing storm or sanitary sewer line, or manhole the Contractor shall excavate and expose the existing facility where shown on the plan. In the event there is no existing tee or wye, the actual graft or insertion of a tee or other connection shall be made by the Owner unless otherwise specified.

69-3.02 PIPE LAYING, JOINTING AND TESTING

Pipe laying, jointing and testing for pipe connections shall conform to the applicable requirements of Section 62, excepting however, that testing for acceptance as provided in Section 62-3.10 will not be required when such pipe connections are not connected directly to a main sanitary sewer or storm drain pipe for testing simultaneously with the main pipe test.

69-3.03 CATCH BASIN CONNECTIONS

Catch basin connections are pipe lines connecting outlets of catch basins to a receiving sewer, storm drain, or other approved outlet. Both the alignment and the slope shall be on straight line, unless otherwise approved by the Engineer.

Section 70—Sewer Lamphole

No connection shall be made to the catch basin spigot pipe of casting until after backfill for the catch basin excavation has been compacted in place to the elevation specified in Section 64-3.

69-3.04 INLET CONNECTIONS

Inlet connections are pipe connections from standard types of drainage inlets to catch basins, storm sewers or other approved outlets. Inlet connections shall be laid upgrade from catch basins openings, storm drain tees or wyes 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 or bends are necessary, the altered alignment shall be subject to the Engineers approval.

Pipe connections shall not be made to a catch basin until the compaction requirements of Section 64-3 have been completed and approved by the Engineer.

69-3.05 VERTICAL CONNECTIONS

Vertical pipe connections are concrete encased pipe as shown on the standard plan.

The concrete block foundation for supporting vertical connections in a sewer trench shall bear upon firm native ground to avoid any concentrated load on the main sewer pipe.

All applicable construction details pertaining to the laying and jointing of pipe in Section 62 shall apply to the placement of the vertical pipe for encasement in concrete above the foundation, including the sealing of unused tee or wye branches at the top of the connection.

Backfilling around vertical pipe connections, unless otherwise provided in the special provisions or authorized by the Engineer, shall be made by compacting suitable excavated materials in eight (8) inch layers with mechanical tampers. The density shall be as directed by the Engineer. Backfilling shall start from a wide base foundation and slope up evenly to the top of the vertical connection, thus to provide a compacted subgrade for the connecting pipe that will be supported thereon.

69-4 MEASUREMENT

Measurement for catch basin pipe connections shall be the actual length of pipe installed between the tee opening or wye branch in the receiving main pipe, or other approved terminal at which the connection is discharged, and the spigot end of a catch basin outlet pipe.

Measurement for inlet pipe connections will be made upon basis of linear feet of pipe laid.

Measurement for vertical pipe connections shall be by the linear foot for the overall length of vertical connection in place, measured from the bottom of the concrete block foundation to the top of the highest pipe of the vertical connection which is encased or partially encased in concrete. Payment for tee or wye branch pipe used in

constructing vertical connections will be made on a per each basis, which will be additional to the measurement for vertical connection.

69-5 PAYMENT

Payment for pipe connections of the kind specified shall be made by such of the following bid items included in any particular contract:

1. "(Size) Catch Basin Connection," per linear foot, or "(Size) Inlet Connection," per linear foot.
2. "(Size) Vertical Connection," per linear foot.
3. "Tee or Wye, (size)," per each.

The above unit contract prices shall be payment in full for all labor, materials, tools and any other work that may be required to complete the work items as described, in accordance with the standard specifications.

Section 70—Sewer Cleanout

70-1 DESCRIPTION

This section of these specifications shall apply to the construction of sewer clean-outs as shown on the standard plan.

70-2 MATERIALS

All materials incorporated into the total clean-out structure shall meet the requirements of the various applicable sections of these specifications.

70-3 CONSTRUCTION DETAILS

Pipe joints shall be of the type specified in Section 60-3.

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.

The unit contract price per each for "Sewer Clean-out, in place," 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.

70-4 MEASUREMENT

Measurement for clean-out shall begin at the wye branch and extend to the lamphole casting, as shown on the standard plan.

70-5 PAYMENT

Payment will be made in accordance with the following bid item:

1. "Sewer clean-out in place," per each.

**STANDARD
SPECIFICATIONS
FOR
MUNICIPAL PUBLIC WORKS
CONSTRUCTION**



DIVISION IV—WATER DISTRIBUTION

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NOTE: There are no sections between Section 78 and Section 100.

DIVISION IV—WATER DISTRIBUTION

Section 72—Pipe for Water Mains

72-1 GENERAL

These specifications cover the pipe and fittings normally used for water distribution systems. Special considerations will be covered in the plans and special provisions.

Specification references made herein for manufactured materials such as pipe, hydrants, valves and fittings refer to designations for American Water Works Association (AWWA), or to United States of America Standards Institute (USASI), as they are effective on the date of call for bids.

72-2 PIPE

72-2.01 CAST IRON PIPE

Cast iron pipe shall conform to the latest AWWA Standard C106 or C108. Cement lining shall be in accordance with AWWA C104. Type of joint, class, thickness designation, castings, lining, marking, testing, etc., shall be as specified in the special provisions in accordance with applicable USASI or AWWA designations.

72-2.02 DUCTILE IRON PIPE

Ductile iron pipe shall be of the class specified on the plans and shall be in accordance with AWWA C-151-71, Ductile Iron, with cement lining as specified in the Standard Plans and Specifications for cast iron pipe.

Joints shall be of single rubber gasket type per AWWA C111-72.

72-2.03 ASBESTOS-CEMENT PIPE

Asbestos-cement pipe shall conform to the latest AWWA Standard C400. Class, marking, etc., shall be as specified in the special provisions.

72-2.04 CONCRETE CYLINDER PIPE

Reinforced concrete water pipe, steel cylinder type prestressed, shall conform to the latest AWWA Standard C303. Size, class, marking, specials, lengths, etc., shall be as specified in the special provisions.

72-2.05 STEEL PIPE

Steel pipe up to 3½" in diameter shall conform to ASTM Designation A120 and shall (including fittings) be hot dip galvanized inside and out. The pipe shall be coupled by using malleable iron screw coupling in accordance with USASI Specification B16.3.

Steel pipe 4" to 30" in diameter shall conform to the latest issue of AWWA Standard C202. Special provisions shall include outside diameter, wall thickness, class and details lengths, tests (including hydrostatic), protective treatment, etc.

-2.05A Coatings for Steel Pipe

Types of protective treatment shall be as follows:

1. Coal tar coating per AWWA Standard C204.
2. Other special coatings as may be described in special provisions.

-2.05B Couplings for Steel Pipe

All steel pipe 4" and larger shall be coupled by the following:

1. Dresser coupling style 38, or equal.
2. Bell and spigot with O-ring rubber gasket which provides unrestricted flow in either direction.
3. Flanges shall conform to AWWA Standard C207.
4. Other types as specified in special provisions. Couplings shall be coated same as the pipe.

72-2.06 GALVANIZED STEEL PIPE

Galvanized steel pipe shall conform to latest revision of ASTM Designation A 120.

72-2.07 GALVANIZED WROUGHT IRON PIPE

Galvanized wrought iron pipe shall conform to latest revision of ASTM Designation A 72 for wrought iron pipe. Specify standard in special provisions.

72-2.08 PIPE FITTINGS

-2.08A Cast Iron

All cast iron fittings shall conform to the latest USASI

Specifications A21.10 for short body, cast iron fittings 12" and less, and AWWA C100 for fittings 14" and larger. Lining, type of joints or other special items shall be specified in special provisions.

-2.08B Steel

Steel fittings for pipe 4" and larger shall conform to AWWA C208—class to be at least the same as pipe. Fittings shall be coated the same as pipe.

For pipe 3½" and smaller, malleable iron screwed fittings in accordance with USASI Specification B16.3. They shall be galvanized unless black is specified.

72-2.09 SPECIAL FITTINGS

Special fittings shall be in accordance with special plans and provisions.

72-3 MEASUREMENT AND PAYMENT

Payment for pipe, valves and fittings is described in Section 74-3.

Section 73—Trench Excavation and Backfill for Water Mains

73-1 GENERAL

The specifications in this section, and those of sections 72 through 78, shall apply to the construction of water distribution mains and appurtenances in sizes up to and including twenty-four inches (24") in diameter for both temporary and permanent installation under ordinary conditions.

Specification references for manufactured materials such as pipe, hydrants, valves and fittings will refer to the designations for American Water Works Association (AWWA), or to United States of America Standards Institute (USASI), as effective on the date of call for bids. Copies of these publications may be obtained at nominal cost from the American Water Works Association, 2 Park Avenue, New York 16, New York, and from the United States of America Standards Institute, 10 East 40th Street, New York, New York.

Water mains will be constructed on locations as shown on the plans.

Where grading is required, such grading as excavation and embankment shall conform to the requirements of Section 13, and rough grading shall be completed before excavation of the water main trench.

Guaranty: Unless otherwise provided by the special provisions, the unit contract prices shall include a guaranty by the Contractor that the design, materials, workmanship and performance of the pipe, valves, hydrants, valve chambers, boxes, fittings and accessories furnished by him will be as specified, and that they and the installation of them will be satisfactory to the Owner for the purpose intended for a period of one year after final acceptance of the contract.

73-1.01 UNGRADED STREETS

On ungraded streets, when grading is not provided in the contract schedule, the depth of trench excavation shall be as shown on the plan and profile and as staked by the Engineer.

Where the plans show the pipe is to be laid above the existing ground surface, an embankment fill shall be made and compacted to conform with the section shown on the plans and the water main trench shall be excavated therein. That portion of the embankment below the bottom of the pipe shall be compacted with rollers or mechanical compactors under controlled moisture conditions as required under Method B of Section 13-3.10E3.

Where no bid items are provided in the contract schedule for earthwork, filling, or embankment fill, such work shall be considered as incidental to the construction and all costs thereof shall be included in the unit contract price per linear foot for "Trench Excavation and Backfill."

Where, in the opinion of the Engineer, the extent of the work of earthwork, filling, or embankment fill justifies

Section 73—Trench Excavation and Backfill for Water Mains

ties bid items, such items and payment will be as provided in Section 13, under the specifications of which the work shall be done, unless otherwise provided in the special provisions.

73-1.02 CLEARING AND GRUBBING IN UNGRADED STREETS

Where not provided under schedules for "Grading" the area to be excavated or filled shall be cleared and grubbed by the Contractor. This work shall consist of the removal and disposal of all logs, stumps, roots, brush and other refuse. All such material shall be burned, or removed and disposed of as directed by the Engineer. Burning shall be done in a manner that will avoid all hazards such as damage to existing structures, construction in progress, or to trees and vegetation. All burning operations shall be in accordance with federal, state and local regulations, and shall be conducted in such a manner as not to create undue or unnecessary nuisance.

Payment for clearing and grubbing will be made in accordance with provisions in Section 12.

73-1.03 REMOVAL OF PAVEMENT FROM DRIVEWAYS AND SIDEWALKS

Removal of existing street improvements shall be performed as specified in Section 52 except that payment therefor shall be considered as incidental to the construction and the costs thereof shall be included by the Contractor in the unit contract price per linear foot for "Trench Excavation and Backfill."

The removal of material from pavement, driveway and sidewalk and the disposal thereof shall be considered as incidental to the construction, and the costs thereof shall be included by the Contractor in the unit contract price per linear foot for "Trench Excavation and Backfill."

73-1.04 GRADE AND ALIGNMENT

Grade and alignment on ungraded streets will be given from hubs set parallel to the line of the pipe, and 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 special provisions. The Contractor shall transfer lines and grades to the pipe from hubs set by the Engineer or from existing concrete curbs or sidewalks as an incidental part of his work.

Sequence of operations, traffic requirements, or restrictions on the amount of open trench, if any, will be provided in the special provisions.

73-1.05 LOCATING AND MARKING UNDERGROUND UTILITIES

See sections 5.09 and 5.10.

73-2 TRENCH EXCAVATION

The Contractor shall perform all excavation of every description and of whatsoever substances encountered to the depth indicated on the drawings or specified herein. All excavations shall be made by open cut unless otherwise provided in the special provisions. The banks of the trenches shall be kept as nearly vertical as soil conditions will permit, and where required to control trench width or to protect adjacent structures the trench shall be properly sheeted and braced.

The maximum trench excavation width for pipes four (4) inches to twelve (12) inches shall not exceed thirty (30) inches, and for larger sizes of pipe the trench bottom width shall not exceed that specified in Section 61-3.01 for sewers, unless authorized by the Engineer.

Work shall comply with the Washington State Safety Code for construction work as required by the State Safety Inspector. Where, in the opinion of the Engineer, damage is liable to result from withdrawing sheeting, the Engineer may require the sheeting to be left in place and payment therefor will be made in accordance with Section 73-3.07.

All 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 suffi-

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cient 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.

The Contractor shall exercise sound engineering and construction practices 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 or 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 own 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, and excavation below that depth shall be backfilled with selected backfill material and compacted to the satisfaction of the Engineer at the Contractor's expense.

The bottom of trenches shall be accurately graded to provide uniform bearing and support for each length of pipe or undisturbed or compacted soil at every point along its entire length, except at the joints. Bell holes shall be excavated to an extent sufficient to permit accurate work in making and inspecting the joints.

73-2.01 CUTTING EXISTING SERVICES

When utility services occupy the same space as the new water main, the Owner will cut the utility services ahead of the excavating machine and reconnect them after the machine passes.

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, he shall be responsible for any and all damages incurred to the services by reason of his operations and shall immediately arrange for replacement of all damaged services. All additional costs incident to such work under either method by the Contractor shall be considered as incidental to the construction and shall be included in the unit contract price per linear foot for "Trench Excavation."

73-2.02 SOLID ROCK EXCAVATION

Solid rock shall include solid rock formations requiring systematic drilling and blasting with explosives and any boulders or broken rock larger than one-half cubic yard in volume. Hardpan or cemented gravel, even though it may be advantageous to use explosives in its removal, shall not be classified as solid rock excavation. Solid rock shall be excavated to a width equal to the outside barrel diameter of the pipe plus 24 inches, and to a grade line not less than six inches below bottom of pipe. Bottom of the trench shall be brought up to grade by backfilling with selected backfill material and be compacted to the satisfaction of the Engineer.

The Contractor shall notify the Engineer at least 24 hours prior to any blasting. All blasting shall be done in accordance with local, county and state regulations governing this class of work. Any damage to persons or property resulting from blasting operations shall be the sole responsibility of the Contractor and his surety.

Payment for solid rock will be made in accordance with Section 73-3.03.

73-2.03 EXTRA EXCAVATION

Changes in grades of the water main from those shown on the plans, or as provided in the special provisions, may be necessary because of unplotted utilities, or for other reasons. If, in the opinion of the Engineer, it is necessary to adjust, correct, relocate or in any way change the line and grade, such changes shall be made by the Contractor under the terms of these specifications.

When a change in horizontal alignment is ordered by the Engineer, payment will be made for any trench which has been excavated upon the original location at the unit contract price per linear foot for "Trench Excavation and Backfill."

Changes in grade which will involve additional depth of trench by not more than four feet will be paid for at the unit contract price per cubic yard for "Extra Exca-

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vation," computed on the basis of the specified minimum trench width and additional depth.

Additional depth of trench involving more than four feet will be paid for either on a negotiated price basis or as force account work, as the Engineer may determine.

In cases where sheeting becomes necessary on account of the additional depth, payment therefor will be made: the Contractor on a negotiated price basis or as force account work, as the Engineer may determine.

73-2.04 UNFORESEEN BURIED OBJECTS ENCOUNTERED IN TRENCH EXCAVATION ON GRADED STREETS

Where streets have been graded, it is presumed that stumps, railroad ties, buried pavements, etc., will have been removed in the original grading work. Where such unexpected objects are encountered in trench excavation for water mains, they shall be removed and disposed of by the Contractor. In cases where they can be removed by the same equipment or method at hand for excavating, and where it is unnecessary to employ special equipment, install shoring or bracing, or to increase the trench width or depth more than two feet for any one object, then in that event the removal of such obstructions shall be considered as an incidental part of the Contractor's work and no additional payment will be made therefor.

Where objects, railroad ties, buried pavements, etc. are continuous and require extra work beyond the scope of the work outlined above, or extra equipment for their removal, additional payment will be made upon a negotiated price basis, or as force account work as the Engineer may determine.

73-2.05 REMOVAL OF UNSUITABLE MATERIALS

Wherever in excavating the trench for water mains the bottom of the trench exposes peat, soft clay, quicksand or other material which is unsuitable in the opinion of the Engineer, such material shall be removed and disposed of by the Contractor. The material thus removed shall be replaced by suitable surplus material obtained from trench excavation within the limits of the project which shall be deposited and compacted in eight-inch layers by mechanical compaction. If surplus material is not available within the limits of the project, the Contractor shall furnish suitable material, as provided in Section 73-2.08, Bank Run Gravel for Trench Backfill.

Measurement and payment for removal and replacement of unsuitable material will be made in accordance with Section 73-3.04.

73-2.06 BACKFILLING TRENCHES

Backfilling of trenches shall be made with the same materials excavated from the trenches unless these materials are found to be unsuitable by the Engineer.

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.

Bedding for water mains will not ordinarily be required. When required, it shall consist of clean granular sand and gravel of which 100% will pass the U. S. standard 3/4-inch opening and not more than 3% will pass the U. S. No. 200 (wet sieve), with a minimum sand equivalent of 50. Payment for furnishing and placing bedding material will be made upon measurement in trucks at point of delivery at the unit contract price per cubic yard for "Bedding Material."

Backfill up to six 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. The balance of the material may be placed by dumping into the trench by any method at the option of the Contractor and shall be compacted as specified herein-after.

A minimum of 3-inch sand cushion shall be placed between the watermain and existing pipelines or other conduits when encountered during construction and as directed by the Engineer. No extra payment will be made for furnishing and placing sand as specified but the cost thereof shall be considered as being included in the unit prices bid for the various items comprising this improvement.

73-2.07 COMPACTION OF BACKFILL

On graded streets without pavement or on roadway shoulders and unimproved areas, compaction of backfill may be by water settling or wheel rolling.

The backfill shall be compacted to ninety-five percent (95%) of the maximum density determined by the Compaction Control Test specified in Section 13-3.10E5.

-2.07A Water Settling of Trenches

Where water settling of trenches is required, the jetting method shall be used. Jets shall be inserted at not more than four-foot intervals throughout the length of the backfilled area and shall be slowly forced down to the bottom of the trench and held until the trench backfill is completely saturated with water. The jetting operations shall be completed as close behind the pipe laying and backfilling as practicable.

After the water-settled trench has set for several days, any depression in the trench shall be filled and mounded up over the trench, and then further compacted by the use of heavy rubber-wheeled equipment.

-2.07B Equipment for Water Settling Trenches

The Contractor shall furnish all hose and equipment necessary for jetting operations. The minimum size of hose and equipment shall be such as to provide not less than thirty-five (35) pounds per square inch pressure at the discharge. The jet shall be a rigid iron pipe with a minimum diameter of one (1) inch.

-2.07C Source of Water for Water Settling

Source of water will depend upon local conditions and shall be as provided in the special provisions. Where no provision for water is made in the special provisions, the Contractor shall make his own arrangements for it.

-2.07D Compaction of Backfill under Special Conditions

At locations where paved streets, driveways or sidewalks will be constructed or reconstructed over the trench, or where provided for in the special provisions or directed by the Engineer, the backfill shall be spread in layers and be compacted by mechanical tampers. In such cases the backfill material shall be placed in successive layers, not exceeding eight (8) inches in thickness and each layer shall be compacted with mechanical tampers to the density directed by the Engineer. Mechanical tampers shall be of the impact type as specified in Section 15-2.01A.

73-2.08 BANK RUN GRAVEL FOR TRENCH BACKFILL

Selected backfill material shall consist of bank run gravel Class A or Class B, as specified in Section 26 excepting, however, that 100% of the material shall pass the 2 1/2-inch square opening.

Payment for bank run gravel Class A or Class B will be made in accordance with Section 73-3.06.

73-2.09 SHEETING LEFT IN PLACE

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 24 inches below grade. Payment will be made in accordance with Section 73-3.07.

73-2.10 TEMPORARY PEDESTRIAN CROSSINGS

The Contractor shall provide all necessary temporary pedestrian crossings for the proper handling of pedestrian traffic over the trench and shall provide access to private property where required by the Engineer. Temporary pedestrian crossings shall have the minimum requirements shown on standard plan.

73-3 MEASUREMENT AND PAYMENT

73-3.01 CLEARING AND GRUBBING

When an item for "Clearing and Grubbing" is provided in the bid proposal, payment will be made on basis of a "Lump Sum" contract price which shall be in full for the removal and disposal of all material as specified, or in accordance with provisions of Section 12.

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When no item is provided in the bid proposal, all clearing and grubbing shall be considered as incidental to the work of constructing the water main and all costs thereof shall be included in the unit contract price per linear foot for "Trench Excavation and Backfill."

73-3.02 TRENCH EXCAVATION AND BACKFILL

Measurement for "Trench Excavation and Backfill" shall be by the linear foot measured along the center line of the pipe from end to end, including also fittings, valves, etc. When two trenches intersect, the measurement of each shall be to the intersection of the center lines of the cross or tee.

Payment for "Trench Excavation and Backfill" will be made at the unit contract price per linear foot of trench, which price shall be full compensation for all costs of materials, labor and equipment required to excavate the trench to the depth and in the manner required by the plans and specifications including: (a) excavation for bell holes, valves, fittings, and other appurtenances except chambers, (b) the removal and disposal of pavements, sidewalks and driveways, (c) the furnishing, placing and removal of sheeting, (d) the clearing and grubbing if there be no separate item for such in the proposal, and (e) the backfilling of the trench and compaction of backfill in accordance with the specifications. Exception is made, however, that excavation of solid rock and of unforseen buried objects will be paid for additionally in the manner hereinbefore described.

73-3.03 SOLID ROCK EXCAVATION

Payment for "Solid Rock Excavation" will be made at the unit contract price per cubic yard, which price shall be in addition to the price per linear foot for "Trench Excavation and Backfill." The volume of solid rock excavation will be based upon a trench width equal to the outside barrel of the pipe plus 24 inches, and to a grade six inches below the bottom of the pipe and the profile of the top of the rock as established by field measurements.

Selected backfill used in adjusting the bottom of the trench to grade will be measured and paid for as described in Section 73-2.06.

73-3.04 REMOVAL AND REPLACEMENT OF UNSUITABLE MATERIAL

Payment will be made at the unit contract price per cubic yard for "Removal and Replacement of Unsuitable Material," which price shall be full compensation for excavating and disposing of the unsuitable material as defined in Section 73-2.05 herein, and the loading, hauling and placing of suitable excess material in the trench as specified.

If suitable excess material is not available, the Contractor will be paid for furnishing suitable material from other approved source as provided in Section 73-2.08, "Bank Run Gravel for Trench Backfill."

Compaction of suitable replacement material shall be by mechanical tampers as specified in Section 73-2.07D, as directed by the Engineer, and will be paid for at the unit contract price per hour for "Mechanical Tamping."

73-3.05 MECHANICAL TAMPING

Where mechanical tamping is required, payment will be made at the unit contract price per hour for "Mechanical Tamping," which price shall be full compensation for any additional costs of spreading backfill in layers and for all materials, labor, equipment, tools and incidentals required to complete the mechanical tamping in accordance with the specifications. Payment will be made for the actual time that mechanical tamping is performed, and as and when required by the Engineer.

Mechanical tamping is work not required within the payment scope of "Trench Excavation and Backfill."

73-3.06 BANK RUN GRAVEL FOR TRENCH BACKFILL

Measurement of "Bank Run Gravel for Trench Backfill" will be by the cubic yard measured in trucks at point of delivery.

Payment for "Bank Run Gravel" will be made at the unit contract price per cubic yard, which price shall be full compensation for the furnishing and hauling of the material to the trench. Handling of the material at the

trench shall be included in the unit contract price per cubic yard for "Trench Excavation and Backfill."

73-3.07 SHEETING LEFT IN PLACE

Sheeting left in place at the discretion of the Engineer will be paid for at the unit contract price per thousand feet board measure (MBM) for the actual amount of lumber left in the trench. Such payment shall be full compensation for the material, and for the labor and equipment required to cut off that portion of the sheeting not intended to be left in place and to make satisfactory disposal of it.

73-3.08 TEMPORARY PEDESTRIAN CROSSINGS

Payment for temporary pedestrian crossings will be made at the unit contract price per each for "Temporary Pedestrian Crossing," which price shall be full compensation for furnishing, placing and removal of the crossing. Each crossing will be paid for as a separate unit whether it is new construction or has been moved from a prior location.

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74-1 GENERAL

Pipe shall be installed in accordance with the manufacturer's specifications and instructions for installing the type of pipe used unless modified or changed in the special provisions. The Contractor shall provide all tools and equipment including any special tools designed for installing each particular type of pipe used.

74-2 CONSTRUCTION

74-2.01 DEWATERING OF TRENCH

Where water is encountered in the trench, it shall be removed during pipe-laying operations and the trench so maintained until the ends of the pipe are sealed and provisions are made to prevent floating of the pipe. Trench water shall not be allowed to enter the pipe at any time.

74-2.02 HANDLING OF PIPE

All types of pipe shall be handled in such manner as will prevent damage to the pipe, pipe lining or coating. Damage to pipe, pipe lining or coating shall be repaired to the satisfaction of the Engineer or be removed from the job and methods of handling shall be corrected to prevent further damage.

Threaded pipe ends shall be protected by couplings or other means until laid.

The pipe and fittings shall be inspected for defects and cast iron pipe, while suspended above grade, shall be rung with a light hammer to detect cracks.

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. 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 absolute cleanliness inside the pipe.

74-2.03 LAYING OF PIPE ON CURVES

Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflections at the joints. If the pipe is shown curved on the plans and no special fittings are shown, the Contractor can assume that the curves can be made by deflection of the joints with standard lengths of pipe. If shorter lengths are required, the plan will indicate maximum lengths that can be used.

Where field conditions require deflection or curves not anticipated by the plans, the Engineer will determine the methods to be used. No additional payment will be made for laying pipe on curves as shown on the plans, nor for field changes involving standard lengths of pipe deflected at the joints. When special fittings not shown on the plans are required to meet field conditions, additional

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payment will be made for special fittings as provided in Section 74-3.02.

Maximum deflections at pipe joints and laying radius for various pipe lengths are as found in the following standards:

Cast Iron Pipe	AWWA C 600-64 Sec. 7.8
Bell and Spigot Lead Joints	
Cast Iron Pipe Mechanical Joints	AWWA C 600-64 Sec. 9b.5
Cast Iron Pipe Push-on Joints	AWWA C 600-64 Sec. 9c.4
Asbestos-cement Pipe	AWWA C 400 53T
Concrete Cylinder Pipe	AWWA C 303-70 Sec. 4.3
Steel Pipe O-Ring Joints	See manufacturer's recommendations
Steel Pipe Welded Joints	See latest AWWA Spec.

When rubber gasketed pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment. Trenches shall be made wider on curves for this purpose.

74-2.04 LAYING CAST IRON PIPE

-2.04A Joints for Cast Iron Pipe

Joints for cast iron pipe shall consist of one of the three following types unless otherwise provided in the special provisions:

1. Bell and spigot pipe with lead joints.
2. Mechanical joints.
3. Rubber gasket joints (Push-on).

-2.04B Bell and Spigot Pipe with Lead Joints

This type joint shall be made by use of a packing material followed by melted lead calked in place.

-2.04C Packing Material

Packing material shall be molded rubber rings. Dry braided sterile packing of a type approved by the Engineer and State Department of Health may be used only when the space between the bell and the spigot will not permit use of a rubber ring. When removed from the container, special care shall be used to prevent contamination to the rings or the braided packing.

-2.04D Preparation of Joint

The bell and spigot ends of the pipe shall be thoroughly brushed and cleaned of all oil, grit, tar and other foreign matter. The molded rubber packing ring shall be placed on the spigot end and the pipe entered to the full depth of the socket. The rubber ring shall be driven home and the joint filled with molten lead.

When yarning material is used, it shall be placed around the spigot of the pipe and shall be of proper dimensions to center the spigot in the bell. When the spigot is shoved home, the yarning material shall be driven tightly against the inside base or hub of the bell with suitable yarning tools.

When a single strand of yarning material is used, it shall have an overlap at the top of not more than two inches. When more than a single strand is required for a joint, each strand shall be cut to sufficient length so that the ends will meet without causing overlap. Ends of successive yarning rings shall be staggered and shall be driven home separately.

-2.04E Depth of Jointing Material

The depth of the lead joints shall be not less than 2 1/4" for pipe having a nominal diameter of 20" or less, and 2 1/2" in 24-inch pipe.

-2.04F Lead

Lead for calking purposes shall contain not less than 99.73 percent pure lead. Impurities shall not exceed the following limits:

	PERCENT
Arsenic, antimony and tin together	0.015
Copper	0.08
Zinc	0.002
Iron	0.002
Bismuth	0.25
Silver	0.02

The producer's name or the mark of Lead Industries shall be clearly cast or stamped upon each piece of lead.

-2.04G Heating and Pouring of Lead

Lead shall be heated in a melting pot, kept in easy reach of the joint to be poured so that the molten metal will not be chilled in being carried from the melting pot to the joint, and shall be brought to a proper temperature so that when stirred it will show a rapid change of color. Before pouring, all scum shall be removed. Each joint shall be made with one continuous pour filling the entire joint space with solid lead. Spongy or imperfectly filled joints shall be burned out and be repoured.

-2.04H Position of Joint Runner

The joint runner shall fit snugly against the face of the bell and the outside of the pipe and shall be dammed with clay to form a pouring lip to provide for filling the joint flush with the face and to the top of the bell.

-2.04I Calking Lead Joints

After the lead has cooled to the temperature of the pipe, lead joints shall be calked with pneumatic or hand tools, operated by competent workmen until such joints are thoroughly compacted and watertight, without overstraining the bell of the pipe. The finished joint shall show a hard and even hammered surface overall.

74-2.05 JOINTING MECHANICAL JOINT PIPE

The outside diameter of the spigot end of bell-and-spigot pipe varies with the type, size and class of pipe. There is only one joint size for each diameter of mechanical joint pipe. Thus, difficulty may be met when attempts are made to connect existing bell-and-spigot pipe to mechanical joint pipe. When such a connection must be made, an adapter having a fitting bell and a mechanical joint socket is manufactured and shall be used.

-2.05A Cleaning and Assembling Joint

The last 8 inches outside of the spigot and inside of the bell of mechanical joint pipe shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating), and other foreign matter from the joint, and then painted with a soap solution made by dissolving one-half cup of granulated soap in one gallon of water. The cast iron gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket or bell end. The rubber gasket shall be painted with the soap solution and placed on the spigot end with the thick edge toward the gland.

-2.05B Bolting of Joint

The entire section of the pipe shall be pushed forward to seat the spigot end of the bell. The gasket shall then be pressed into place within the bell, being careful to have the gasket evenly located around the entire joint. The cast iron gland shall be moved along the pipe into position for bolting, all of the nuts inserted, and the nuts screwed up tightly with the fingers. All nuts shall be tightened with a torque wrench. The torque for various sizes of bolts shall be as follows:

Size Inch	Range of Torque Ft.-Lbs.
3/8	40 - 60
1/2	60 - 90
3/4	70 - 100
1	90 - 120

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

74-2.06 JOINTING RUBBER GASKET JOINT PIPE

-2.06A Cleaning and Assembling Joint

The inside of the bell shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating) and other foreign matter from the joint. The circular rubber gasket shall be flexed inward and inserted in the gasket seat provided in the socket and released with the gasket fitting over the bead in the gasket seat.

A thin film of gasket lubricant shall be applied to the inside surface of the gasket. Gasket lubricant shall be a solution of vegetable soap or other solution supplied by the pipe manufacturer and approved by the Engineer.

The spigot end of the pipe shall be cleaned and

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entered into the rubber gasket in the socket, using care to keep the joint from contacting the ground. The joint shall then be completed by forcing the plain end to the bottom of the socket, using a forked tool or jack-type tool or other device approved by the Engineer. Pipe which is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint.

Field-cut pipe lengths shall be filed or ground to resemble the spigot end of manufactured pipe.

74-2.07 LAYING ASBESTOS-CEMENT PIPE

-2.07A Couplings for Asbestos-cement pipe

Asbestos-cement pipe shall be furnished with one of the following types of couplings: Super Simplex Automatic, Fluid-tite and Ring-tite. Each coupling shall be grooved to fit the type of rubber ring used. Rings shall be molded rubber, of manufacturer's design and as furnished by manufacturer to fit the type of pipe and coupling used.

-2.07B Cleaning and Assembling Joint

All parts of the pipe ends and couplings shall be thoroughly cleaned to remove oil, grit or other foreign matter from the joint.

Insert the two molded rubber joint rings in the grooves provided in the coupling.

Lubricate the outside surface of the pipe ends back to the stop shoulder with a solution of vegetable soap and water or other prepared solution supplied by the manufacturer and approved by the Engineer.

Align the pipe and coupling and jack the pipe home until rings are properly seated with recommended tolerance between pipe lengths.

-2.07C Short Lengths and Field Cut Joints

Short lengths of pipe supplied by the manufacturer shall be used whenever possible to provide the proper spacing of valves, tees or special fittings.

Whenever it becomes necessary to cut a length of pipe, the cut shall be made by abrasive saw or by a special pipe cutter, using a cutting blade rotated around the pipe at right angles to the axis of pipe.

Cut ends shall be machined with special machining equipment to the exact dimensions of the pipe supplied by the manufacturer.

74-2.08 LAYING STEEL PIPE

-2.08A Threaded Steel Pipe in Sizes up to and Including 3 1/2 Inch

All steel pipe in sizes up to and including 3 1/2 inch shall be connected with malleable iron screwed couplings in accordance with USASI Specification B16.3. Couplings shall be galvanized. Unions or flanges shall be used at all equipment and valves.

Exposed threads, after jointing, shall be brush-coated with an asphalt coating approved by the Engineer.

-2.08B Coupled Pipe 4-inch and Larger

All steel pipe 4-inch and larger for use in underground services shall be coupled by either one of the following methods:

Dresser Couplings, Style 38 or approved equal.

O-Ring rubber gasket joint of a design approved by the Engineer and having the following basic design:

One end expanded to form a bell.

The other, or spigot end, shall have a rolled groove to accommodate a round rubber gasket of proper diameter and cross section.

All parts shall be thoroughly cleaned before assembly and a vegetable soap solution shall be brushed on the inside of the bell just prior to assembly.

All component parts of couplings, rings, bells, etc., shall receive a protective coating in the same manner as specified for steel pipe. Bolts and nuts, exposed edges, flanges, etc. shall, after installation, be covered with a heavy hot pour of asphalt if asphalt coated pipe is used, or with coal tar enamel if coal tar coated pipe is used.

All steel pipe 4-inch and larger for above ground service shall be coupled with flanges, dresser type or victaulic type couplings. All flanges for steel pipe shall conform to AWWA Standard C-207, Class B for working

pressures up to 86 psi, Class D for working pressures up to 150 psi, and Class E for working pressures up to 275 psi.

Pipe for outdoor service above ground shall be protected with one coat primer and one coat coal tar paint approved by the Engineer.

Pipe for indoor service shall be protected with one coat of red lead and two coats of approved enamel paint of a color specified or selected by the Engineer.

74-2.09 LAYING CONCRETE PIPE

Concrete cylinder pipe with steel joint rings, or concrete non-cylinder pipe when called for on the plans or special provisions, shall be laid to conform with requirements that follow.

-2.09A Cleaning and Assembling Joint

All parts of the joint, both bell and spigot ends, shall be thoroughly brushed and cleaned to remove oil, grit and other foreign matter. The circular rubber gasket provided with the pipe shall be stretched and snapped into the groove provided on the spigot end. It shall be lifted and released at several points on the circumference to equalize tension and remove twist in the gasket.

The bell end of the pipe shall be lubricated with a solution of vegetable soap and water or other prepared solution supplied by the pipe manufacturer and approved by the Engineer. The pipe shall then be jacked home until it stops.

The outside annular space at the joint shall be filled with cement mortar.

The grouting of the outside joints shall be made by wrapping the joint with two bands of strong waterproof sisalkraft paper. The bands of paper shall then be tightly strapped to the pipe with 3/8-inch box strapping, using tools recommended by the manufacturer of the strapping. Hand-tamped backfill shall be built up around the band to the horizontal diameter of the pipe. The joint shall then be filled with mortar from one side only until the mortar appears on the other side of the pipe. Mortar shall be mixed with the least amount of water that will permit placing by the method described. Flexible wires shall be worked around the joint to assist grouting and ensure proper filling of the joint. The top of the pipe shall then be grouted and the paper band laid over the entire joint to protect it while curing.

The inside annular space shall also be filled with cement mortar and troweled flush. Mortar shall consist of one part portland cement and two parts of plaster sand. Mortar for inside joints shall be mixed with only enough water for "dry packing."

No grouting of joints will be allowed within three joints of laying operations. A representative of the Engineer shall be present when outside joints are being poured.

74-2.10 CONNECTIONS TO EXISTING MAINS

All connections to water mains in use shall be made by the utility unless otherwise provided in the special provisions. All crosses or other specials required to be inserted in any main already in use shall be furnished by the Contractor and be set by the utility. The Contractor shall furnish the special, as shown on the plans, and all other material required. He shall make all necessary excavations to assure gradual transition between the new and existing water main, and he shall perform all necessary backfilling.

Where the connection of new work to old requires interruption of service and notification of customers affected, the superintendent of the utility, the Engineer and the Contractor shall mutually agree upon a date for connections which will allow ample time to assemble labor and materials, and to notify all customers affected.

74-2.11 WATER SERVICE CONNECTIONS

The utility will, at no cost to the Contractor, make all taps for service connections and install the service pipe, unless otherwise provided on the plans or in the special provisions.

The Contractor shall leave the main trench open at all points where service connections are to be made until such services are installed and tested to the curb cock.

When requested by the Engineer, the Contractor shall open side trenches to such depths as may be necessary to

Section 74—Pipe Installation for Water Mains

carry services from the main to the curb. Excavation and backfill of side trenches for water service connections shall be as specified for water main trenches in Section 73. Unless otherwise provided, payment for side trenches will be made at the unit contract per linear foot for "Trench Excavation and Backfill for Water Service Connections."

Where existing services are to be transferred from old to new mains, the Contractor shall plan and coordinate his work with that of the utility so that service will be resumed with the least possible inconvenience to consumers.

Whenever the Contractor is required by the plans and special provisions to remove an existing water main, the special provisions will state whether or not the salvage of pipe, valves, hydrants and fittings will be required, and the method of payment therefor.

The Contractor shall not in any case remove old pipe until all service connections have been transferred to the new main. Adequate provisions shall be made by the Contractor during construction for the care and protection of mains or services in use.

Where salvage of pipe, valves, hydrants and fittings is required under the contract, salvage methods shall be used which will save all materials intact and undamaged. Salvaged material shall be stored at the trench side for removal by the utility, unless otherwise provided.

If salvage is not specified, the materials therefrom shall become the property of the Contractor and shall be promptly removed from the site for disposal as he sees fit.

To supply customers with water during the construction of a water main project where any section of the pipe has passed a satisfactory hydrostatic and bacteriological test, the Utility reserves the right to tap corporation cocks into the section of a new main and install service connections at such locations as the Utility may elect, at no expense to the Contractor. The attaching of any such service connections by the Utility shall not be construed by the Contractor as an acceptance by the Owner of any part of the work required under the contract.

74-2.12 FIELD TESTS

All pipe and appurtenances shall be subjected to a hydrostatic test after they are laid. Each section of pipe between valves shall be tested as soon as possible after laying, or when directed by the Engineer.

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. All costs to the Contractor for installing temporary blocking shall be included in the unit bid prices for the water mains.

The Contractor shall furnish all labor and equipment necessary to make the tests except for pressure gauges which will be furnished by the Utility.

Where the Utility has water available for testing, it will be furnished without charge. All costs of tapping and piping shall be borne by the Contractor unless otherwise specified in the special provisions. Where water is not available from the Utility, the Contractor shall provide water from an approved source for testing and the cost thereof shall be included in other unit contract prices of the work.

Hydrostatic tests shall be performed on every complete section of water main between two gate valves, and each gate shall withstand the same test pressure as the pipe, with no pressure active in the section of pipe beyond the closed gate valves.

The test pressures to which cast iron pipe water mains and appurtenances shall be tested hydrostatically are as follows:

Diameter	4	6	8	10	12	16	Over 16
Pipe-inches	4	6	8	10	12	16	Over 16
Test Pressure	300	300	300	275	250	225	200
lbs. per square inch							

The test pressures to which ductile iron pipe water mains and appurtenances shall be tested hydrostatically are as follows:

Diameter	4	6	8	10	12	16	Over 16
Pipe-inches	4	6	8	10	12	16	Over 16
Test Pressure	175	175	175	175	175	150	150
lbs. per square inch							

The test pressures to which asbestos-cement pressure pipe water mains and appurtenances shall be tested hydrostatically are as follows:

Class	100	150	200
Test Pressure, p.s.i.	150	225	300

The test pressure shall be applied at the low end of the section of water main being tested. Air in the pipe shall be vented at all high points.

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 fifteen (15) minutes and the pressure drop is less than fifteen (15) pounds the main will be accepted as a watertight installation. When testing short lengths of main pipe, or hydrants, maintaining the test pressure without pumping for five (5) minutes with less than five (5) pounds drop in pressure will be evidence of a satisfactory test.

Defective materials or workmanship, discovered as a result of hydrostatic field test, shall be replaced by the Contractor at his expense. Whenever it is necessary to replace defective material or correct the workmanship the hydrostatic test shall be re-run at the Contractor's expense until a satisfactory test is obtained.

-2.12A Testing Section With Hydrants Installed

When hydrants are included with the section of main pipe to be tested, the testing shall be conducted in three separate tests as follows:

Test No. 1—Water main gate valves and all hydrant auxiliary gate valves closed, with the hydrant operating stem valves and hose ports wide open.

Test No. 2—Water main gate valves and the hydrant operating stem valves tightly closed but the hydrant auxiliary gate valves and hose ports shall be wide open. (150 psi)

Test No. 3—Each hydrant shall be tested to a pressure of three hundred (300) pounds per square inch with the hydrant auxiliary gate valve and hose ports closed, but the hydrant operating stem valve shall be wide open. No pressure above twenty-five (25) pounds per square inch shall be in the supply main beyond the hydrant auxiliary gate valve when testing a hydrant singly.

-2.12B Testing Extensions from Existing Mains

When an existing water main is extended with new pipe to a new gate valve and the distance from the existing pipe to the new gate valve is eighteen (18) feet or less, the section of new pipe installed between the new gate valve and the end of the existing main shall be made by the Utility with pretested, prechlorinated pipe, and no hydrostatic test will be required. When the required hydrostatic tests are conducted in the new main section beyond the installed new gate valve in the closed position, the normal pressure of the existing main may be present against the other side of the new gate valve.

Where the distance between the end of an existing water main pipe extension to the gate valve is more than eighteen (18) feet, the connection of the new pipe to existing pipe shall not be made until after hydrostatic tests have been made to the required pressure in both directions against the new gate valve. This shall be accomplished by a temporary cap or plug installed on the end of the new pipe, beyond the new gate, as close as possible to the existing pipe for testing purposes.

The short length of pipe between the temporary cap or plug end with the new gate valve in the closed position, with no hydrostatic pressure active on the opposite side of the gate valve, shall be subjected to the required test pressure. The same test shall be made against the other side of new gate 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 Utility with pretested prechlorinated pipe.

-2.12C Testing Hydrants Installed on Existing Mains

Hydrants shall be installed and connected to an exist-

Section 74—Pipe Installation for Water Mains

ing main, in accordance with the standard plans. The hydrant connection, including hydrant tee, connection pipe and six (6) inch auxiliary gate valves, will be installed by the Utility with pretested materials.

After the hydrant connection has been made to the existing main, the hydrant installation shall be subjected to the hydrostatic test No. 3 of Section 74-2.12A.

74-2.13 DISINFECTION OF WATER MAINS

Before being placed in service, all new water mains and repaired portions of, or extensions to existing mains shall be chlorinated and a satisfactory bacteriological report obtained. The Owner will pass on the results of the bacteriological test. No separate payment will be made for chlorinating water mains.

-2.13A Flushing

Sections of pipe to be disinfected shall first be flushed to remove any solids or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, then a tap shall be provided large enough to develop a velocity of at least 2.5 fps. in the main. One 2½ inch hydrant opening will, under normal pressure, provide this velocity in pipe sizes up to and including 12-inch.

Taps required by the Contractor for chlorination or flushing purposes shall be provided by him as a part of the construction of water mains, unless otherwise provided in the special provisions. Service taps or taps that are necessary for temporary or permanent release of air will generally be provided by the Utility; if not performed by the Utility, the Engineer may direct the Contractor to make the taps for which work he will receive extra compensation.

Where dry calcium hydrochlorite is used for disinfection of the pipe, flushing shall be done after disinfection.

The Contractor shall be responsible for disposal of treated water flushed from mains and shall neutralize the waste water for protection of aquatic life in the receiving water before disposal into any natural drainage channel. However, disposal may be made to any available sanitary sewer provided the rate of disposal will not overload the sewer.

-2.13B Requirement of Chlorine

Before being placed into service, all new mains and repaired portions of, or extensions to existing mains shall be chlorinated so that a chlorine residual of not less than 10 ppm remains in the water after standing 24 hours in the pipe. The initial chlorine content of the water shall be not less than fifty (50) parts per million.

-2.13C Form of Applied Chlorine

Chlorine shall be applied by one of the methods which follow, to give a dosage of not less than 50 ppm of available chlorine.

-2.13D Dry Calcium Hypochlorite

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 50 ppm available chlorine, calculated on the volume of the water which the pipe and appurtenances will contain.

The number of ounces of 65% test calcium hypochlorite required for a 20-foot length of pipe equals ".008431d", in which "d" is the diameter in inches.

-2.13E Liquid Chlorine

A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device, or the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas, or the gas itself, must provide means for preventing the backflow of water into the chlorine.

-2.13F Chlorine-bearing Compounds in Water

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 in the amounts as shown in the table which follows.

Chlorine Requirements for 100-Ft. Lengths of Various Sizes of Pipe

Pipe Size Inches	Volume of 100-ft. Length Gals.	Amount Required to Give 50 ppm. Cl. 100% Chlorine Lb.	1% Chlorine-Water Solution in Gals.
4	65.3	0.027	1/4
6	146.5	0.061	3/4
8	261.0	0.108	1 1/4
10	408.0	0.170	2
12	588.7	0.240	3

-2.13F1 Sodium Hypochlorite

Sodium Hypochlorite, commercial grade (15% Cl) or in the form of liquid household bleach (5% 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 50 ppm.

-2.13G Point of Application

The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it, and through a corporation stop inserted by the utility 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 made by the utility on the pressure side of the gate valve controlling the flow into the pipe line extension. Alternate points of application may be used when approved or directed by the Engineer.

-2.13H Rate of Application

Water from the existing distribution system, or other source of supply, shall be controlled to flow very slowly into the newly laid pipe line 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 50 parts per million.

-2.13I Preventing Reverse Flow

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves may be used if desired.

-2.13J Retention Period

Treated water shall be retained in the pipe at least twenty-four (24) hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least ten (10) parts per million.

-2.13K Chlorinating Valves and Hydrants

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipe line is filled with the chlorinating agent and under normal operating pressure.

-2.13L Final Flushing and Testing

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe until the replacement water throughout its length shows, upon test, the absence of chlorine. In the event chlorine is normally used in the source of supply, then the tests shall show a residual not in excess of that carried in the system.

After flushing, the Engineer will arrange for taking samples by the Utility or by health authorities.

-2.13M Repetition of Flushing and Testing

Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the Contractor until satisfactory results are obtained. Failure to get a satisfactory test shall be considered as failure of the Contractor to keep the pipe clean during construction, or to properly chlorinate the main, and no additional payment will be made for reflushing and rechlorinating until a satisfactory test is made.

Section 75—Gate Valves for Water Mains

74-2.14 CONCRETE BLOCKING

Concrete thrust blocking, as detailed on the plans or on the standard drawings, shall be placed at bends, tees, and crosses as directed by the Engineer. Blocking shall be Class 5 (1½) concrete mix poured in place, unless precast blocks are authorized by the Engineer.

Concrete blocking, when placed as indicated on the standard drawing, shall be bearing against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints of the pipe or fittings.

74-2.15 1½ INCH BLOWOFFS

Water main blowoff assemblies shall be constructed as shown on the standard plan.

Drilling and tapping of the Mueller pipe thread into the water main will be performed by the Utility.

Seamless copper tubing for blowoffs shall conform to the requirements for Seamless Copper Water Tube, ASTM Designation B 88, Type K. Galvanized steel pipe, fittings and gate valves shall conform to the requirements in Section 72.

The unit contract price for the blowoff assembly shall include all materials called for on the standard plan, with the exception of copper pipe and concrete blocking.

Payment will be made for such of the following bid items as are included and shown on any particular contract:

1. "1½-inch Blowoff Assembly," per each.
2. "1½-inch Copper Pipe," per linear foot.
3. "Concrete Blocking," per cubic yard.

The unit contract price for the above items shall be full compensation for all labor, tools and equipment necessary for complete installation in accordance with the plans and specifications.

74-3 MEASUREMENT AND PAYMENT

74-3.01 MEASUREMENT OF WATER MAINS

Measurement shall be 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 pipe measured with 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.

74-3.02 PAYMENT FOR WATER MAINS AND WATER SERVICE CONNECTIONS

The unit contract price per linear foot for each size and kind of pipe shall be full compensation for furnishing the pipe and all fittings required for complete installation along the run of each pipe size and kind. The unit contract price per linear foot shall also include all costs of every nature for the laying and jointing of the pipe and fittings along each run, and also all costs for the testing, flushing and disinfecting of the pipe line.

In case any fittings are omitted in the construction by direction of the Engineer, or if any additional ones not shown on the plans are required, then in that event an adjustment, down or up, will be made the Contractor upon basis of the unit contract price per pound for "Extra Fittings." If there is no such item in the proposal the adjustment will be made upon a negotiated basis.

Excavation and backfilling of trenches, pipe line accessories such as hydrants, hydrant connections, gate valves, etc., will be paid for separately as provided in sections 73, 77 and 75, respectively.

74-3.03 PARTIAL PAYMENT FOR MATERIALS DELIVERED

Pipe and fittings delivered to the trench side but not installed will be included in the estimate of monthly payments to the Contractor, as provided in Section 9-1.05.

74-3.04 CONCRETE BLOCKING

The unit contract price per cubic yard for "Concrete Blocking in Place" shall be full compensation for all labor, material, equipment and tools necessary to place concrete blocking of the proportions required. It shall

include also, all excavation, 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.

74-3.05 TRENCH EXCAVATION AND BACKFILL FOR WATER SERVICE CONNECTIONS

Trench excavation and backfill for water service connections shall be measured and paid for in accordance with Section 73-3.02.

74-4 UNIT PRICE METHOD OF PAYMENT FOR WATER DISTRIBUTION MAIN CONSTRUCTION (An alternate method)

74-4.01 MEASUREMENT OF WATER MAINS FOR UNIT PRICE PAYMENT

Measurement for all piping shall be based upon the center line slope distance (laying length) of the pipe installed in any particular run, excluding the lengths so determined for all valves, fittings and specials. This method of measurement shall apply also to pipe installed for "Hydrant Connections."

74-4.02 PAYMENT FOR WATER MAIN CONSTRUCTION UNDER UNIT PRICE METHOD

Payment will be made for various kinds and sizes of pipe, fittings and specials at the unit contract price per linear foot, in place. Such payment shall be compensation in full for all labor, equipment, tools and materials required to lay, joint, disinfect and test the pipe line.

The unit contract price shall be used for price adjustment for either an increase or a decrease in quantities from that shown on the plans or listed in the proposal.

Excavation and backfilling of trenches including water settlement, pipe line accessories such as hydrants, gate valves, bank-run sand and gravel, disposal of spoil, concrete thrust anchors, etc., will be paid for separately at unit contract prices upon items and units contained in the proposal.

Section 75—Valves for Water Mains

75-1 DESCRIPTION

The valves shall be suitable for an ordinary waterworks service, intended to be installed in a normal position on buried pipe lines for water distribution systems.

The minimum requirements for all gate valves shall, in design, material and workmanship, conform to the standards of the AWWA C500-61. All materials used in the manufacture of waterworks gate valves shall conform to the AWWA Standards designed for each material listed. All gate valve operating stems shall be equipped with a two (2) inch operating nut. All gate valves shall open either counterclockwise or clockwise at the discretion of the Owner.

The minimum requirements for all butterfly valves shall in design, material and workmanship conform to the standards of the AWWA C504-70.

75-2 MATERIALS

75-2.01 MANUFACTURE AND MARKING

The valves shall be standard pattern of a manufacturer whose products are approved by the Owner 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.

75-2.02 TYPE AND MOUNTING

The valve bodies shall be cast iron, mounted with approved noncorrosive metals. All wearing surfaces shall be bronze or other approved noncorrosive material and there shall be no moving bearing or contact surfaces 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.

All gate valves shall be two-faced, double disc, with parallel seats and bronze or other approved wedging devices placed between them. The stem shall be of high tensile strength bronze or other approved noncorrosive metal. All nonferrous bushings shall be of substantial thickness, tightly fitted and pressed into machined seats.

Section 76—Valve Chambers and Boxes for Water Mains

75-2.03 END CONNECTIONS

The dimensions of hub or bell end connections shall conform to the dimensions of the AWWA Standard No. C100-55. The dimensions for the mechanical joint connections shall conform to the USASI Specifications No. A21.11.

The end flanges of flanged valves shall conform in dimensions and drilling to the standard USASI B16.1 for cast iron flanges and flanged fittings, Class 125, unless specifically provided otherwise. The bolt holes shall straddle the vertical center line.

75-2.04 GATE VALVES 16-INCH AND LARGER

Gate valves 16-inch and larger shall be double square bottom arranged for operation in the horizontal position and shall be equipped with bronze tracks fastened into a groove or slot within the valve body casting, together with bronze rollers, shafts, bushings and scrapers. They shall be nonrising stem type and shall be equipped with approved barrel type rugged gate position indicators. The valves shall be provided with handwheels or operating nuts as designated in the proposal. Where handwheels are called for, a design of ample proportion is required. Where operating nuts are called for, a standard 2" operating nut shall be furnished.

All gears on gate valves shall be cut tooth steel gears, housed in heavy cast iron extended type grease cases of approved design. The valves shall be equipped with by-passes and gate valves of the sizes adopted as standard in the specifications of AWWA. All by-pass gate valves shall be equipped with standard 2" operating nuts, except as otherwise specified.

All gate valves 16-inch and larger shall be enclosed in a masonry chamber and shall be geared with gearing designed for handwheel operating in a horizontal plane, or for an operating nut mounted on a vertical pinion shaft, as shown on the standard drawings.

The Contractor shall furnish shop drawings of double square bottom gate valves to the Engineer for approval.

Prior to shipment, three certified copies of performance tests, complying with Section 25 of the AWWA C-500 Standard Specifications shall be submitted to the Engineer.

75-2.05 GATE VALVE STEM SEALS

Unless otherwise designated in the proposal, all gate valves up to and including 12-inch in size shall be furnished with O-Ring Stem Seals. Number, size and design shall conform to the AWWA Standards for gate valve O-Ring Stem Seals. For all valves over 12", the stem seals shall be conventional type stuffing-box with graphited packing per AWWA Standard No. C600-18.1.

75-2.06 TAPPING VALVES

Tapping valves shall be furnished with flanged inlet end connections having a machined projection on the flanges to mate with a machined recess on the outlet flanges of the tapping sleeves and crosses. The outlet ends shall conform in dimensions to the AWWA Standards for hub or mechanical joint connections, except that the outside of the hub shall have a large flange for attaching a drilling machine. The seat opening of the valves shall be larger than normal size to permit full diameter cuts.

75-2.07 HYDROSTATIC TEST PRESSURE AT FACTORY FOR CLASS 150 VALVES

Each gate valve shall be tested at the factory for performance and operation prior to painting and shall be subjected to the following hydrostatic pressure tests: each 3-inch to 12-inch valve, inclusive, shall be subjected to hydrostatic test under pressures of both 300 psi and 175 psi, and each 16-inch to 48-inch valve, inclusive, shall be subjected to test pressures of 300 psi and 150 psi. These tests shall be conducted in accordance with provisions of AWWA C500-61 Sec. 29, or latest revision thereof. Tests for special valves shall be made as provided in the special provisions.

75-2.08 PAINTING AT FACTORY

After the factory test and inspection, all ferrous parts of the valves except finished or bearing surfaces shall be painted inside and out with two coats of asphalt varnish, Federal Specifications TT-V-51A or approved equal.

75-3 INSTALLATION OF GATE VALVES

All gate valves shall be inspected upon delivery in the field to insure proper working order before installation. They shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connection 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, and the cleaned area shall then be recoated with two or more field coats of Quigley Triple A-10 or Triple A-20, or equal.

Valves 12-inch and under shall be installed in a vertical position and be provided with a standard valve chamber or cast iron gate box so arranged that no shock will be transmitted to the valve. The box shall be centered over the operating nut, and the cast iron box cover shall be set flush with the roadbed or finished paved surface.

After installation, all valves shall be subjected to the field test for piping as outlined in Section 74-2.12 of these specifications. Should any defects in design, materials or workmanship appear during these tests, the Contractor shall correct such defects with the least possible delay and to the satisfaction of the Engineer. Should the Contractor fail to do this within a reasonable period of time in the judgment of the Engineer, he may cause such defects to be corrected and deduct the cost thereof from any moneys or payments due or to become due the Contractor.

75-4 MEASUREMENT AND PAYMENT

75-4.01 PAYMENT FOR VALVES

Payment for "Gate Valve (size)" and "Butterfly Valve (size)" will be made at the unit contract price per each, which price shall be full compensation for all labor, material, equipment and tools necessary to furnish and install the valve complete in place in the water main, including trenching, jointing, painting, disinfecting and hydrostatic testing.

Section 76—Valve Chambers and Boxes for Water Mains

76-1 DESCRIPTION

This section shall apply to the construction of standard valve chambers, special valve chambers and cast iron valve boxes, all in accordance with the standard drawings.

Where shown on the plans or where directed by the Engineer, gate valves shall be enclosed in valve chambers, or shall be provided with cast iron valve boxes set over the operating stem.

76-2 MATERIALS

76-2.01 RING AND COVER AND VALVE BOX CASTINGS

Castings for cast iron ring and cover and for cast iron parts of valve boxes shall conform to the requirements of Standard Specifications for Gray Iron Castings, ASTM Designation A-48-56.

76-2.02 PORTLAND CEMENT CONCRETE BLOCKS

Portland cement concrete blocks shall be solid and conform to the requirements of ASTM Designation C 139-39. Over-all thickness of block shall be six (6) inches with optional lengths and widths. Curved manhole blocks shall be used for round valve chambers.

76-2.03 PORTLAND CEMENT CONCRETE

Concrete for cast in place valve boxes shall be Class 5(1½) mix.

76-2.04 MORTAR

Portland cement mortar shall be one (1) part portland cement to not less than one and one-half (1½) parts nor more than three (3) parts of plaster sand,

Section 77—Fire Hydrants

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.

76-2.05 BRICK

-2.05A Concrete Brick

Concrete brick when used, shall conform to the Specification for Concrete Building Brick ASTM C 55, Grade A.

-2.05B Clay Brick

Clay brick, when used, shall conform to the ASTM Specification C 62, Grade SW.

76-3 CONSTRUCTION DETAILS

Valve chambers may be either precast, cast in place, or be made of solid concrete blocks according to the details shown on the standard drawings.

76-3.01 PRECAST VALVE CHAMBERS

Precast valve chambers for nominal depth of cover from 2'-6" to 3'-6" are cast in one piece with slotted holes for placing over the main.

Precast valve chambers for nominal depth of cover from 4'-6" to 6'-6" are made in two sections.

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 first be wrapped with two (2) inch thick styrofoam material under the chamber walls and after setting the chamber the remaining space shall be filled with cement mortar or mortared bricks. In no case shall the chamber walls rest on the pipe.

76-3.02 CAST-IN-PLACE CHAMBERS

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.

76-3.03 CHAMBERS MADE WITH PRECAST CONCRETE BLOCKS

Circular or rectangular chambers may be made with solid precast concrete blocks. The base shall first be poured in place and after reaching 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 drawings.

Rectangular chambers shall have a cast-in-place or precast concrete cover.

76-3.04 SETTING CAST IRON FRAME AND COVER

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 two 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 cement-lime brick 2¼ inches thick.

76-3.05 VALVE CHAMBER DRAIN

Unless otherwise specified, each rectangular valve chamber shall be provided with a drain consisting of a short length of four-inch (4") sewer pipe leading to a gravel drain.

The gravel drain shall consist of one-half (½) cubic yard of clean paving gravel (¾" to ¾") placed outside of and below the bottom of the chamber. In naturally porous soils the gravel may be omitted at the direction of the Engineer.

76-3.06 CAST IRON VALVE BOXES

Cast iron valve boxes, as shown on the standard drawing, are placed for enclosing gate valves of small size in lieu of gate valve chambers.

Cast iron valve boxes in general are set to position during backfilling operations so they will be in a vertical alignment to the gate valve operating stem. The lower casting of the unit is installed first in such a manner as to be supported by a minimum backfill or by a styrofoam collar not less than two (2) inches in thickness. The casting shall not rest directly upon the body of the gate valve or upon the water main. The upper casting of the unit is then placed in proper alignment and to such an elevation that its top will be at final grade. Backfilling around both units shall be placed and compacted to the satisfaction of the Engineer.

76-4 MEASUREMENT AND PAYMENT

76-4.01 PAYMENT FOR VALVE CHAMBERS

For purposes of payment, valve chambers will have three classifications as follows: "Valve Chambers, Standard" for valve chambers for valves up to and including 12-inch set vertically; "Valve Chambers, Large" for rectangular valve chambers for valves 16-inch to 30-inch, inclusive, laid horizontally, and "Valve Chambers, Special" with inside dimensions given to nearest foot according to detail plans (i. e. "Valve Chamber Special 5' 8").

In each case payment will be made at the unit contract price per each, which price shall be in full for all materials, labor and equipment, including cast iron ring and cover, cast iron valve box, concrete, bricks, grout, expansion material (for large or special), one length of sewer piped drain, gravel pocket, excavation and backfilling, and disposal of surplus excavation not needed for backfilling.

76-4.02 PAYMENT FOR CAST IRON VALVE BOXES

The unit contract price per each for "Cast Iron Valve Box," shall be full compensation for all labor, material, equipment and tools necessary to furnish and install a cast iron valve box in proper position during the backfilling operations, as specified.

Section 77—Fire Hydrants

77-1 DESCRIPTION

These specifications are to be used in conjunction with the AWWA Standard C502-54 approved as Standard May 27, 1954, or the latest revision thereof for fire hydrants for ordinary water works service.

77-2 MATERIALS

77-2.01 MATERIAL FOR HYDRANTS AND APPURTENANCES

All materials used in the production of fire hydrants for ordinary service shall conform to the specifications designated for each material listed in AWWA Standard C502-54.

77-2.02 MANUFACTURE AND MARKING

The hydrant shall be of standard manufacture and of a pattern approved by the Owner-municipality. The name or mark of the manufacturer, size of the valve opening and year made shall be plainly cast in raised letters and so placed on the hydrant barrel as to be visible after the hydrant has been installed.

77-2.03 TYPE AND MOUNTING

As a minimum requirement, all hydrants shall be designed for a working pressure of 150 lbs. per square inch and in workmanship, design and material, shall conform to the AWWA Standard C502-54, or latest revision thereof. The hydrant bodies shall be cast iron, fully mounted with approved noncorrodible metals. All wearing surfaces shall be either bronze or some other approved noncorrodible material, and there shall be no moving bearing or contact surfaces of iron in contact with iron or steel. All contact surfaces shall be finished or machined in the best workmanlike manner and all wearing surfaces shall be easily renewable.

The design of the hydrant shall be such that all working parts may be removed through the top of the

Section 77—Fire Hydrants

hydrant and shall have the required AWWA specified number of turns of the stem to open the gate an area equal to the area of the valve opening. Any change in area of the water passage through the valve must have an easy curve, and all outlets must have round corners of good radius.

77-2.04 END CONNECTIONS

The dimensions of hub or bell end connections shall conform to the dimensions of the AWWA Standard No. 100-55. The dimensions for the mechanical joint connections shall conform to the USASI Specification No. A21.11.

The flanged lateral connection shall be faced and drilled to conform to the American Standard for 125-lb. W. P. flanged fittings. Flanges shall be machine finished to a true surface. Bolt holes shall straddle the vertical center line.

77-2.05 HYDRANT DIMENSIONS

The dimensions and details of hydrant and nozzles, unless otherwise noted, shall be as follows:

	Hydrant 4-inch Connection	Hydrant 6-inch Connection
Hydrant connection pipe size inside dia.	4 inches	6 inches
Standpipe, minimum inside dia.	6 inches	7 inches
Length of hyd. from bottom of hyd. conn. to sidewalk ring	As required by Owner	
Valve opening, minimum dia.	4 inches	5 inches
Size of auxiliary gate valve	4 inches	6 inches
Hose nozzles, number and size	2—2½ inches	2—2½ inches
Thread (Nat. Board of Fire Underwriters)	7½ per inch	7½ per inch
Outside dia. finished	3-1/16 ins.	3-1/16 ins.
Dia. at root of thread	2.8715 inches	2.8715 inches
Pattern of thread	60° V-thread	60° V-thread
Total length of threaded male nipple	1 inch	1 inch

Streamer nozzles, number and size. }
 Thread, outside dia. finished. }
 Dia. at root of thread. } to match Owner's
 Spreads } existing pattern
 Pattern of thread. }
 Total length of threaded male nipple

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.

77-2.06 OPERATING NUTS

The operating nuts on hydrant stem and nozzle caps shall be the same for both sizes of hydrants. Dimensions shall be as follows:

Pattern of Nut	Tapered Pentagonal
Height	1-1/16 inch
Size of Pentagon	1.35-inch at bottom of nut 1.23-inch at top of nut (measured from point to flat)

The hydrant valve shall open by turning to the left (counterclockwise).

77-2.07 SHACKLING LUGS

Lugs, if required for harnessing the hydrant to the connecting pipe form the main in the street, shall be provided on the bell of the elbow or on the hydrant bottom casting. A drawing of the lug construction shall be submitted for approval, on request of the Engineer.

77-2.08 SIDEWALK FLANGE CONSTRUCTION

Hydrants shall be provided with a sidewalk flange. Breaking devices, if required, shall be at the sidewalk flange which will allow the hydrant barrel to separate at this point with a minimum breakage of hydrant parts in case of damage. There shall also be provided at this point a safety stem coupling on the operating stem that will shear at the time of impact. Unless otherwise speci-

fied, all hydrants shall be equipped with O-Ring stem seals.

77-2.09 FACTORY HYDROSTATIC TEST

Before the hydrant is painted at the factory, it shall be subjected to an internal hydrostatic test of 300 pounds per square inch with the hydrant valve in a closed position and again with the hydrant valve in an open position.

77-2.10 PAINTING

All iron parts of the hydrant both inside and outside shall be thoroughly cleaned and painted. 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.

The outside of the hydrant above the finished ground line shall be thoroughly cleaned and thereafter painted with one coat of paint of a durable composition conforming to Federal Specification TT-P-86a, Type IV, and one additional coat of a color specified by the Owner.

77-3 CONSTRUCTION DETAILS

77-3.01 SETTING HYDRANTS

Where shown on the plans or where designated by the Engineer, hydrants shall be installed in accordance with the detail shown on the standard drawings.

All hydrants shall be inspected in the field upon arrival to ensure proper working order. After installation, they shall be subjected to a hydrostatic test not to exceed the factory test pressure.

77-3.02 HYDRANT CONNECTIONS

Hydrant laterals shall consist of a section of 4-inch or 6-inch pipe from the main to the hydrant and shall include an auxiliary gate valve set vertically and placed in the line as indicated in the standard drawing for hydrant settings.

-3.02A Shackle Rods

Hydrants shall be harnessed to the auxiliary gate valve and the valve to the tee at the main with steel rods of size, shape and arrangements, as indicated in the detail drawing for hydrant settings.

All hydrant shackle rods, after installation, shall be thoroughly cleaned and painted with two (2) coats of asphalt varnish, as specified in Section 77-2.10, or with such other bituminous paint as may be authorized by the Engineer.

-3.02B Auxiliary Gate Valve

All auxiliary gate valves shall conform to Section 75 in all respects, except that the end connections shall be provided with lugs for rodding or the bells shall have sufficient clearance between the body of the valve and the hub to permit the installation of shackles.

-3.02C Cast Iron Valve Boxes

See Section 76-3.06.

77-3.03 RESETTING EXISTING HYDRANTS

Where existing hydrants are shown on the plans for adjustments to conform to new street alignment and/or grade, the hydrant shall be relocated without disturbing the location of the hydrant lateral tee at the main.

The method of harnessing the hydrant shall be determined by the conditions found in the field and shall be reshackled or reblocked as directed by the Engineer.

This work shall conform in all respects to the specifications for setting hydrants mentioned elsewhere in these specifications.

77-3.04 MOVING EXISTING HYDRANTS

When shown on the plans or when directed by the Engineer, existing hydrants shall be moved. When the existing tee is moved to a new hydrant location, a new tee shall be inserted and the open part of the abandoned tee shall be securely sealed and shackled. When the existing hydrants are blocked to the main line, the same method shall be used to anchor the hydrants at their new

Section 78—Restoration and Cleanup of Water Main Construction

locations unless, in the judgment of the Engineer, it is found necessary to shackle them in which case the harnessing of the hydrants shall be as indicated in the standard detailed drawings for Hydrant Setting Type A and Type B. The work shall conform in all respects to hydrant settings as described elsewhere in these specifications.

77-3.05 RECONNECTING EXISTING HYDRANTS

When reconnecting existing hydrants is specified, the hydrants remain unchanged in their original position, but the existing hydrant connection is changed to connect with a new hydrant tee provided in a new main.

Hydrant reconstructions shall meet all the requirements for new work.

Where existing hydrants were not shackled to the old main, the new connection shall be shackled with steel rods as shown on the standard drawings, or by such other shackling method as may be directed by the Engineer.

All hydrants shall be set on concrete pier blocks as shown on the standard drawing.

The hydrant drain shall waste into a pit of crushed stone or gravel situated at the base of the hydrant as shown on the standard drawing.

77-3.06 HYDRANT EXTENSIONS

The minimum requirements for all flanged hydrant barrel extensions, operating stems and flanged adaptors for hydrant lateral connections shall, in design, material and workmanship conform to the AWWA Standards for such castings. The drilling of the flanges on the extensions shall match the drilling of the flanges on the hydrant. The drilling of the adaptor flanges shall match those of the hydrant foot flange and the auxiliary gate valve flange.

77-4 MEASUREMENT AND PAYMENT

77-4.01 FIRE HYDRANTS

Payment will be made at the unit contract price per each for "Hydrant, 4-inch Connection" and "Hydrant, 6-inch Connection" which shall be full compensation for the hydrant in place. As incidental thereto, the Contractor shall include in his unit contract prices of the hydrants all costs of every kind for shackles, tie rods, pier blocks, coarse gravel, painting, and other things that will be required for the complete installation of the hydrant as specified, excepting however, that the 4-inch and 6-inch cast iron pipe connecting the hydrant to the main will be paid for at the unit contract price per linear foot for "Water Mains." Auxiliary gate valves will be paid for at the unit contract price per each for "Gate Valves."

77-4.02 RESETTING EXISTING HYDRANTS

Payment for "Resetting Existing Hydrants" will be made at the unit contract price per each and shall include the costs for shackling, painting and all other labor, material and equipment necessary to place and connect the hydrant in its new location, but the unit contract price shall not include payment for new pipe used for hydrant connections. New pipe will be paid for at the unit contract price per linear foot for "Water Mains" of the size used.

77-4.03 MOVING EXISTING HYDRANTS

Payment will be made for "Moving Existing Hydrants" at the unit contract price per each and shall include all costs for shackling, painting and all other labor, material and equipment necessary to move and reconnect the hydrant in its new position, excepting however, that the new pipe and fittings for hydrant connections will be paid for at the unit contract price per linear foot for "Water Mains."

77-4.04 RECONNECTING EXISTING HYDRANTS

Payment for "Reconnecting Existing Hydrants" will be made at the unit price per each, and it shall be full compensation for adjustment of hydrant connections, shackling, painting and all other labor, material and equipment necessary to connect the hydrant to the new main, excepting however, that any new pipe used for the

connection will be paid for at the unit contract price per linear foot for "Water Mains."

77-4.05 HYDRANT EXTENSIONS

Payment for vertical and horizontal hydrant extensions will be made at the unit contract price bid for "Hydrant Extension Vertical," per pound in place, and "Hydrant Extension Horizontal," per pound in place. The weight paid for shall include the weight of castings and the weight of additional length of hydrant rods, bolts, nuts, washers and gaskets.

The price paid per pound shall cover the cost of all machine work and all labor required to lengthen the rods and there will not be any additional compensation either per pound additional or otherwise for such work. Lengthening of hydrants to specified length with vertical hydrant extensions will not be allowed except by permission of the Engineer, and in such cases no extra payment will be allowed for vertical extensions, and such cost shall be included in the unit price bid for "Hydrants."

Section 78—Restoration and Cleanup of Water Main Construction

78-1 GENERAL

Surface improvements such as pavement curb, curb and gutter and other like surface facilities that have been removed or damaged during the construction of water mains, shall be restored by the Contractor if there is one or more bid items in the proposal to cover the work.

If there is no bid item in the proposal for restoration, it will be assumed that the Owner will do the work with its own forces. The Contractor shall, however, backfill the trench to the surface and perform such work as may be required under the specifications and special provisions.

78-2—CONSTRUCTION DETAILS

78-2.01 REMOVAL OF EXISTING STREET IMPROVEMENTS

Removal and disposal of existing street improvements shall be done in accordance with applicable sections of the specifications, and Section 73-1.03 which provides that removal and disposal shall be considered as incidental to the construction and the costs thereof shall be included in the unit contract price per linear foot for "Trench Excavation and Backfill."

78-2.02 RESTORATION OF EXISTING STREET IMPROVEMENTS

Restoring of existing street improvements shall be as specified in the applicable sections of these specifications pertaining to their construction and the measurement and payment will be as described in Sections 78-3.01 and 78-3.02.

At all pavement openings where backfill is to be compacted with mechanical tampers in accordance with Section 73-2.07D and where the pavement is not restored immediately, the Contractor shall place and maintain at his own expense an asphalt concrete surfacing to the elevation of the existing pavement until final restoration is made.

In the event backfill is placed at the direction of the Engineer without proper compaction to accommodate a critical traffic condition and the final settlement and compaction is made by traffic or otherwise, the cost of placing and maintaining the temporary asphalt concrete surfacing until final restoration is made will be paid for as extra work in accordance with Section 9.03.

78-2.03 MAINTAINING POSTAL SERVICE

Maintenance of postal service including removal and replacement of mail boxes, and new supports for boxes whenever such is necessary for proper replacement, shall be in accordance with Section 7-1.19.

78-2.04 FINISHING AND CLEANUP

Finishing and cleanup shall be as specified in Section 57.

Section 78—Restoration and Cleanup of Water Main Construction

78-3 MEASUREMENT AND PAYMENT

78-3.01 EXISTING STREET IMPROVEMENTS

Cement concrete pavement, driveway, sidewalk, asphalt concrete pavement, or bituminous plant mix pavement will be measured and payment made therefor at the unit contract prices specified in the applicable sections pertaining to their construction, excepting however, that measurement and payment will be limited to a trench width equal to the outside diameter of the barrel of the pipe plus forty-eight (48) inches. Any surfaces requiring restoration outside of this limit which is removed or damaged by the Contractor, shall be restored by him at his own expense. Payment will be made, however, for any additional area of cement concrete pavement necessitated by expansion joints or cracks that occur within three (3) feet of the recovery width above described.

78-3.02 CEMENT CONCRETE CURB, CURB AND GUTTER

Payment for cement concrete curb and curb and gutter will be made at the unit contract prices set up for same in applicable sections pertaining to their construction. Measurement for payment will be restricted as follows:

1. Where the water main crosses the curb or curb and gutter at right angles, measurement for payment will be the length of the curb removed but not more than

the outside diameter of the pipe plus forty-eight (48) inches.

2. Where the water main crosses the curb or curb and gutter in a diagonal course, the measurement will be no more than the diagonal distance along the face of the curb between two lines, each projected parallel to the outside of the barrel of the pipe and each twenty-four (24) inches distant therefrom.
3. Where it is necessary to remove curb or curb and gutter within the pay width of trench excavation (outside pipe diameter plus 24 inches each side), and where the curb or curb and gutter parallels the center line of the water main, or approximately so, measurement and payment will be at the unit contract price per linear foot for the actual length of curb, or curb and gutter, that is required to be constructed.

78-3.03 FINISHING AND CLEANUP

Whenever the proposal includes an item per lump sum or per station for "Finishing and Cleanup," the measurement and payment will be made in accordance with Section 57, Finishing and Cleanup.

If the proposal does not include an item for "Finishing and Cleanup," the work required shall be performed as specified in Section 57, but shall be considered as incidental to the construction and the costs thereof shall be included by the Contractor in other bid items of the contract.

Section 78—Restoration and Cleanup of Water Main Construction

78-3 MEASUREMENT AND PAYMENT

78-3.01 EXISTING STREET IMPROVEMENTS

Cement concrete pavement, driveway, sidewalk, asphalt concrete pavement, or bituminous plant mix pavement will be measured and payment made therefor at the unit contract prices specified in the applicable sections pertaining to their construction, excepting however, that measurement and payment will be limited to a trench width equal to the outside diameter of the barrel of the pipe plus forty-eight (48) inches. Any surfaces requiring restoration outside of this limit which is removed or damaged by the Contractor, shall be restored by him at his own expense. Payment will be made, however, for any additional area of cement concrete pavement necessitated by expansion joints or cracks that occur within three (3) feet of the recovery width above described.

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**STANDARD
SPECIFICATIONS
FOR
MUNICIPAL PUBLIC WORKS
CONSTRUCTION**



DIVISION V—STRUCTURAL AND RELATED SPECIFICATIONS

Sec.	Title	Page	
100	Structures—General	V-1	
101 to 118	Vacant		

NOTE: The Underground Utility Installations has been deleted.

DIVISION V—STRUCTURAL AND RELATED SPECIFICATIONS

Section 100—Structures—General

100-1 DESCRIPTION

Division 6 and other sections referenced in Division 6 and Division 2, Section 2-09 of the current edition and current supplemental amendments of the State of Washington Standard Specifications for Road and Bridge Construction shall be the standard specifications for this Division V—Structures and Related Specifications. Copies of the State of Washington Standard Specifications and supplemental amendments thereto will be furnished by the Owner for each project as may be required.

All references to Department of Highways are hereby deleted and owner is substituted therefor.

All references to Director or Director of Highways or to Engineer shall be the Engineer as defined by Section 1-1.02.

All references to Inspector or State Welding Inspector shall be the Inspector as defined by Section 1-1.04.

This division of the specifications shall apply to all bridges, retaining walls, concrete culverts, cribbing, and similar structures.

Manholes, catch basins, pipe, valve chambers and in-

lets constructed for sewers, storm drains and water distribution as described elsewhere in these APWA Standard Specifications shall not be classified as structures.

Buildings, water tanks, sewage treatment facilities, transmission and radio towers and other similar structures are not covered in these APWA Standard Specifications.

All construction details, measurement and payment for excavation for structures shall be in accordance with Division 2, Section 2-09 (Structural Excavation) of the current edition and current supplemental amendments of the State of Washington Standard Specifications for Road and Bridge Construction.

All construction details, measurements and payment shall be in accordance with Division 6, Structures, and other sections referenced in Division 6 of the current edition and current supplemental amendments of the State of Washington Standard Specifications for Road and Bridge Construction.

All construction materials shall be in accordance with applicable referenced sections of Division 9, Materials and other referenced sections of the current edition and current supplemental amendments of the State of Washington Standard Specifications for Road and Bridge Construction.

**STANDARD
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FOR
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CONSTRUCTION**



DIVISION VI—STANDARD FORMS

Form	Title	Page	Form	Title	Page
1	Proposal	VI-1	8	Letter for Employment of Subcontractor	VI-8
2	Proposal Signature Sheet	VI-2	9	Contract Change Order Agreement	VI-9
3	Bid Bond Form	VI-3	10	Force Account Statement for Street Work	VI-10
4	Bidder's Check List	VI-4	11	Force Account Statement Other Than Street	VI-11
5	Contract	VI-5	12	Weekly Statement of Working Days	VI-12
6	Performance Bond Form	VI-6	13	Non-Collusion Affidavit Form	VI-13
7	Minimum Wage Affidavit	VI-7			

Standard Forms

DIVISION VI—STANDARD FORMS

(STANDARD FORM NO. 1)

PROPOSAL

To the City Clerk (or other) _____, Washington, _____, 19____
 Anywhere, Washington _____ Project No. _____
 _____ L.I.D. No. _____
 _____ W.O. No. _____

The undersigned hereby certifies that _____ has personally examined the location and construction details of work as outlined on the plans and specifications for Project No. _____
 _____ (Job description and location)

and has read and thoroughly understands the plans and specifications and contract governing the work embraced in this improvement and the method by which payment will be made for said work and hereby proposes to undertake and complete the work embraced in this improvement in accordance with said plans, specifications, and contract and at the following schedule of rates and prices:

(NOTE: Unit prices for all items, all extensions and total amount of bid must be shown. Show unit prices in both words and figures and where conflict occurs the written or typed words shall prevail.)

ITEM NO.	APPROX. QUANTITY	ITEM WITH UNIT PRICED BID (Unit prices to be written in words)	UNIT PRICE		AMOUNT	
			Dollars	Cts.	Dollars	Cts.
1.	1011 Cu. Yds.	Unclassified Excavation including haul, at SEVENTY-FIVE CENTS Per Cu. Yd.		75	758	25
2.	1053 Cu. Yds.	Bankrun Gravel for streets, at ONE DOLLAR Per Cu. Yd.	1	00	1053	00
3.	297 Cu. Yds.	Crushed Stone Top Course, at THREE DOLLARS Per Cu. Yd.	3	00	891	00
4.	3860 Cu. Yds.	Trench Excavation and Backfill Class A (Sanitary) ONE DOLLAR Per Cu. Yd.	1	00	3860	00
5.	200 Lin. Ft.	10-Inch Diameter Class C. Sewer Pipe (Sanitary); at FOUR DOLLARS Per Lin. Ft.	4	00	800	00

*Owner's tentative statement of items subject to 5% retail sales tax to be paid by Owner—Items 4 and 5 (subject to final determination). See Sec. 7-1.09, of standard specifications.

Total Bid\$7362.25
 *Sales Tax 233.00

FORM FURNISHED BY POLITICAL SUBDIVISION.

Grand Total\$7595.25

PROPOSAL SIGNATURE SHEET

(Job Description and Location)

Project No.

L.I.D. No.

W.O. No.

....., 19.....
(Date)

.....
(Bidder)

by
(Authorized Official)

.....
(Address)

NOTE: (1) If the bidder is a co-partnership, so state, giving firm name under which business is transacted.

(2) If the bidder is a corporation, this proposal must be executed by its duly authorized officials.

(3) If no bid is submitted, kindly mark "NO BID" and return to
(City clerk, or other)

.....
(Address)

BID BOND FORM

Herewith find deposit in the form of a certified check, cashiers check, cash, or bid bond in the amount of \$..... which amount is not less than five percent of the total bid.

SIGN HERE

BID BOND

KNOW ALL MEN BY THESE PRESENTS:

That we,, as Principal,
and, as Surety,
are held and firmly bound unto the (Political Subdivision), as Obligee, in the penal sum of Dollars, for the
payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by these presents.

The condition of this obligation is such that if the Obligee shall make any award to the Principal for

according to the terms of the proposal or bid made by the Principal therefor, and the Principal shall duly make and enter into a contract with the Obligee in accordance with the terms of said proposal or bid and award and shall give bond for the faithful performance thereof, with Surety or Sureties approved by the Obligee; or if the Principal shall, in case of failure so to do, pay and forfeit to the Obligee the penal amount of the deposit specified in the call for bids, then this obligation shall be null and void; otherwise it shall be and remain in full force and effect and the Surety shall forthwith pay and forfeit to the Obligee, as penalty and liquidated damages, the amount of this bond.

SIGNED, SEALED AND DATED THIS DAY OF, 19.....

.....
Principal

.....
Surety

....., 19.....

Received return of deposit in the sum of \$.....

FURNISHED BY POLITICAL SUBDIVISION.

BIDDER'S CHECK LIST

The bidder's attention is especially called to the following forms which must be executed in full as required:

- (a) Proposal. The unit prices bid must be shown in the space provided. Show unit prices in both words and figures.
(b) Proposal Signature Sheet. To be filled in and signed by the bidder. Non-collusion Affidavit must be subscribed to and sworn before a notary public.
(c) Bond accompanying bid. This form is to be executed by the bidder and the surety company unless bid is accompanied by a certified check. The amount of this bond shall be not less than 5% of the total amount bid and may be shown in dollars or on a percentage basis.

The following forms are to be executed after the contract is awarded:

- (a) Contract. This agreement to be executed by the successful bidder.
(b) Performance Bond To be executed by the successful bidder and his surety company.

CONTRACT

THIS AGREEMENT, made and entered into in triplicate, this ... day of ..., 19 ... by and between (Political Subdivision), hereinafter called the Owner, and ...

hereinafter called the Contractor,

WITNESSETH:

That in consideration of the terms and conditions contained herein and attached and made a part of this agreement, the parties hereto covenant and agree as follows:

I. The Contractor shall do all work and furnish all tools, materials, and equipment for

in accordance with and as described in the attached plans and specifications and the Standard Specifications for Municipal Public Works Construction, which are by this reference incorporated herein and made a part hereof, and shall perform any alterations in or additions to the work provided under this contract and every part thereof.

Work shall start within ... days after execution of contract and be completed in ... (calendar, working) days.

If said work is not completed within the time specified, the Contractor agrees to pay to the Owner the sum of ... dollars for each and every day said work remains uncompleted after expiration of the specified time, as liquidated damages.

The Contractor shall provide and bear the expense of all equipment, work and labor of any sort whatsoever that may be required for the transfer of materials and for constructing and completing the work provided for in this contract and every part thereof, except such as are mentioned in the specifications to be furnished by the (Owner).

II. The (Owner) hereby promises and agrees with the Contractor to employ, and does employ the Contractor to provide the materials and to do and cause to be done the above described work and to complete and finish the same according to the attached plans and specifications and the terms and conditions herein contained and hereby contracts to pay for the same according to the attached specifications and the schedule of unit or itemized prices hereto attached, at the time and in the manner and upon the conditions provided for in this contract.

III. The Contractor for himself, and for his heirs, executors, administrators, successors, and assigns, does hereby agree to the full performance of all the covenants herein contained upon the part of the Contractor.

IV. It is further provided that no liability shall attach to the (Owner) by reason of entering into this contract, except as expressly provided herein.

IN WITNESS WHEREOF the parties hereto have caused this agreement to be executed the day and year first hereinabove written.

Countersigned: this ... day of ... 19 ... (Owner)

By (Authorized Official)

Approved as to legality:

(Legal Officer) (Contractor)

FURNISHED BY POLITICAL SUBDIVISION.

By

PERFORMANCE BOND

BOND TO (Political Subdivision)

KNOW ALL MEN BY THESE PRESENTS:

That we, the undersigned, _____

as principal, and _____, a corporation organized and existing under the laws of the State of _____, as a surety corporation, and qualified under the laws of the State of Washington to become surety upon bonds of contractors with municipal corporations, as surety, are jointly and severally held and firmly bound to the (Political Subdivision) in the penal sum of \$ _____ for the payment of which sum on demand we bind ourselves and our successors, heirs, administrators or personal representatives, as the case may be.

This obligation is entered into in pursuance of the statutes of the State of Washington, the Ordinances of the (Political Subdivision)

Dated at _____, Washington, this _____ day of _____, 19 _____

Nevertheless, the conditions of the above obligation are such that:

WHEREAS, under and pursuant to Ordinance (or Resolution) No. _____ of the (Political Subdivision), passed _____, 19 _____, the (Authorized Official) of said (Political Subdivision) has let or is about to let to the said _____ the above bounden Principal, a certain contract, the said contract being numbered _____ and providing for _____

(which contract is referred to herein and is made a part hereof as though attached hereto), and

WHEREAS, the said Principal has accepted, or is about to accept, the said contract, and undertake to perform the work therein provided for in the manner and within the time set forth;

NOW, THEREFORE, if the said _____ shall faithfully perform all of the provisions of said contract in the manner and within the time therein set forth, or within such extensions of time as may be granted under said contract, and shall pay all laborers, mechanics, sub-contractors and material men, and all persons who shall supply said principal or sub-contractors with provisions and supplies for the carrying on of said work, and shall hold said (Political Subdivision) harmless from any loss or damage occasioned to any person or property by reason of any carelessness or negligence on the part of said principal, or any sub-contractor in the performance of said work, and shall indemnify and hold the (Political Subdivision) harmless from any damage or expense by reason of failure of performance as specified in said contract or from defects appearing or developing in the material or workmanship provided or performed under said contract within a period of one year after its acceptance thereof by the (Political Subdivision), then and in that event this obligation shall be void; but otherwise it shall be and remain in full force and effect.

Approved as to legality: _____

Approved: _____

FURNISHED BY POLITICAL SUBDIVISION.

This form may be used with an attached list, or may be printed on back of payroll.

MINIMUM WAGE AFFIDAVIT FORM

(POLITICAL SUBDIVISION) _____

SS.

COUNTY OF _____

I, the undersigned, having been duly sworn, depose, say and certify that in connection with the performance of the work, payment for which this voucher is submitted, I have paid the following rate per hour for each classification of laborers, workmen, or mechanics, as indicated upon the attached list, now referred to and by such reference incorporated in and made an integral part hereof, for all such employed in the performance of such work; and no laborer, workman or mechanic so employed upon such work has been paid less than the prevailing rate of wage or less than the minimum rate of wages as specified in the principal contract; that I have read the above and foregoing statement and certificate, know the contents thereof and the substance as set forth therein is true to my knowledge and belief.

CONTRACTOR

Subscribed and sworn to before me on this _____ day of _____, 19 _____

Notary Public in and for the State of Washington residing at _____

FURNISHED BY POLITICAL SUBDIVISION.

This form to be used, if required, for requesting permission to employ a subcontractor.

LETTER FOR EMPLOYMENT OF SUBCONTRACTOR

(Date) , 19.....

Mr. NOTE: To be addressed to authorized official.

Dear Sir: Re: Contract No.

We, the undersigned, request permission of the (Political Subdivision) to employ a subcontractor in order to fully perform the work covered by the terms of that written contract made and executed by and between the (Political Subdivision) and ourselves on the ... day of ... , 19... , designated as Contract No.

We intend to employ the firm of

- a.
b.
c.

for the purposes of performing the following described work.

and represent and warrant that the work will be performed by said subcontractors in a good and workmanlike manner and under our direct supervision. We further represent and warrant that the work to be performed by them constitutes approximately ... percent of the total dollar value of said contract.

Very truly yours,

(Signature of Surety)

(CONTRACTOR)

TO BE FURNISHED BY CONTRACTOR.

(POLITICAL SUBDIVISION)

CONTRACT CHANGE ORDER AGREEMENT

Contract.....

Contractor.....

Summary of Proposed Change:

Plan Revisions: Dwg. = Rev. =

Specification Revisions: Page = Paragraph =

New Plans or Specs:

Price Change:

Lump Sum Increase \$... or Decrease \$...

or

Unit Price Item Quantity Price Increase or Decrease

Total \$... or \$...

Signatures: Contractor ... Date ...

Engineer ... Date ...

Approved By ... 19 (Municipal Authority) (Date) (Authorized Official)

FURNISHED BY POLITICAL SUBDIVISION.

Standard Forms
FORCE ACCOUNT STATEMENT FOR STREET WORK

(STANDARD FORM NO. 10)
REVISED 1977

Sample form letter to be used for Submission of Force Account statements for Public Road construction work.

GENERAL CONTRACTORS, INC.
1946 South Alaska St.
Tacoma, Washington

September 24, 1976

NOTE: To be Addressed to
Authorized Official

Dear Sir:

Re: Job No. 99999—Force Account Performed—Removing and replacing 8" wood culvert pipe with standard culvert pipe across roadway on "B" St. at station 12 + 39 on September 13, 1976

This extra work was required because the existing wood pipe was deteriorated and had to be replaced before asphalt could be placed, and was ordered by Mr. _____ (Name) _____ (Title)

of _____ (Political Subdivision)

Labor (Health and Welfare Included)

Foreman	2 hrs. @	\$14.61	\$29.22	
Pipe Layer	4 hrs. @	11.70	46.80	
Laborer	8 hrs. @	11.37	90.96	
				\$166.98

Payroll Taxes

Industrial Insur.	14 hrs. @	0.2292	3.21	
½ Medical Aid	14 hrs. @	0.0048	.07	
½ Supplemental	14 hrs. @	0.0085	.12	
				3.40

20% Profit & Overhead on Labor

170.38
34.08
\$204.46

Materials (Sales Tax Included)

8" Culvert	40 L.F. @	\$5.00	200.00	
------------	-----------	--------	--------	--

Equipment

Pickup Truck	4 hrs. @	4.00	16.00	
			<u>216.00</u>	

15% Profit & Overhead on Material & Equipment

32.40
248.40
\$452.86

TOTAL FORCE ACCOUNT

Yours very truly,

GENERAL CONTRACTORS, INC.

TO BE FURNISHED BY CONTRACTOR.

Page VI—10

Standard Forms
FORCE ACCOUNT STATEMENT OTHER THAN STREET

(STANDARD FORM NO. 11)
REVISED 1977

Sample form letter to be used for submission of Force Account statements on all projects other than Public Road construction work.

GENERAL CONTRACTORS, INC.
1946 South Alaska St.
Tacoma, Washington

September 24, 1976

Mr. _____

← NOTE: To be addressed to
authorized official.

Re: Force Account. L.I.D. No. 4444—Lowering Existing Sanitary Sewer at 3714 So. Cushman Ave. (Sta. 46 + 10, on the left). September 13, 1976

Dear Sir:

This work was necessary because the sanitary line was in the subgrade of the roadway. This extra work was ordered by Mr. _____ (Political Subdivision) _____ (Title)

Labor (Health and Welfare, Incl.)

Foreman	1 hr. @	\$14.61	\$14.61	
Pipe Layer	1 hr. @	11.70	11.70	
Laborer	8 hrs. @	11.37	90.96	
Flagman	4 hrs. @	11.37	45.48	
				\$162.75

Payroll Taxes

Industrial Insur.	14 hrs. @	0.2292	3.21	
½ Medical Aid	14 hrs. @	0.0048	.07	
½ Supplemental	14 hrs. @	0.0085	.12	
				3.40

20% Overhead & Profit on Labor

165.15
33.23
\$199.38

Materials

6" Sewer Pipe	40 L.F. @	\$5.00	200.00	
6" - 1/8 Bend	1 ea. @	15.00	15.00	
				215.00

Equipment

Pickup Truck	1 hr. @	4.00	4.00	
			<u>219.00</u>	

15% Overhead & Profit on Materials & Equipment

32.85
251.85
451.23

*5.1% Sales Tax on \$451.23

TOTAL FORCE ACCOUNT

23.01
\$474.24

Very truly yours,

*Percentage to be in accordance with current rates prescribed by law.

GENERAL CONTRACTORS, INC.

TO BE FURNISHED BY THE CONTRACTOR.

Page VI—11

(POLITICAL SUBDIVISION)

WEEKLY STATEMENT OF WORKING DAYS

Contract No.

Date

Statement No.

TO:, (Contractor)

The following statement shows the number of working days charged to your contract for the week ending, 19....

Date	Day	Weather Condition	Working Day	Unworkable Day Caused By Weather Conditions
	Monday			
	Tuesday			
	Wednesday			
	Thursday			
	Friday			

Working days this week

Working days previously reported

Total working days to date

Starting date specified in special provisions

Working days specified in contract

Computed date for completion (if all days are workable)

Total unworkable days to date

Revised date for completion

Working days remaining to complete contract

Project completed on

REMARKS:

.....
(Authorized Official)

NOTE: The contractor will be allowed 10 days from date of this report in which to protest in writing the correctness of this statement, otherwise it shall be deemed to have been accepted as correct.

FURNISHED BY POLITICAL SUBDIVISION.

NON-COLLUSION AFFIDAVIT

STATE OF WASHINGTON }
COUNTY OF } ss.

NON-COLLUSION AFFIDAVIT

....., being first
duly sworn, on his oath says
that the bid above submitted is a genuine and not a sham or collusive bid, or made in the interest
or on behalf of any person not therein named; and he further says that the said bidder has not di-
rectly or indirectly induced or solicited any bidder on the above work or supplies to put in a sham
bid, or any other person or corporation to refrain from bidding; and that said bidder has not in any
manner sought by collusion to secure to self an advantage over any other bidder
or bidders.

.....
(Contractor)

Subscribed and sworn to before me this day of, 19.....

.....
Notary Public in and for the State of Washington, residing
at

FURNISHED BY THE POLITICAL SUBDIVISION WHENEVER A NON-COLLUSION AFFIDAVIT IS REQUIRED.

**STANDARD
SPECIFICATIONS
FOR
MUNICIPAL PUBLIC WORKS
CONSTRUCTION**



DIVISION VII—STANDARD PLANS (DRAWINGS)

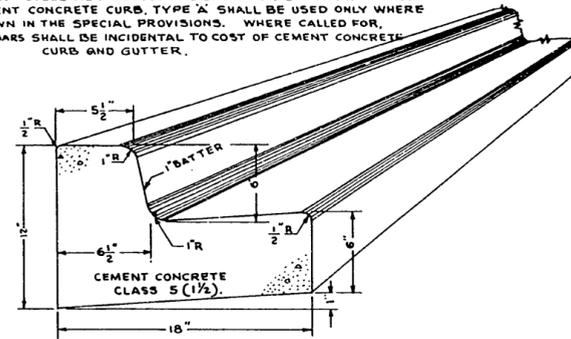
Division VII includes 93 standard plans, sometimes referred to as standard drawings. A complete listing of the plans by number, title and page is shown on Page VII-0, and the plans by consecutive number start on Page VII-1 and end on Page VII-93.

DIVISION VII—STANDARD PLANS (DRAWINGS)

Plan No.	Title	Page	Plan No.	Title	Page
1	CEMENT CONCRETE CURB & GUTTER TYPE A & TYPE A-1.....	VII-1	40	MANHOLE—TYPE V.....	VII-45
2	CEMENT CONCRETE CURB & GUTTER TYPE B & TYPE B-1.....	VII-2	41	MANHOLE STEP & LADDER DETAIL.....	VII-46
3	CEMENT CONCRETE TYPE A.....	VII-3	41-A	MANHOLE SLAB DETAIL.....	VII-47
4	CEMENT CONCRETE CURB TYPE B.....	VII-4	42	24" MANHOLE FRAME & COVER.....	VII-48
5	CEMENT CONCRETE CURB TYPE C & TYPE D.....	VII-5	43	DROP CONNECTION.....	VII-49
6	CEMENT CONCRETE CURB TYPE E-1, E-2, E-3 & E-4.....	VII-6	44	VERTICAL CONNECTION.....	VII-50
6-A	EXTRUDED CEMENT CONCRETE CURB.....	VII-7	45	8" CLEAN-OUT.....	VII-51
7	CEMENT CONCRETE DRIVEWAY TYPE A.....	VII-8	46	TYPE 46A INLET FRAME.....	VII-52
8	CEMENT CONCRETE DRIVEWAY TYPE B.....	VII-9	47	TYPE 46B INLET.....	VII-53
9	CEMENT CONCRETE DRIVEWAY TYPE C.....	VII-10	48	TYPE 46C INLET FRAME & INLET GRATE.....	VII-54
10	CEMENT CONCRETE DRIVEWAY TYPE D.....	VII-11	49	METAL FRAME & GRATE FOR CATCH BASIN & INLET.....	VII-55
11	TYPES OF JOINTS FOR CONCRETE PAVEMENT.....	VII-12	50	TYPE I-A CATCH BASIN INLET MASONRY CONSTRUCTION.....	VII-56
12	CEMENT CONCRETE ALLEY RETURN TYPE A.....	VII-13	51	TYPE I-B CATCH BASIN INLET CAST IN PLACE.....	VII-57
13	CEMENT CONCRETE ALLEY RETURN TYPE B.....	VII-14	52	TYPE I-C CATCH BASIN INLET PRECAST.....	VII-58
14	CEMENT CONCRETE SIDEWALK TYPE A & TYPE B.....	VII-15	53	TYPE II-A CATCH BASIN INLET MASONRY CONSTRUCTION OR CATCH BASIN.....	VII-59
14-A	DEPRESSED CURB & GUTTER (Wheel Chair Ramp) TYPE A.....	VII-16	54	TYPE II-B CATCH BASIN INLET CAST IN PLACE OR CATCH BASIN.....	VII-60
14-B	DEPRESSED CURB & GUTTER (Wheel Chair Ramp) TYPE B.....	VII-17	55	TYPE II-C CATCH BASIN INLET PRECAST OR CATCH BASIN.....	VII-61
14-C	DEPRESSED CURB & GUTTER (Wheel Chair Ramp) TYPE C.....	VII-18	56	CATCH BASIN INLET—PRECAST COVER & EXTENSION UNITS.....	VII-62
15	CEMENT CONCRETE COMBINED WALK, CURB, CURB & GUTTER.....	VII-19	57	TYPE IV-A CURB INLET MASONRY CONSTRUCTION.....	VII-63
16	SIDEWALK DRAIN FOR BUILDING SPOUT TYPE I.....	VII-20	58	TYPE IV-B CURB INLET CAST IN PLACE.....	VII-64
17	SIDEWALK DRAIN FOR BUILDING SPOUT TYPE II.....	VII-21	59	TYPE IV-C CURB INLET PRECAST.....	VII-65
18	PAVEMENT PATCHING.....	VII-22	60	TYPE 60A AND TYPE 60B OUTLET TRAP.....	VII-66
19	MONUMENT FRAME & COVER.....	VII-23	61	PIPE COVERING & EMBANKMENT.....	VII-67
20	PRECAST CONCRETE MONUMENT.....	VII-24	62	PIPE BEDDING.....	VII-68
21	POURED MONUMENT IN PLACE TYPE B.....	VII-25	62-A	PIPE COMPACTION & BACKFILL.....	VII-69
22	POURED MONUMENT IN PLACE TYPE A.....	VII-26	62-B	COUPLINGS FOR CORRUGATED METAL PIPE.....	VII-70
23	SPECIAL INSTALLATION OF MONUMENT FOR CONCRETE PAVEMENT.....	VII-27	63	TEMPORARY PEDESTRIAN CROSSING.....	VII-71
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25	PRECAST CONCRETE TRAFFIC CURBS CLASS I.....	VII-29	65	HYDRANT SETTING, TYPE B.....	VII-73
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27	TRAFFIC BUTTONS.....	VII-31	67	CAST IRON VALVE BOX.....	VII-75
28	ILLUMINATED TERMINAL NOSING TYPE I.....	VII-32	68	VALVE CHAMBER, STANDARD PRECAST.....	VII-76
29	ILLUMINATED TERMINAL NOSING TYPE II.....	VII-33	69	VALVE CHAMBER, STANDARD MASONRY CONSTRUCTION.....	VII-77
30	CONCRETE JUNCTION BOX TYPE I.....	VII-34	70	VALVE CHAMBER, LARGE TYPE A.....	VII-78
31	CONCRETE JUNCTION BOX TYPE II.....	VII-35	71	VALVE CHAMBER, LARGE TYPE B.....	VII-79
32	CEMENT CONCRETE STAIRWAY CONSTRUCTION DETAILS.....	VII-36	72	PLUG AND SHACKLE FOR CAST IRON WATERMAIN.....	VII-80
33	CEMENT CONCRETE STEPS.....	VII-37	73	BLOCKING FOR CONVEY VERTICAL BENDS.....	VII-81
34	MANHOLE—TYPE I-48.....	VII-38	74	2-INCH BLOW-OFF ASSEMBLY.....	VII-82
35	MANHOLE—TYPE I-54.....	VII-39	75	WIRE FENCE.....	VII-83
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37	MANHOLE—TYPE III-48 & TYPE III-54.....	VII-42	78	BEAM GUARD RAIL.....	VII-86
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39	MANHOLE TYPE IVB MONOLITHIC BASE TYPE IVB1 PRECAST UNIT SHAFT TYPE IVB2 MASONRY SHAFT TYPE IVB3 MONOLITHIC CONCRETE SHAFT	VII-44	80	COMMERCIAL SIDEWALK DRAIN—TYPE A.....	VII-88
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			84	RESIDENTIAL SIDEWALK DRAIN.....	VII-92
			85	SHEAR BOARD INSTALLATION.....	VII-93

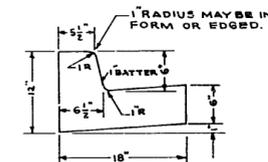
Standard Drawings

NOTE: STEEL TIE BARS SUCH AS SHOWN ON STANDARD DRAWING FOR CEMENT CONCRETE CURB, TYPE "A" SHALL BE USED ONLY WHERE SHOWN IN THE SPECIAL PROVISIONS. WHERE CALLED FOR, TIE BARS SHALL BE INCIDENTAL TO COST OF CEMENT CONCRETE CURB AND GUTTER.



NOTES:
FORMS SHALL BE TRUE TO LINE & GRADE AND SECURELY STAKED.
THE 1" RADIUS ON UPPER FACE OF CURB MAY BE FORMED BY EDGER OR BUILT INTO FACE FORM. 1" RADIUS ON LOWER FACE OF CURB WILL BE FORMED BY THE FACE FORM.

TYPICAL SECTION FOR CURB & GUTTER TYPE A

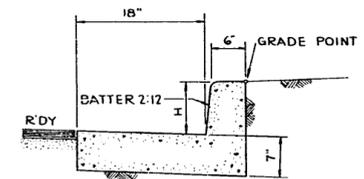


FULL DEPTH DIVISIONS PLATE
TO BE USED ONLY WHERE THRU JOINTS ARE TO BE PLACED, OR AS DIRECTED BY THE ENGINEER. SEE NOTE BELOW FOR THRU JOINTS.

DIMENSIONS OTHER THAN THOSE SHOWN SHALL BE IDENTICAL TO FULL DEPTH DIVISION PLATE.



PARTIAL DIVISION PLATES
TO BE USED AT 10' MINIMUM 15' MAXIMUM SPACING AND USED WITH DUMMY JOINTS, IF SO DIRECTED BY ENGINEER. SEE NOTE BELOW FOR DUMMY JOINTS.

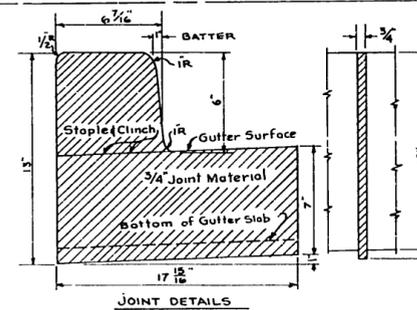


H = HEIGHT OF CURB ABOVE PAVEMENT SPECIFIED

NOTE:
DIVISION PLATES & JOINTS TO BE SIMILAR TO THAT SHOWN, ONLY THE DIMENSIONS SHALL VARY AS NECESSARY FOR TYPE A-1.

TYPICAL SEC. TYPE A-1

GENERAL DATA



JOINT DETAILS

GENERAL NOTES

JOINTS: DUMMY JOINTS SHALL BE PLACED NOT TO EXCEED 15' C/C NOR LESS THAN 10' C/C. THRU JOINTS SHALL BE PLACED ONLY AT POINTS OF TANGENCY ON STREETS, ALLEY AND DRIVEWAY RETURNS. ALL JOINTS SHALL BE CLEAN AND IN THE GUTTER SECTION THEY SHALL BE EDGED. ALL COSTS SHALL BE INCIDENTAL TO COST OF THE CONTRACT.

FORMS SHALL BE STEEL.

MATERIAL SHALL MEET REQUIREMENTS OF THESE SPECIFICATIONS.

CONCRETE SHALL BE CEMENT CONCRETE CLASS 5 (1 1/2) OR 5 (3/4)

PROCEDURES: FOR FURTHER REQUIREMENTS FOR FORMS, FORM SETTING, PLACING, FINISHING AND CURING SHALL BE AS OUTLINED IN THESE SPECIFICATIONS.

NOTE:
DUMMY JOINTS OF NOT LESS THAN 3/16" THICKNESS SHALL BE OF THE SAME DIMENSIONS AS THE CURB & GUTTER EXCEPT THAT IT SHALL EXTEND ONLY 2 1/4" INTO GUTTER SECTION.

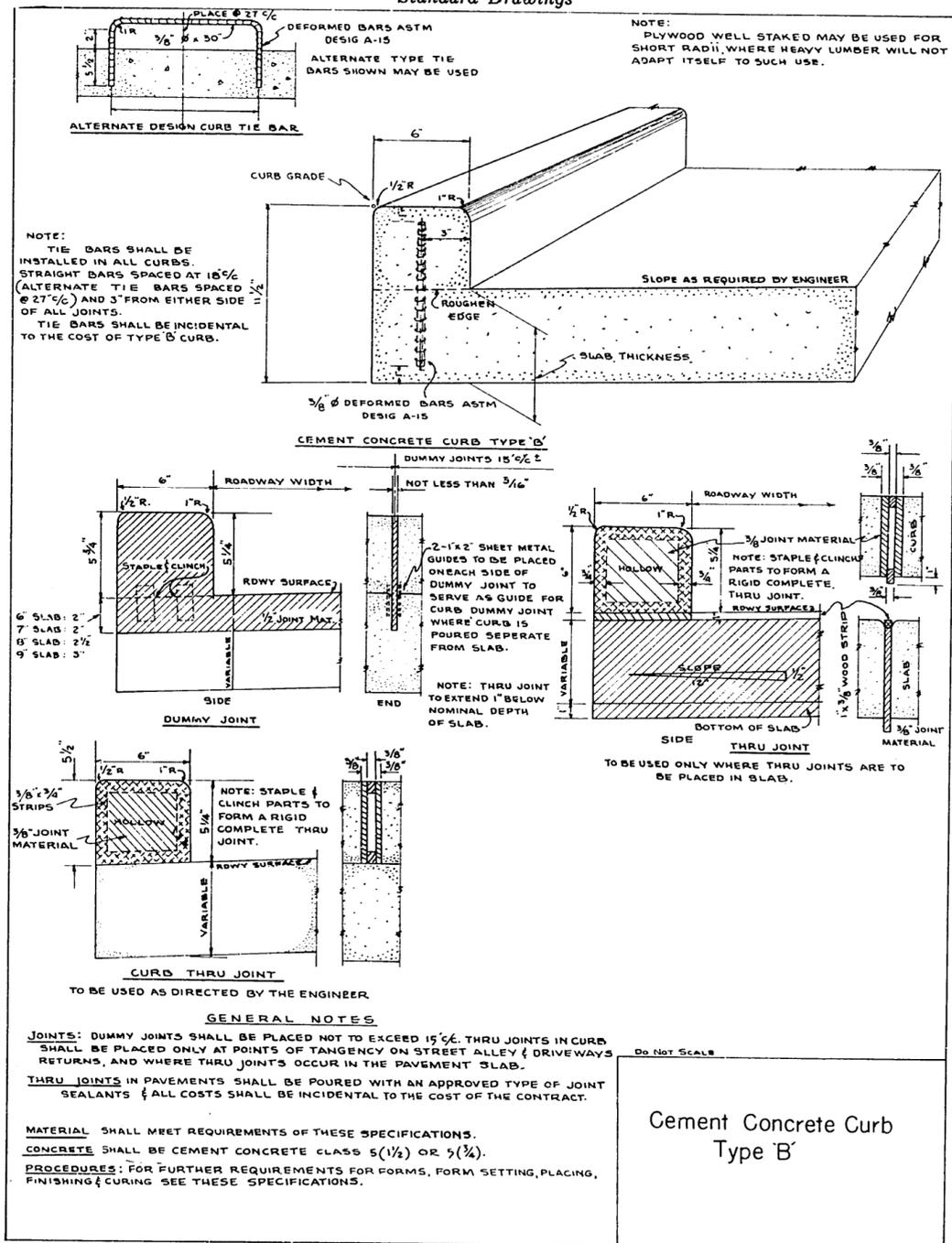
Do Not Scale

Cement Concrete Curb & Gutter Type "A" & Type "A-1"

Standard Plan No. 1

Page VII-1

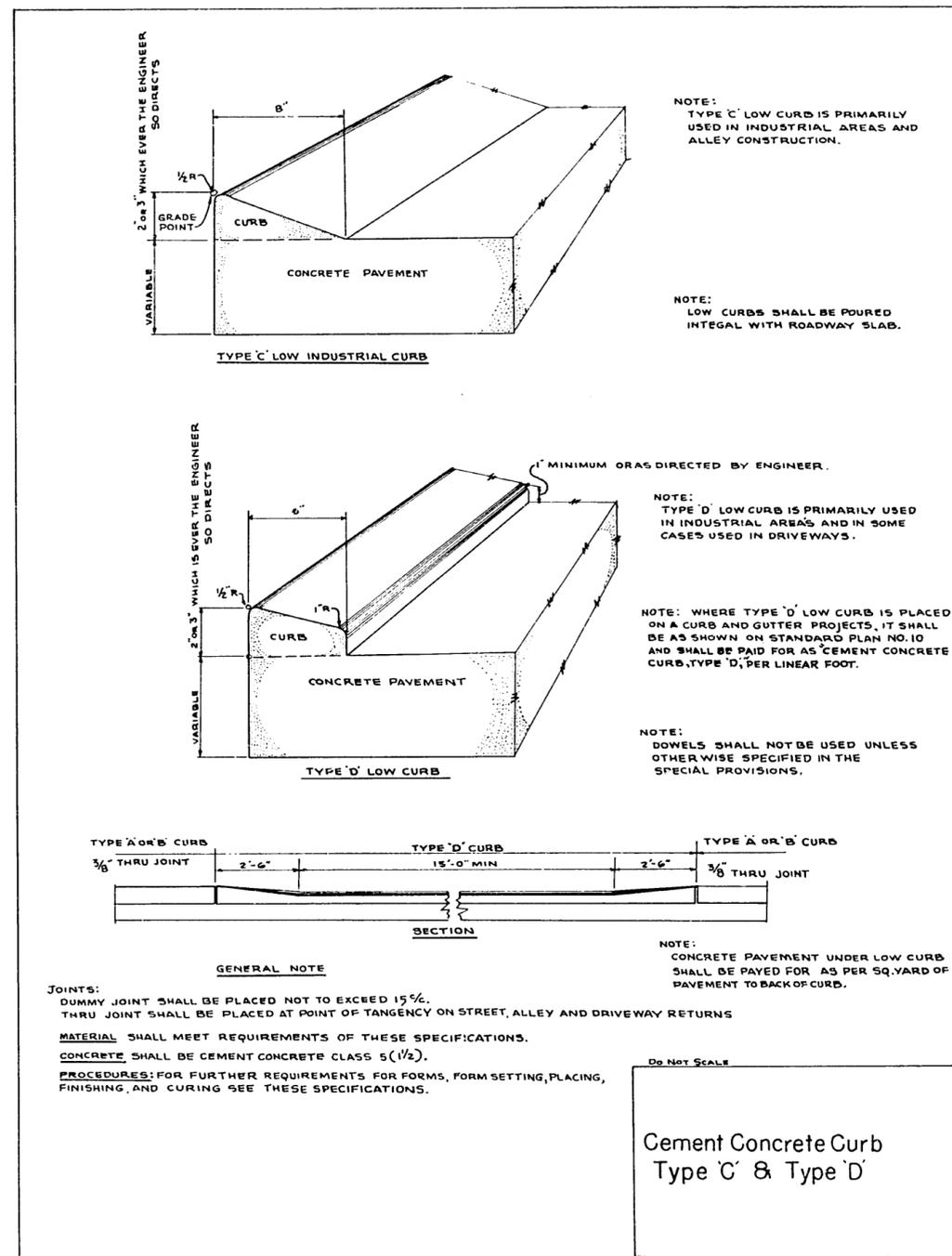
Standard Drawings



Cement Concrete Curb Type B

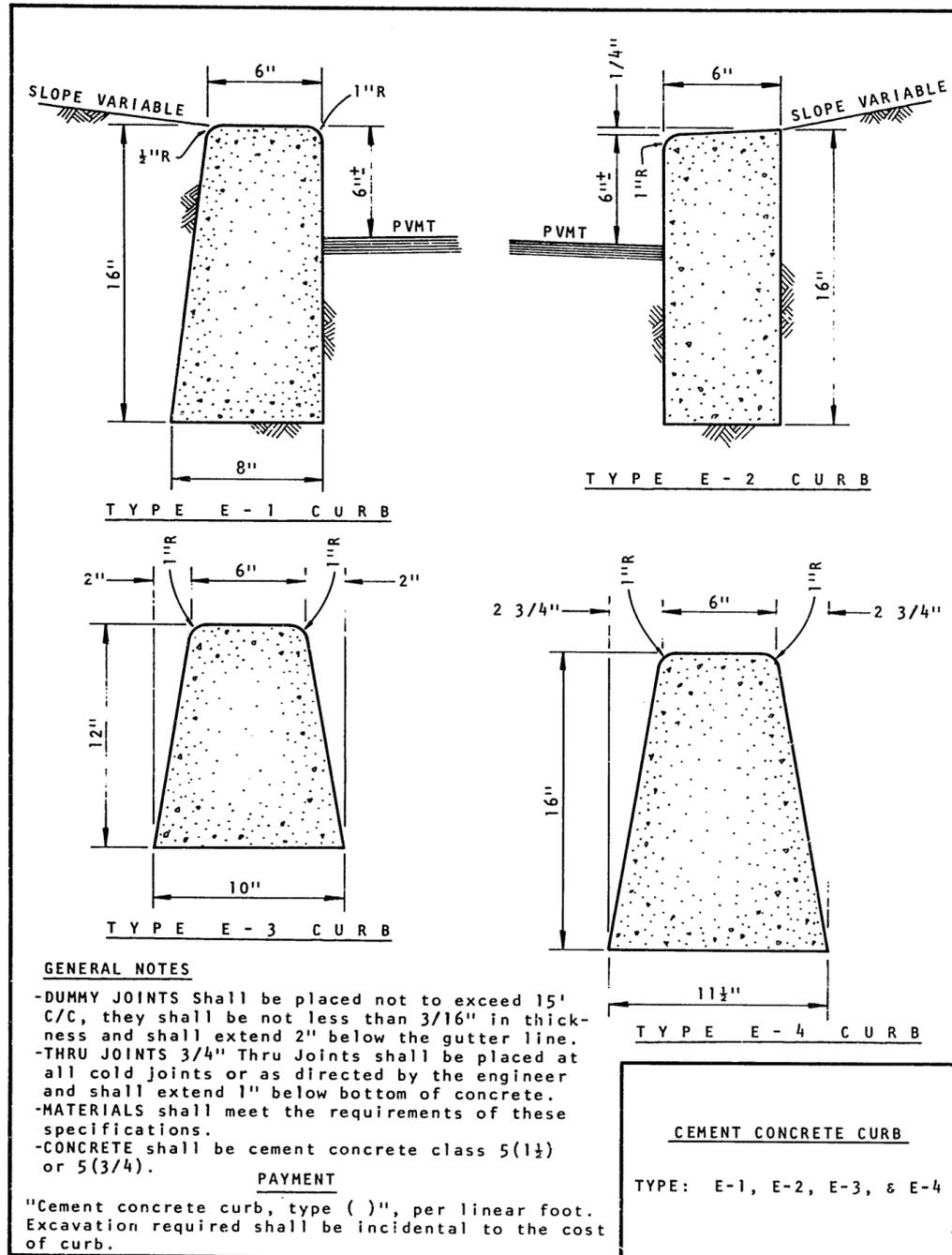
Standard Plan No.4

Standard Drawings

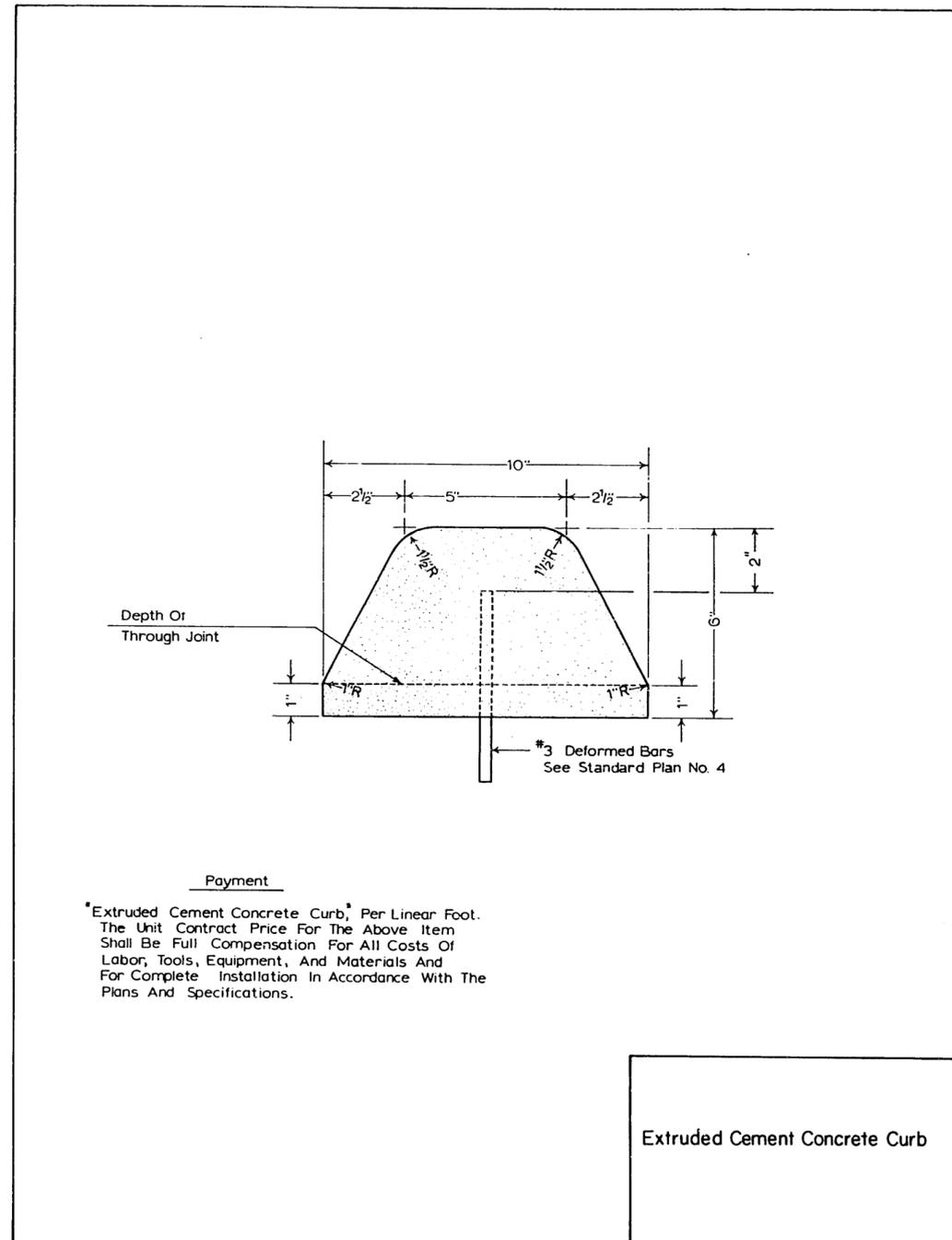


Cement Concrete Curb Type C & Type D

Standard Plan No.5

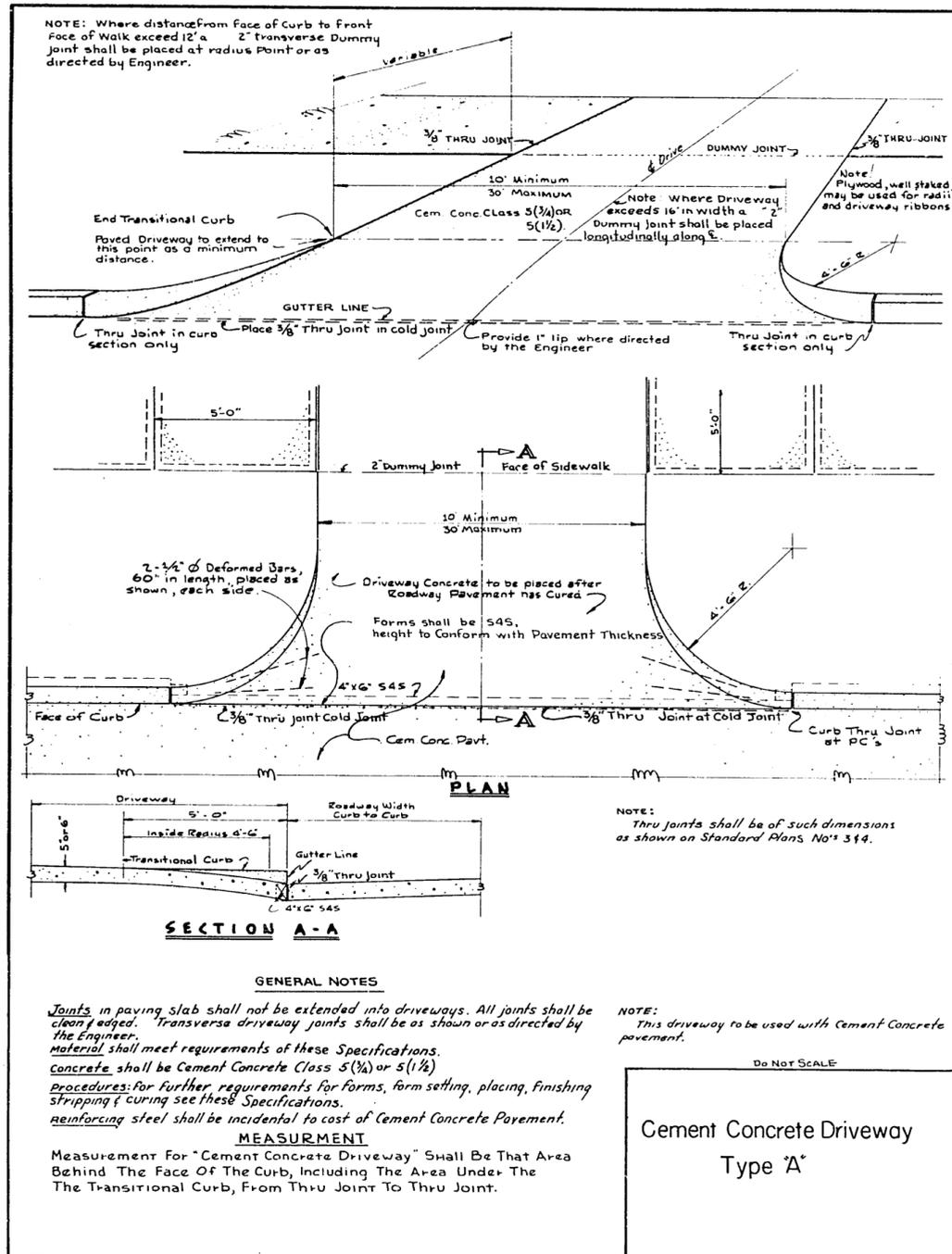


Standard Plan No. 6



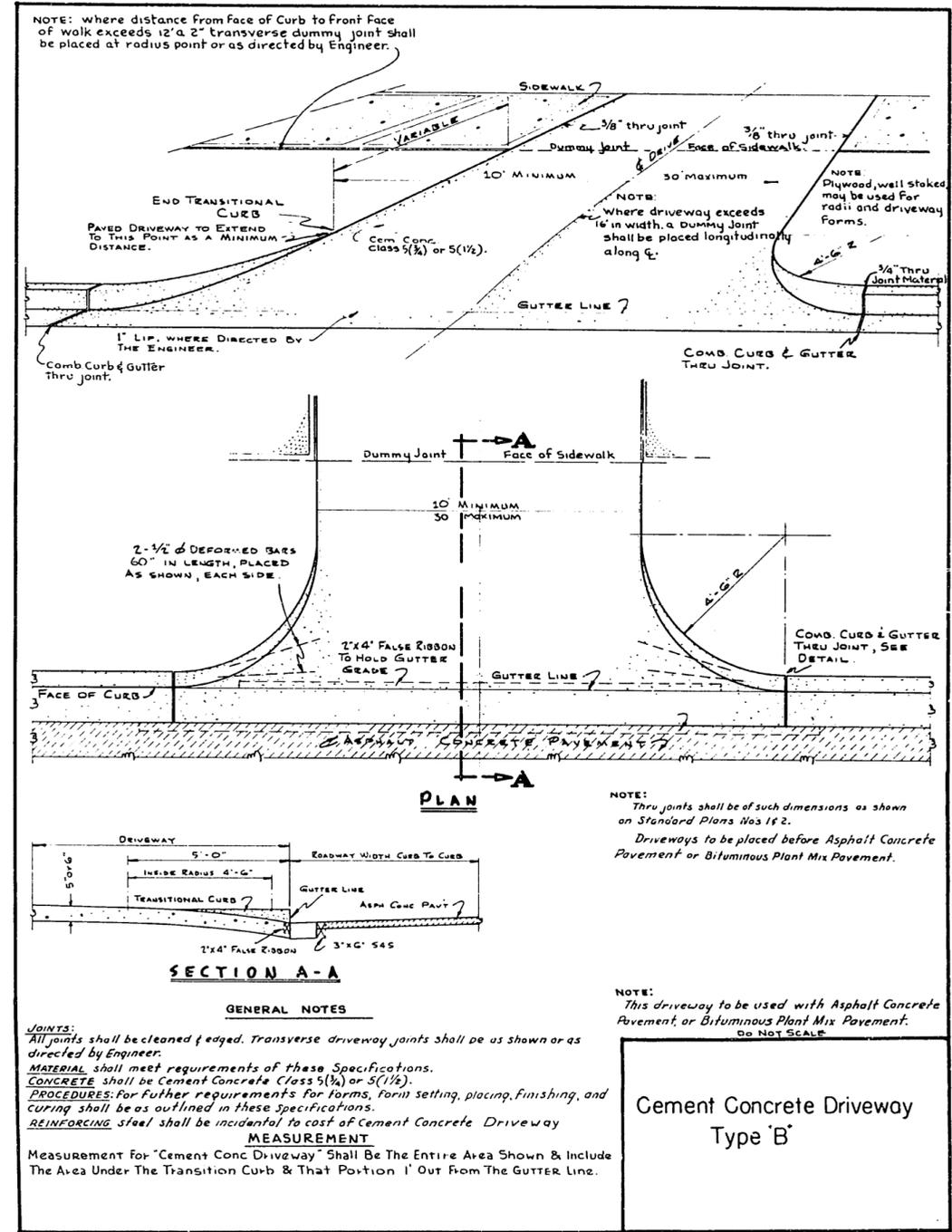
Standard Plan No. 6A
Page VII-7

Standard Drawings



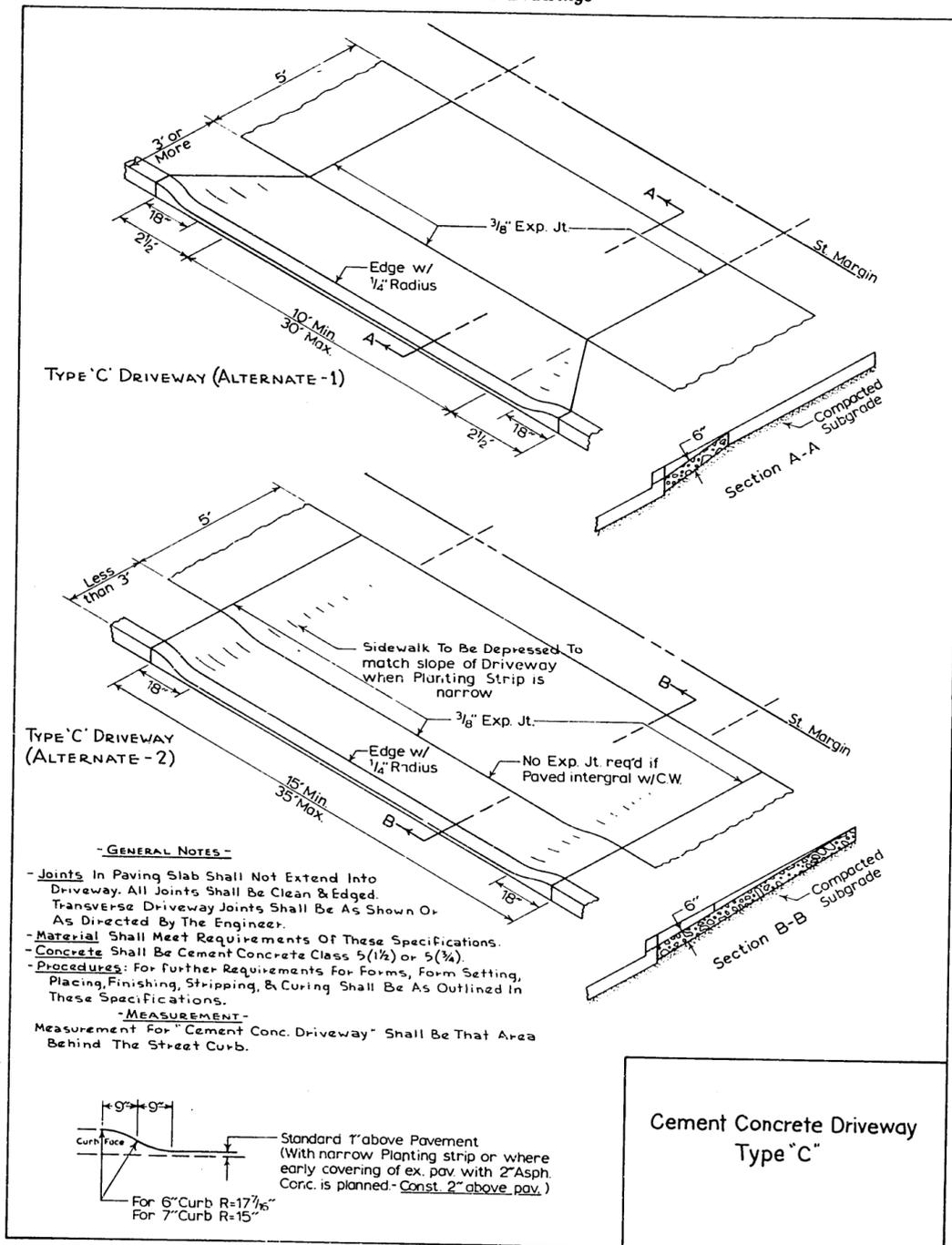
Standard Plan No. 7

Standard Drawings



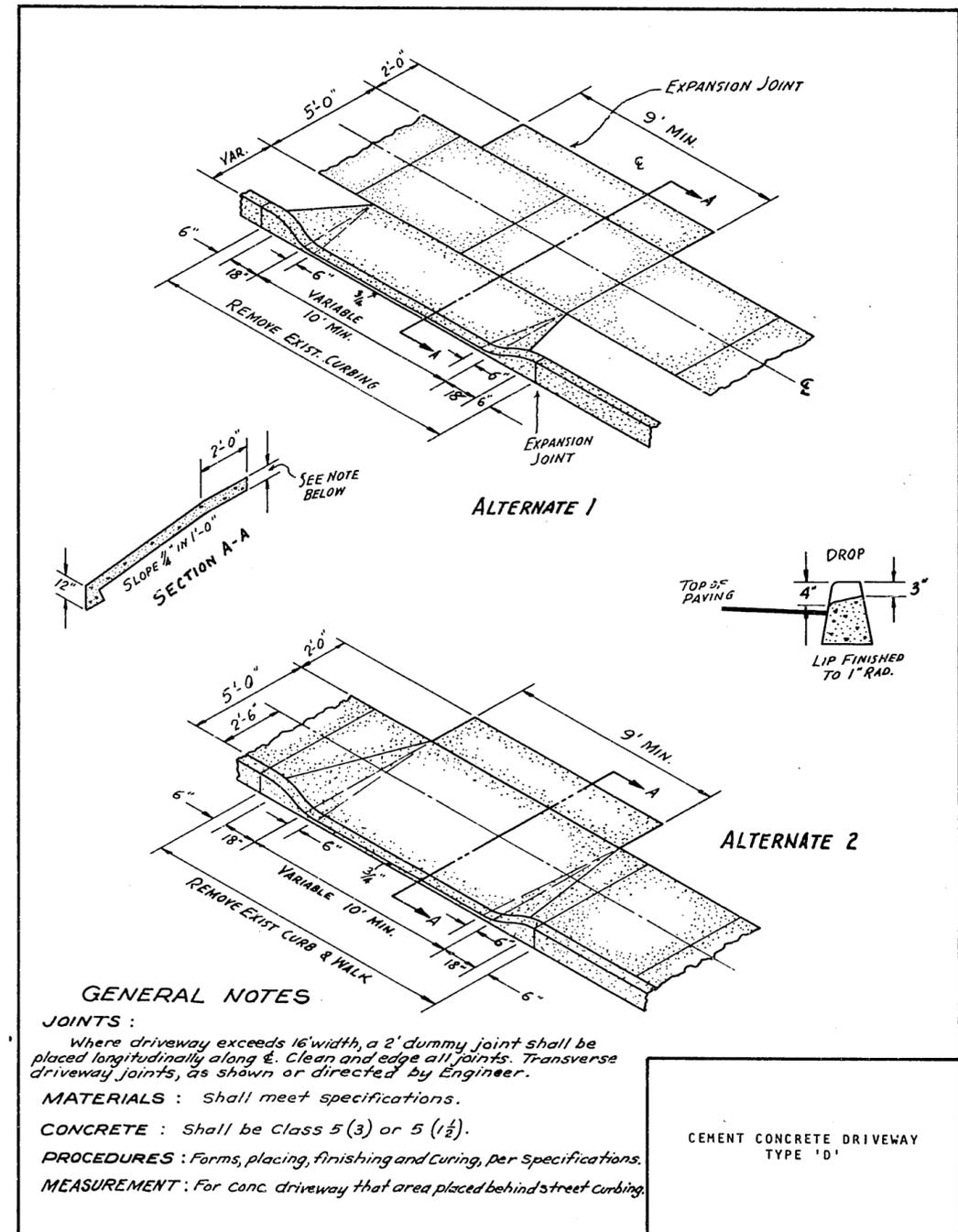
Standard Plan No. 8

Standard Drawings



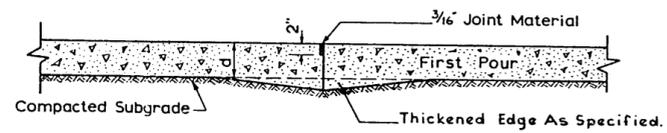
Standard Plan No. 9

Standard Drawings

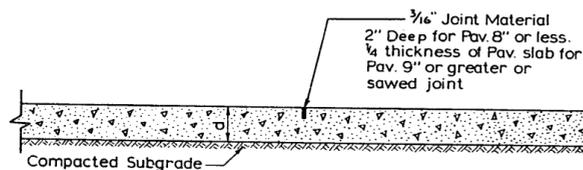


Standard Plan No. 10

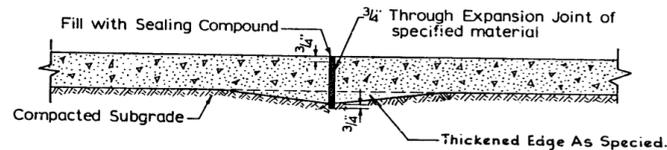
Standard Drawings



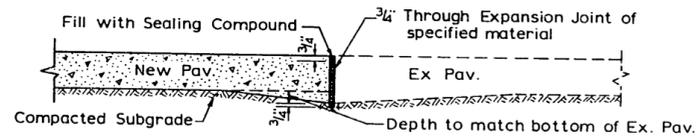
Construction Joint
Longitudinal or Transverse



Contraction Control Joint
Longitudinal or Transverse



Expansion Joint
New Construction

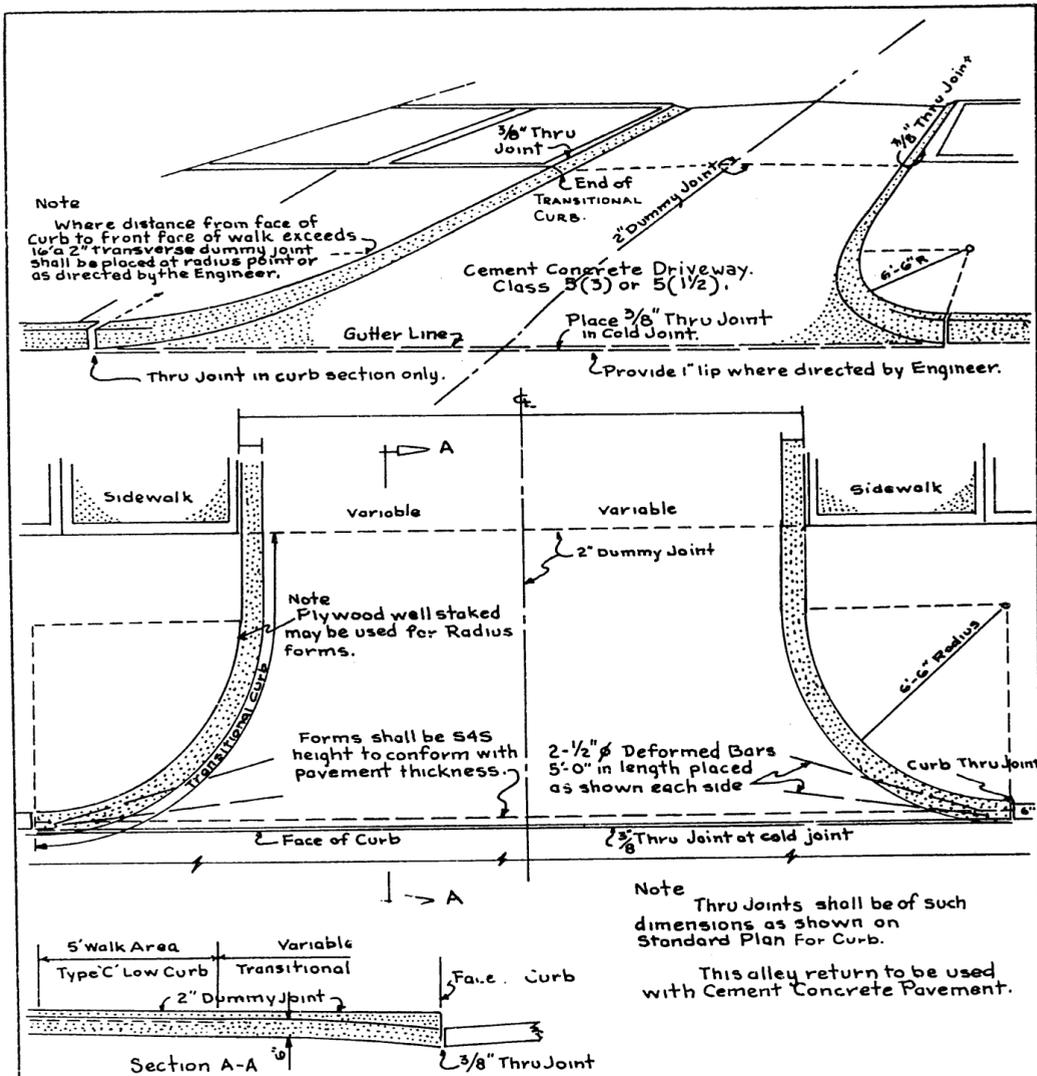


Expansion Joint
Between Old & New Construction

Types of Joints
for Concrete Pavement

Standard Plan No. 11

Standard Drawings



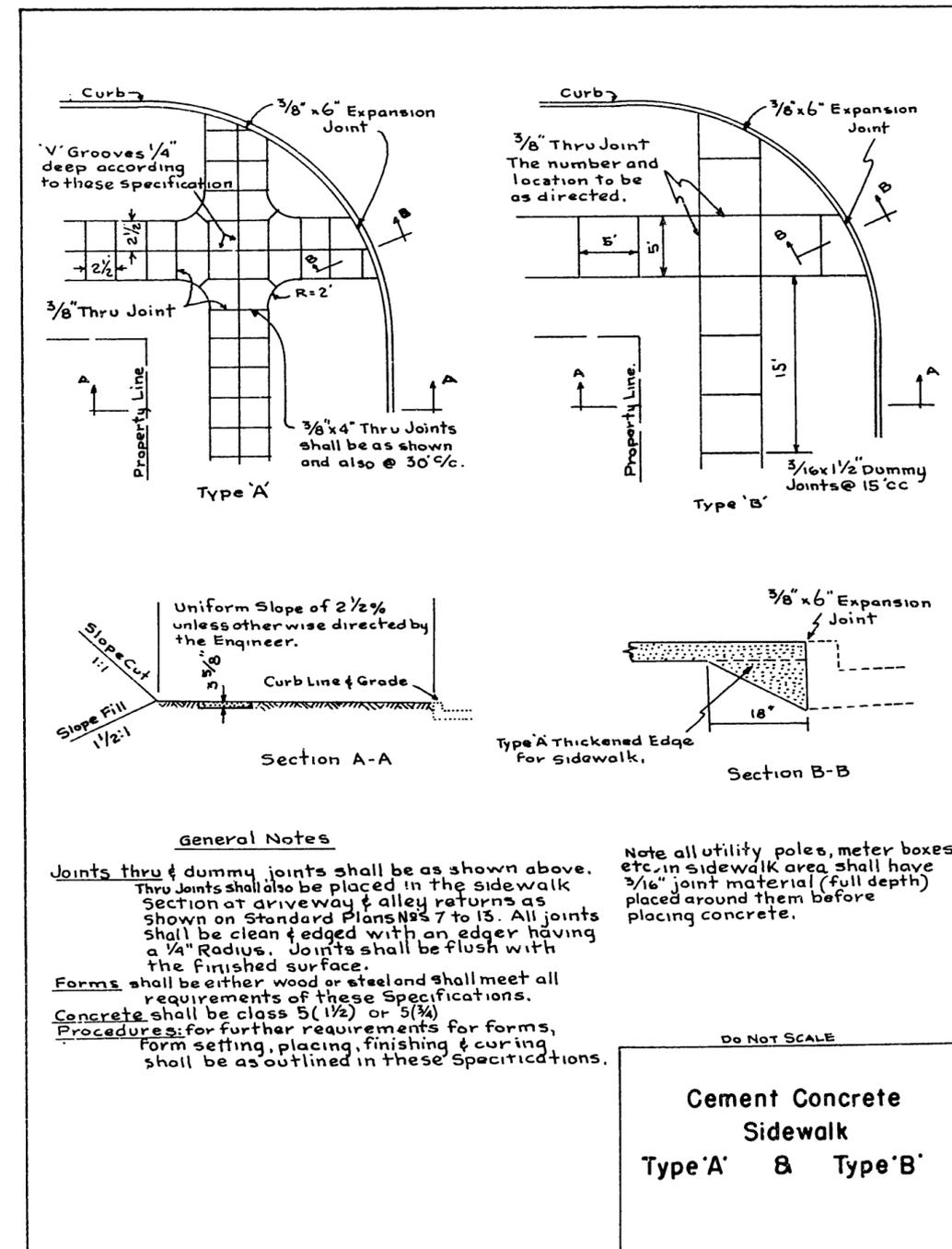
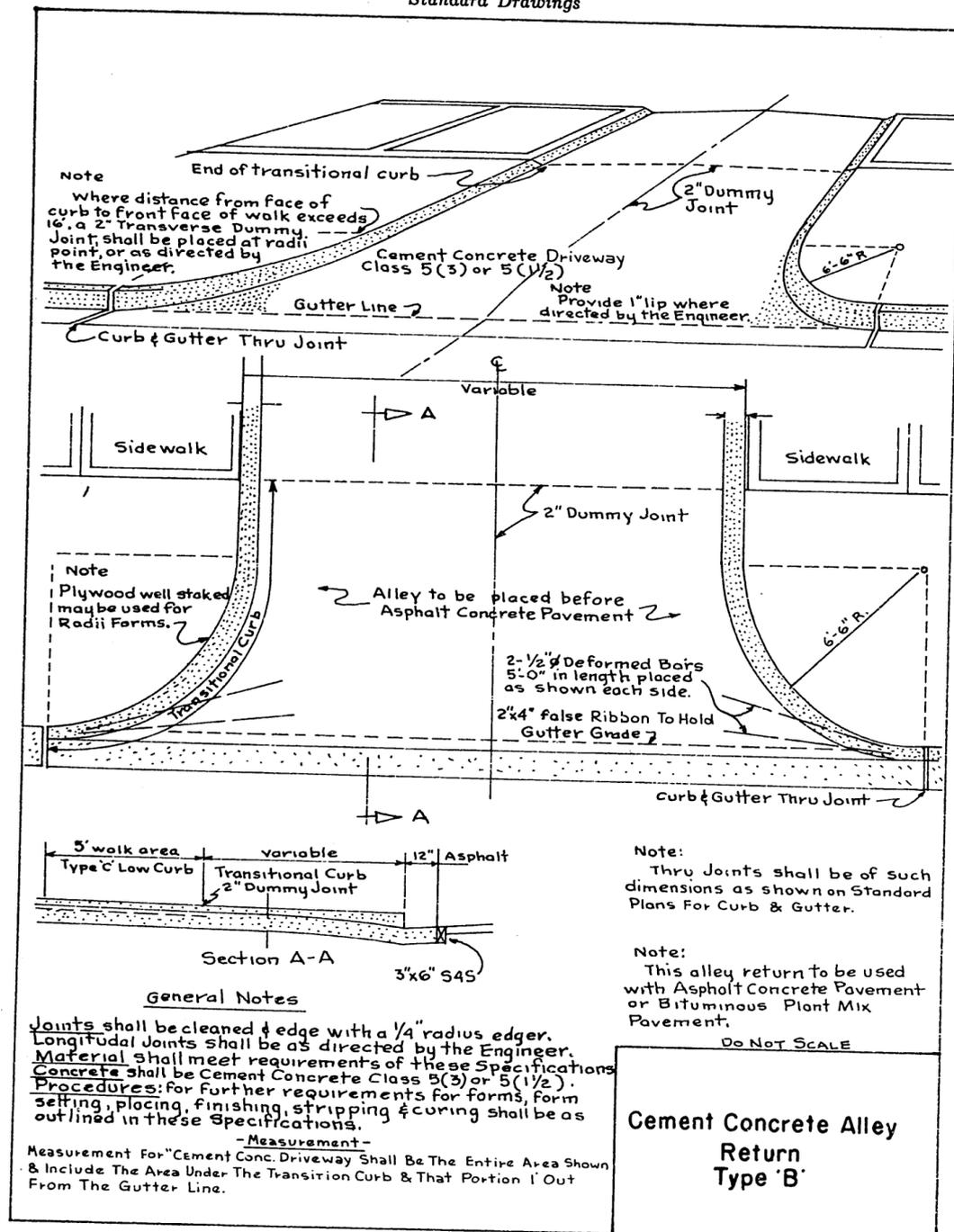
General Notes

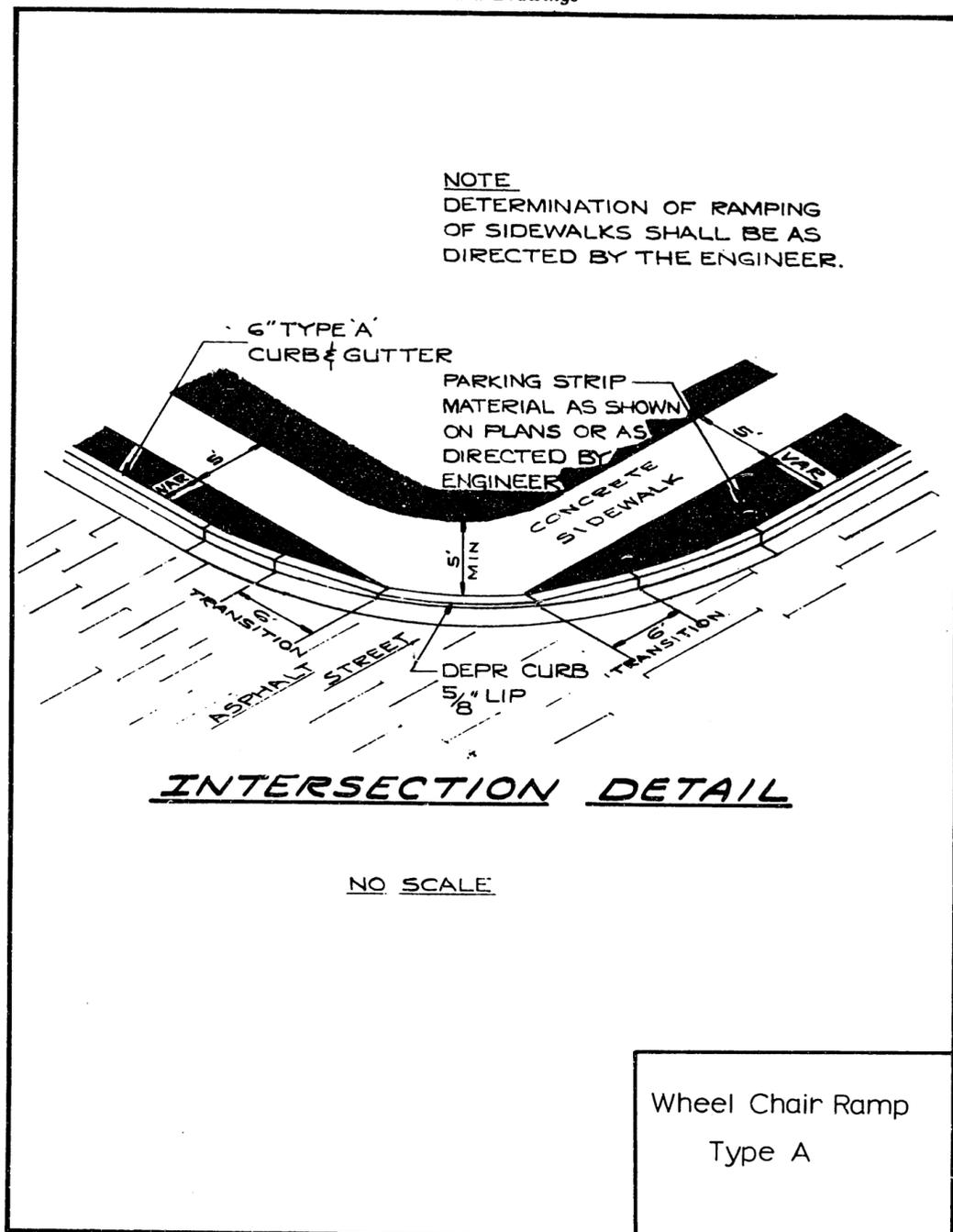
Joints shall be cleaned & edged with a 1/4" radius edger. Longitudinal Joints shall be as directed by the Engineer. Concrete shall be Cement Concrete Class 5(3) or 5(1/2). Material shall meet requirements of these specifications. Procedures for further requirements for forms, form setting, placing, finishing & curing shall be as outlined in these specifications.

- Measurement -
Measurement For "Cement Concrete Driveway" Shall Be That Area Behind The Face Of The Curb, Including The Area Under The Transitional Curb, From Thru Joint To Thru Joint.

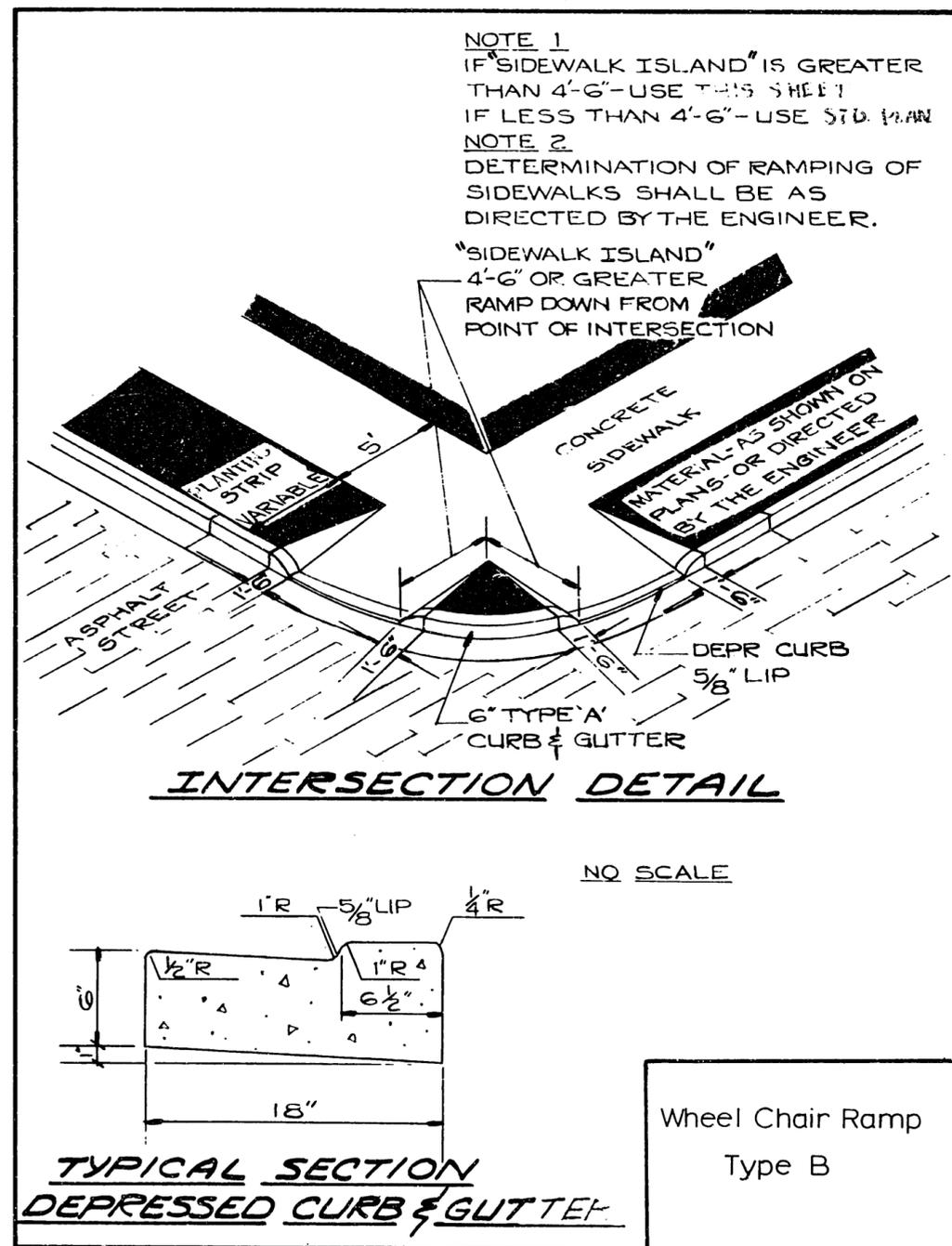
Cement Concrete Alley Return Type 'A'

Standard Plan No. 12
Page VII-13



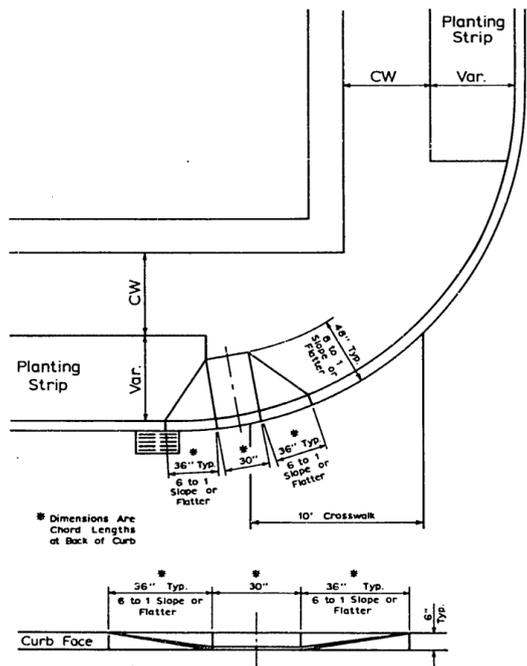
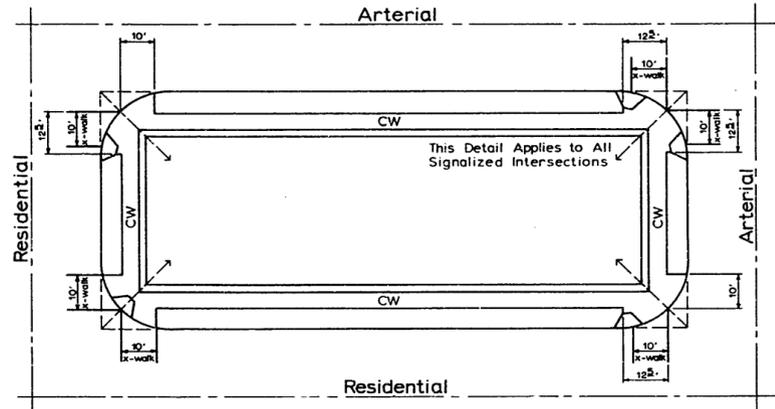


Standard Plan No. 14A



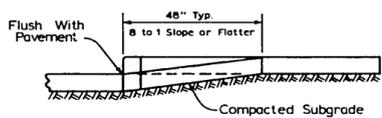
Standard Plan No. 14B

Typical Wheel Chair Ramp Locations



Notes

1. Inlets Shall Be Outside the Wheel Chair Ramp.
2. The Wheel Chair Ramp Shall Be Moved Away from the Crosswalk to Avoid Conflicts with Hydrants, Poles, Inlets, or Other Utilities, Except Where the Street Grade Exceeds 4%.
3. If the Wheel Chair Ramp Cannot Be Moved According to Note 2 and Must Be Located Within the Crosswalk, the Ramp Must Have A Coarse Textured Surface Approved By the City Engineer.
4. Crosswalks Are Not Always Marked.



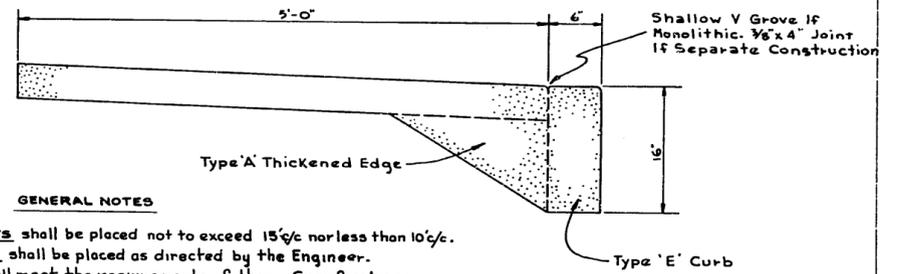
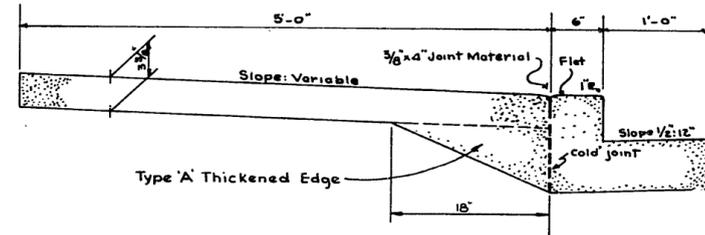
DO NOT SCALE

Wheel Chair Ramp Type C

Standard Plan 14C

NOTE:
Thru and Dummy Joints details are the same as shown on Standard Plan

Note: This section may be either Curb or Curb & Gutter Type 'A' or Type 'B'



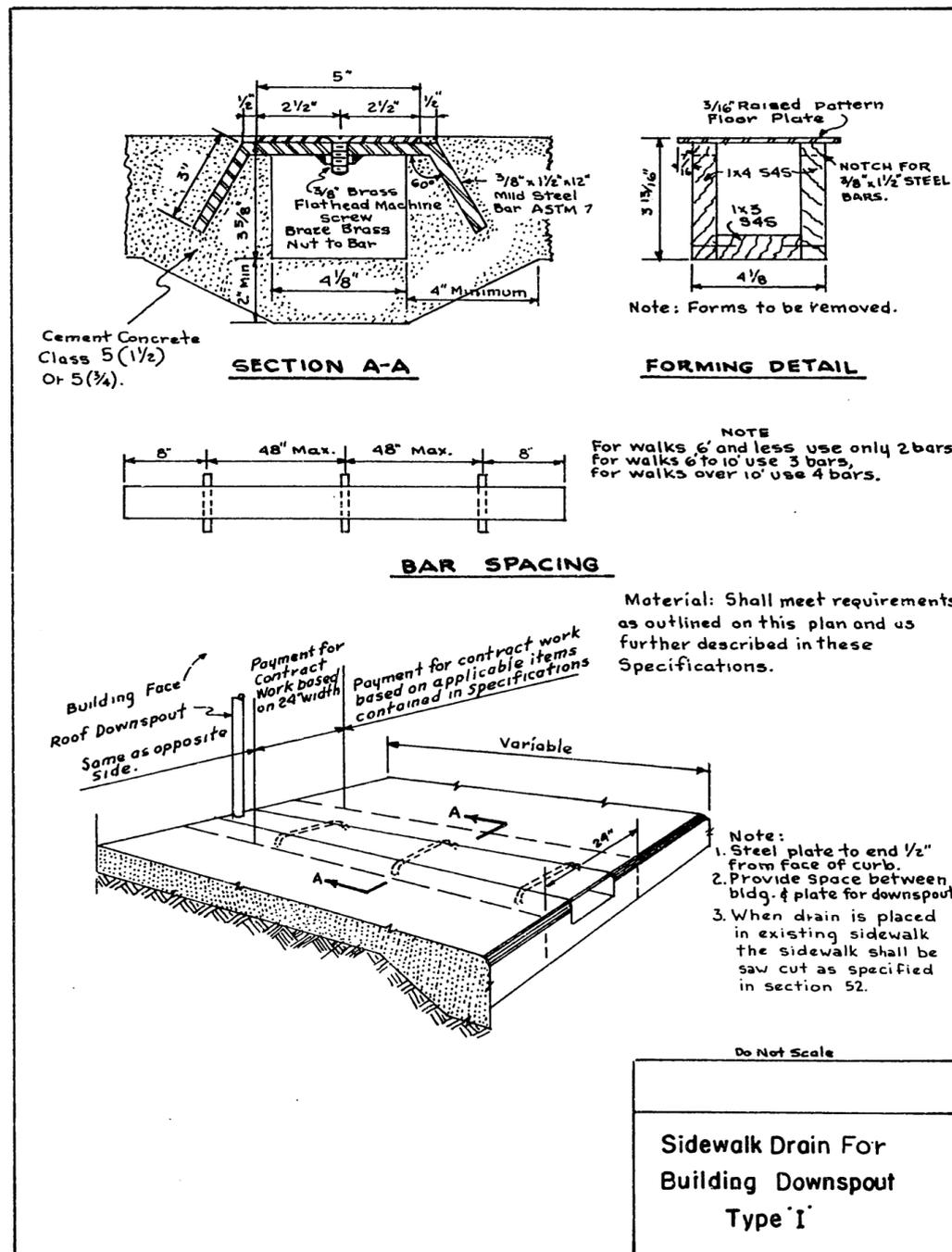
GENERAL NOTES

Dummy Joints shall be placed not to exceed 15' c/c nor less than 10' c/c.
Thru Joints shall be placed as directed by the Engineer.
Material shall meet the requirements of these Specifications.
Concrete shall be cement concrete class 5 (1 1/2) or 5 (3/4).
Procedures for further requirements for forms, form setting, placing, finishing, and curing shall be as outlined in these Specifications.

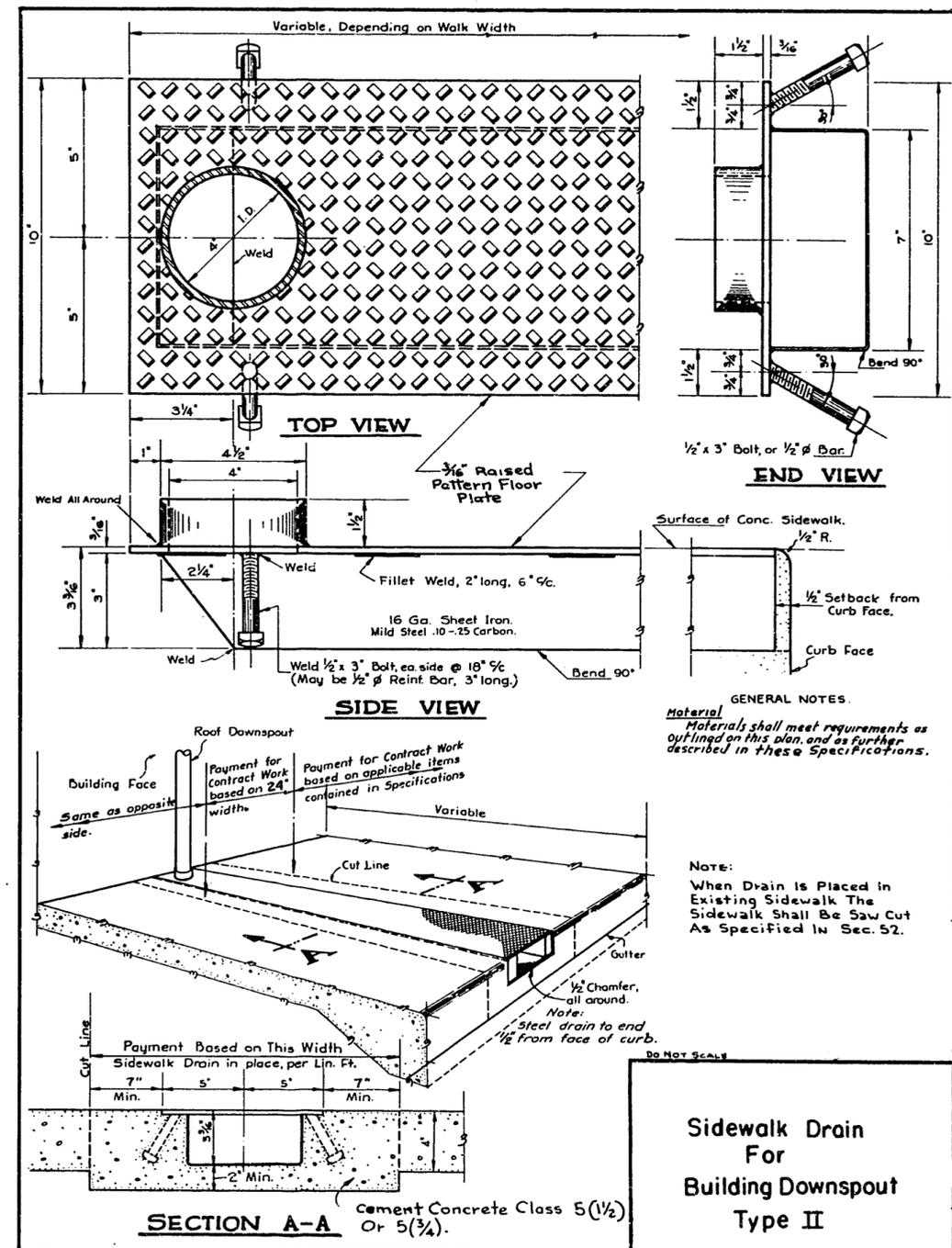
DO NOT SCALE

Cement Concrete Combined Walk, Curb & Gutter

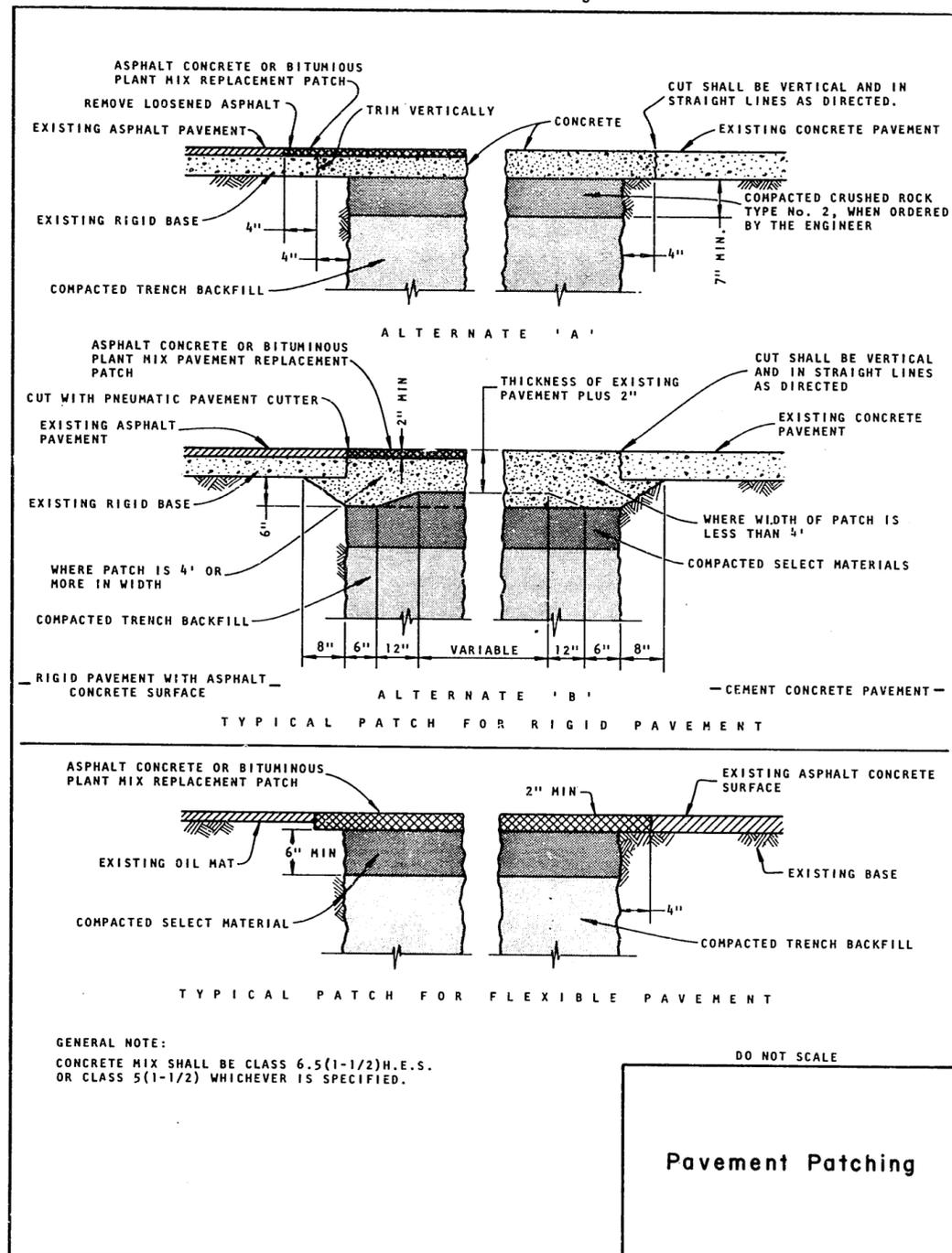
Standard Plan No. 15



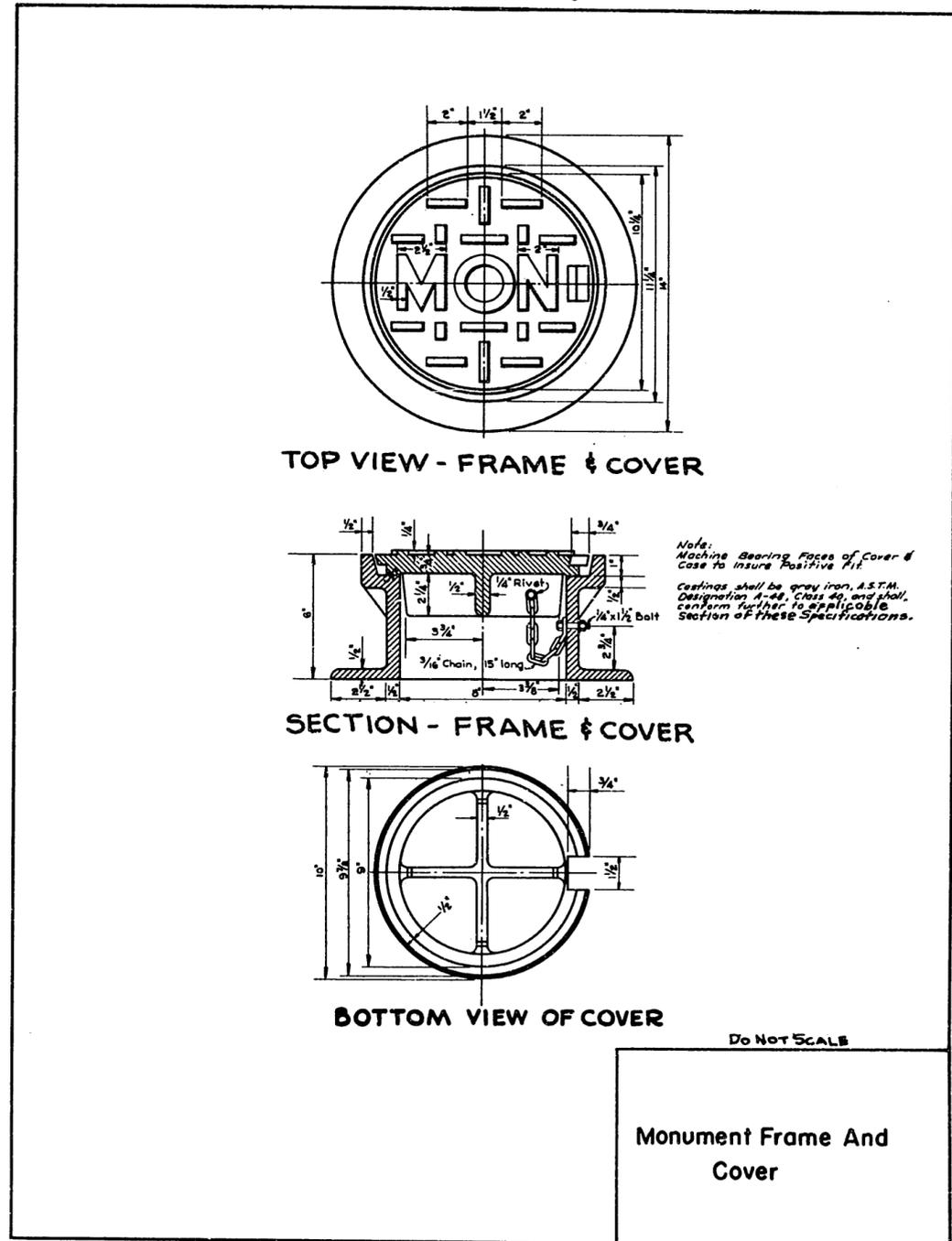
Standard Plan No. 16



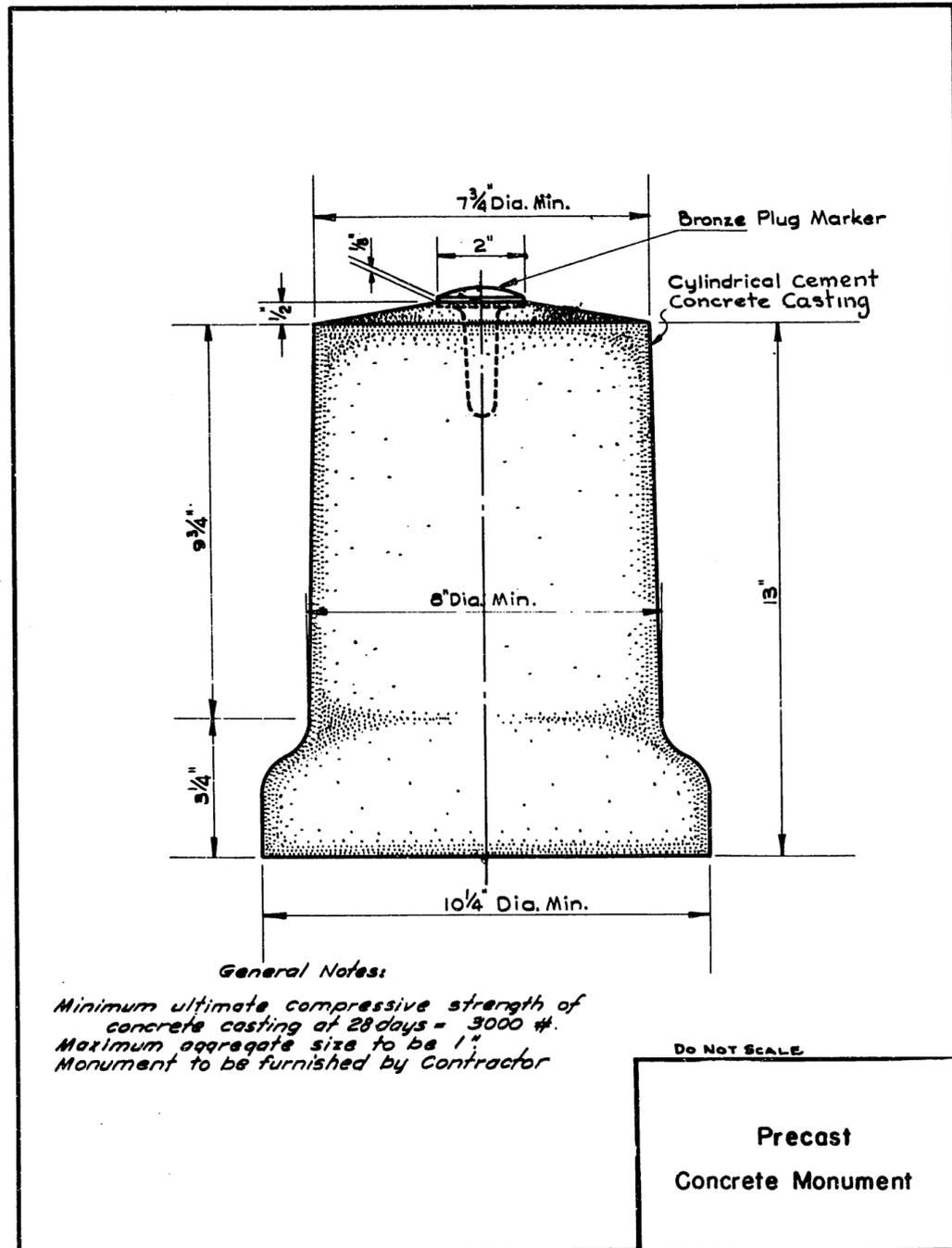
Standard Plan No 17



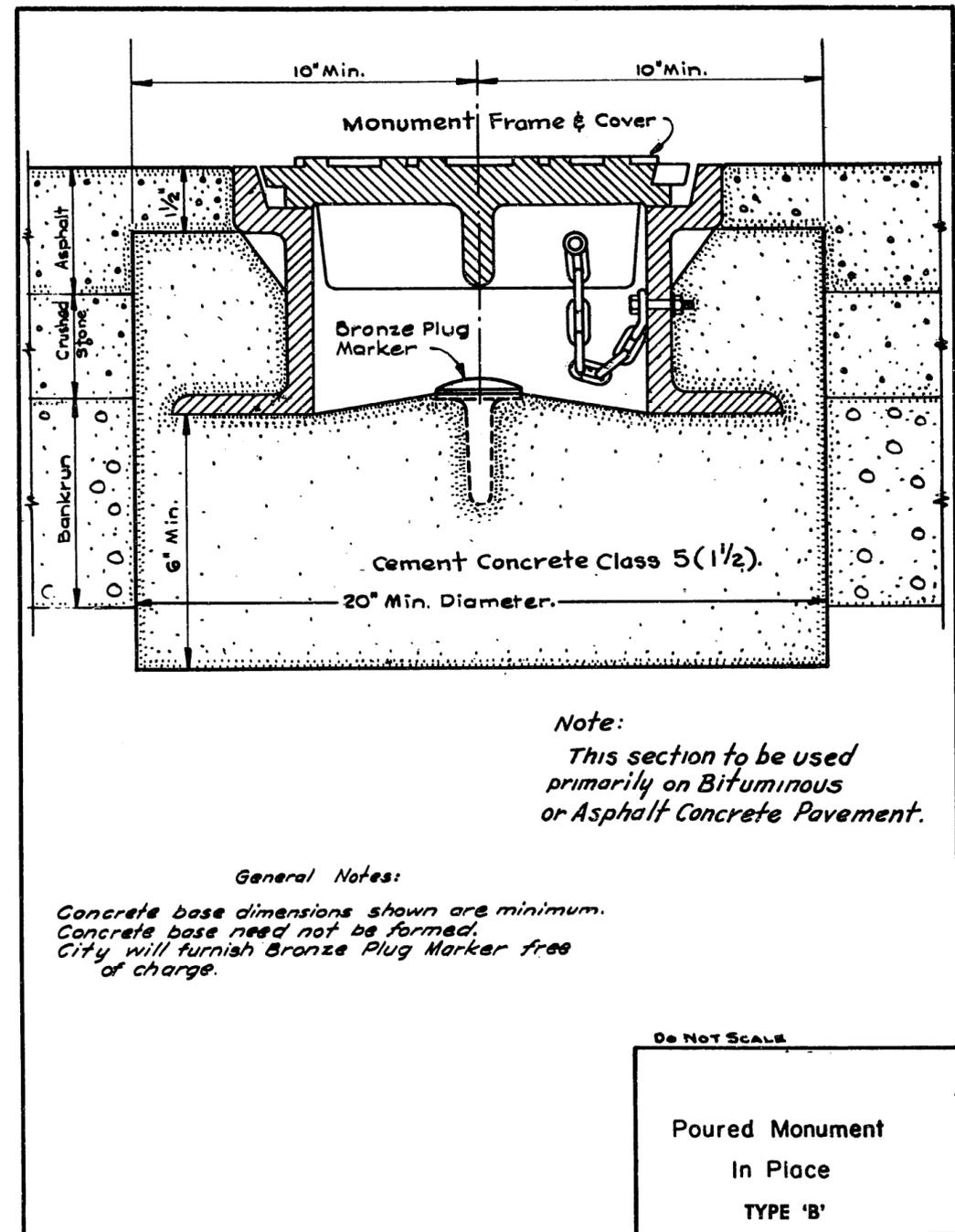
Standard Plan No. 18



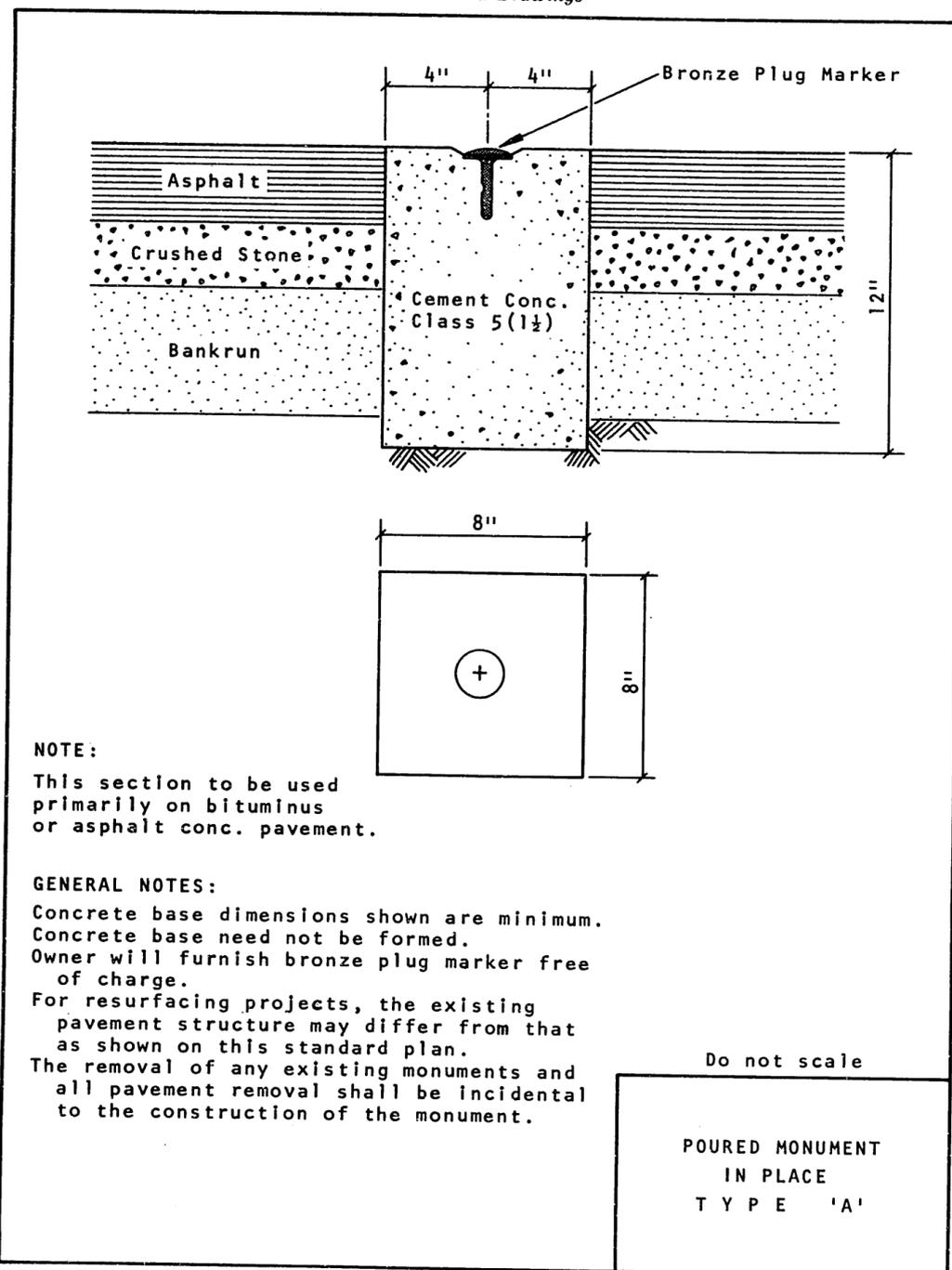
Standard Plan No. 19



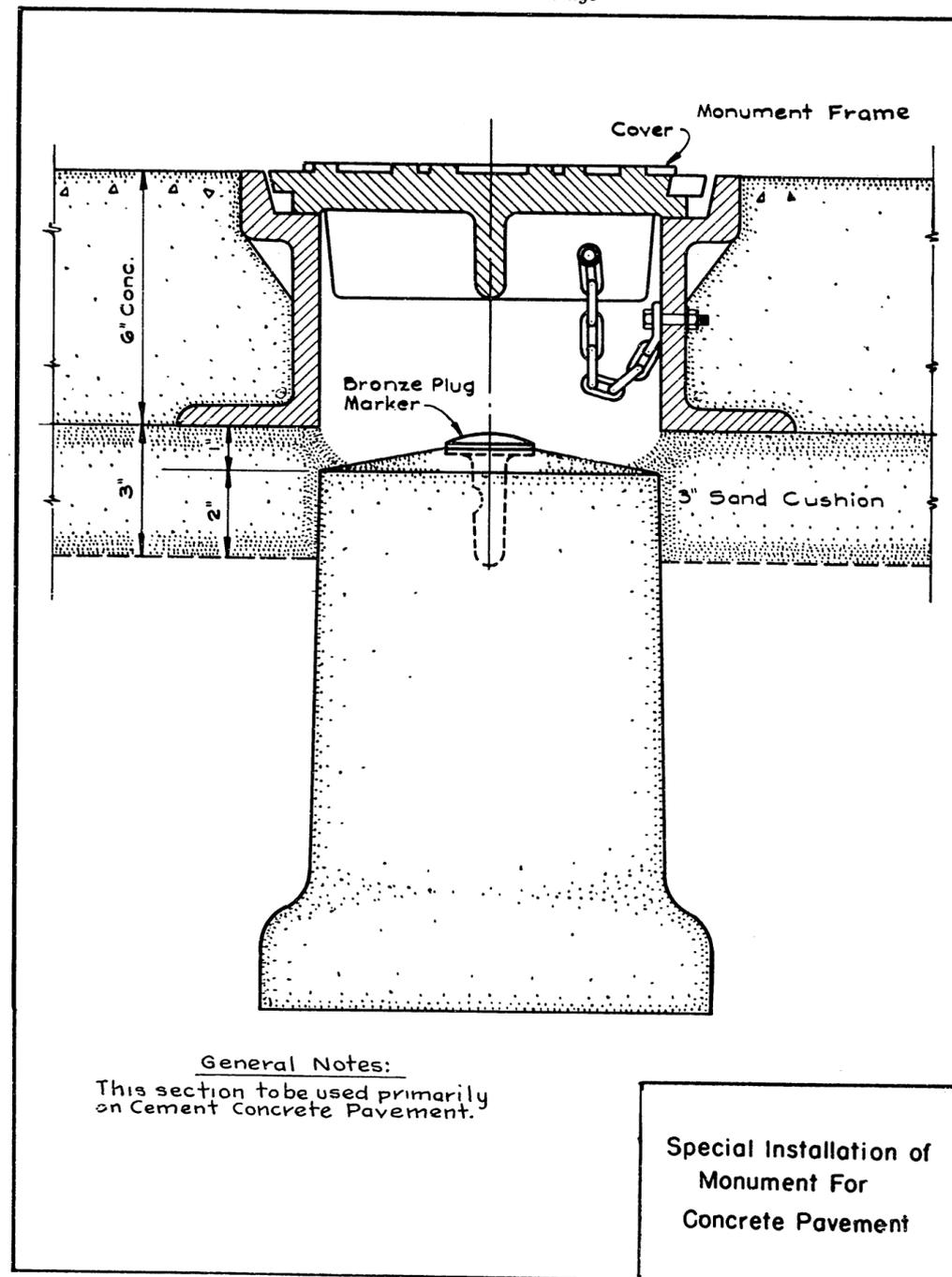
Standard Plan No. 20



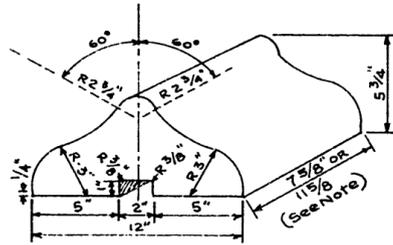
Standard Plan No. 21



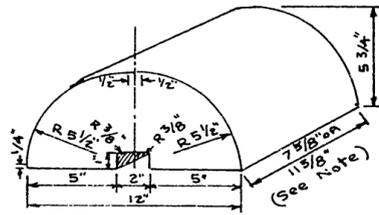
Standard Plan No. 22



Standard Plan No. 23

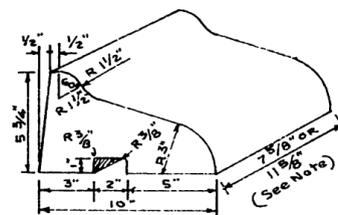


TYPE C BLOCK

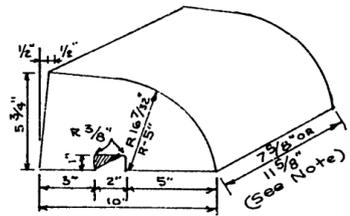


TYPE C REFLECTOR BLOCK

BLOCK TYPE C PRECAST TRAFFIC CURB



TYPE A BLOCK



TYPE A REFLECTOR BLOCK

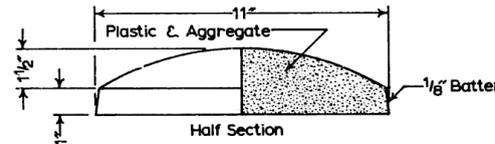
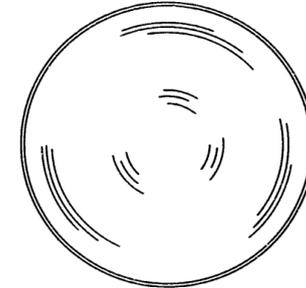
BLOCK TYPE A PRECAST TRAFFIC CURB

Do Not Scale

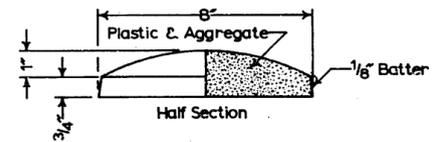
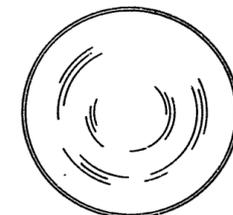
Block Precast Traffic Curbs
Class II

Standard Plan No. 26

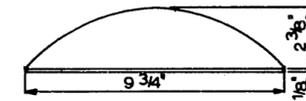
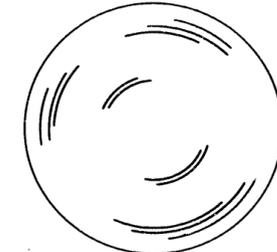
NOTE
With 7 5/8" blocks every sixth block shall be a reflector block.
With 11 5/8" blocks every fourth block shall be a reflector block.
See Section 45 of these Specification for further requirements.



Type 125A
11" Plastic Button

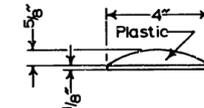


Type 125B
8" Plastic Button



Type 125D
9 3/4" Plastic Button

DO NOT SCALE

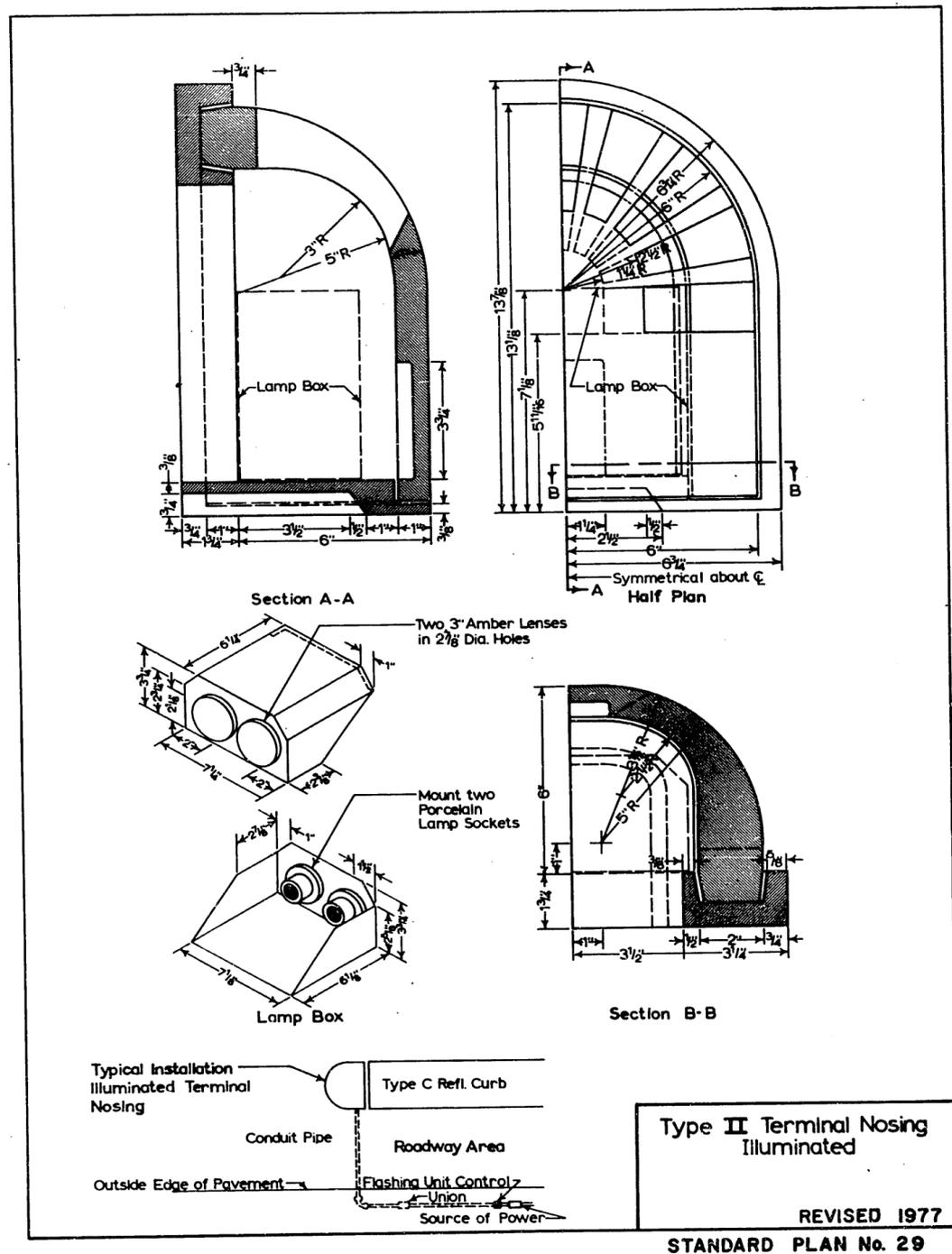
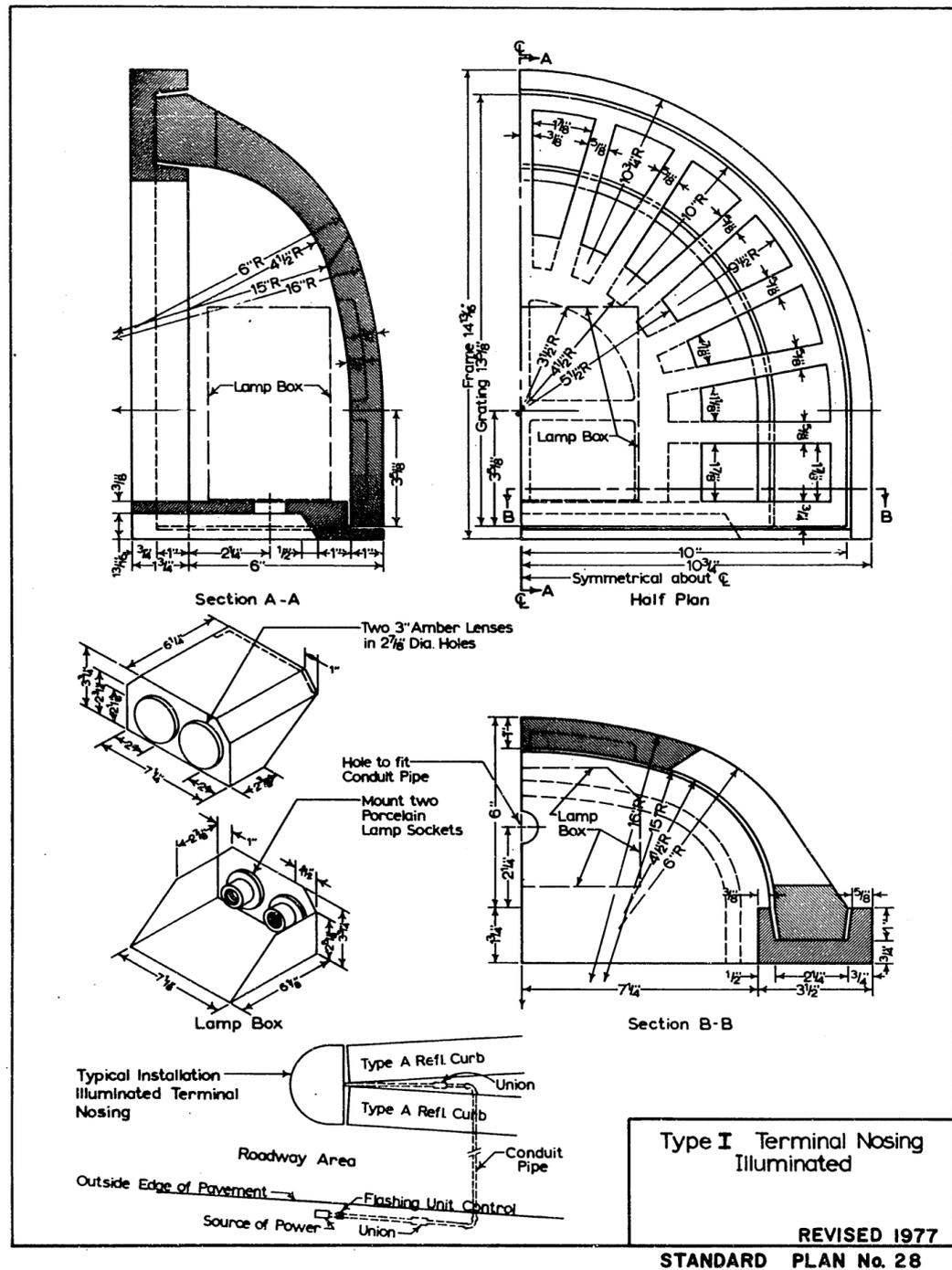


Type 125C
4" Lane Marker

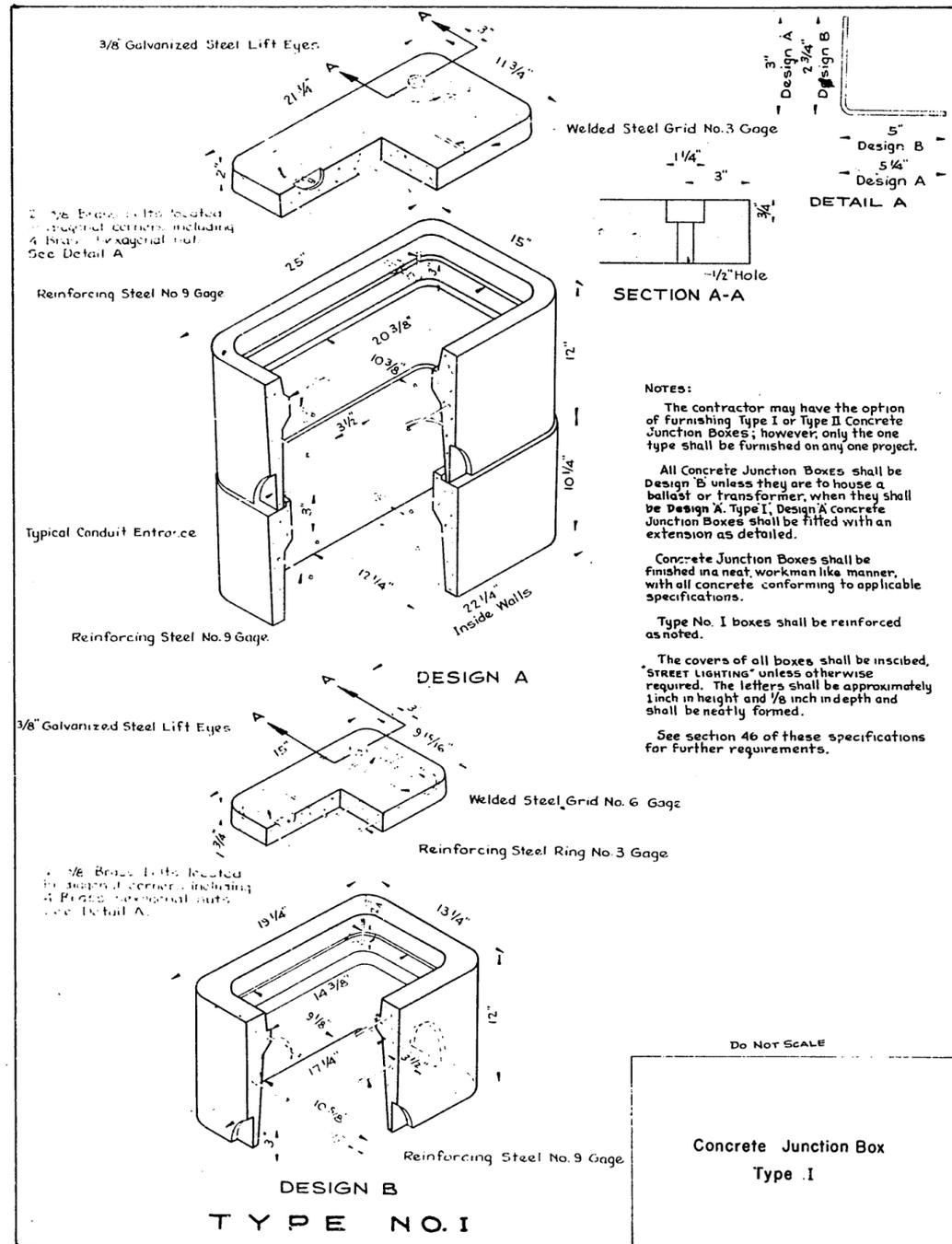
Type 125
Traffic Buttons

REVISED 1977

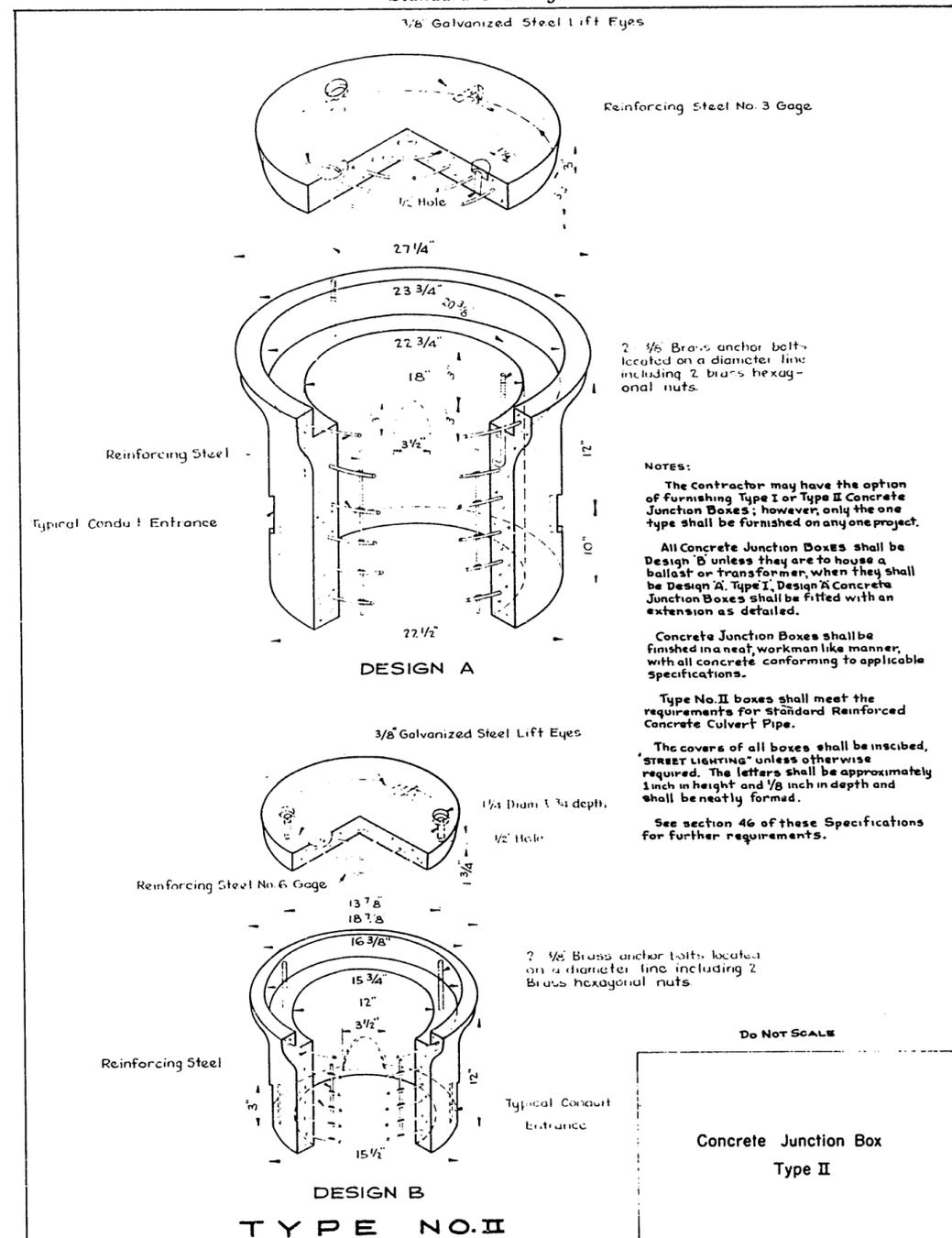
STANDARD PLAN No. 27

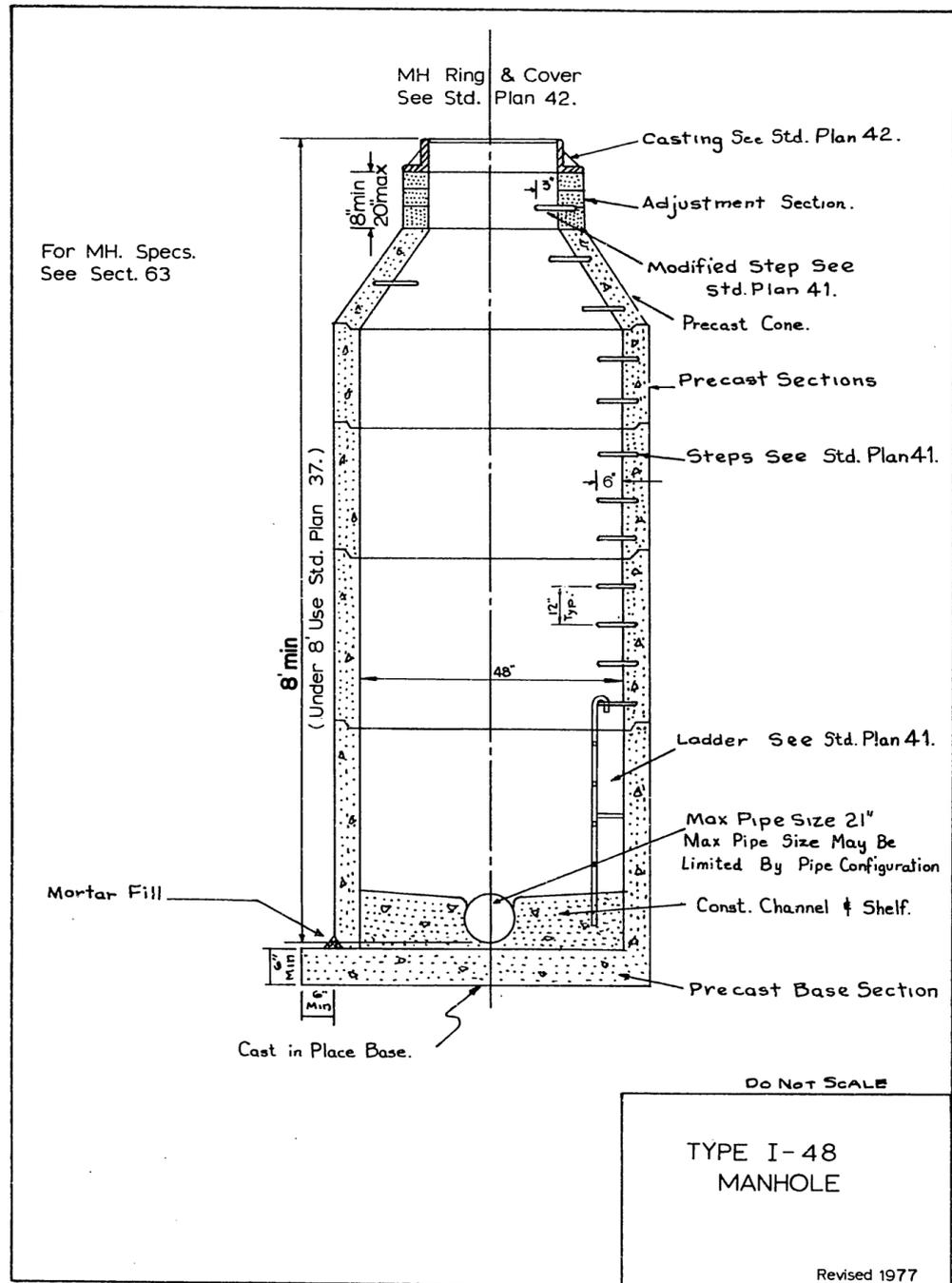


Standard Drawings

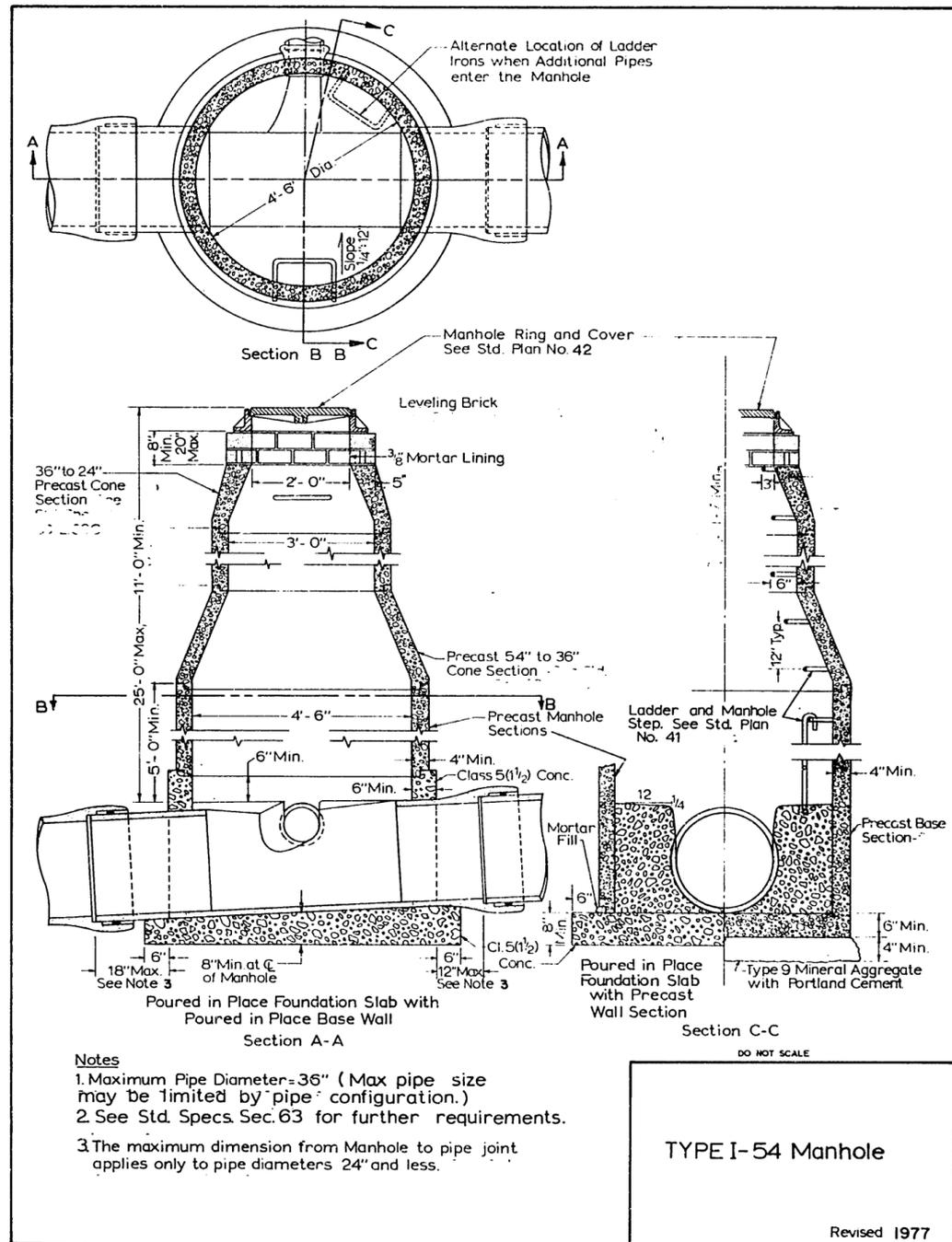


Standard Drawings



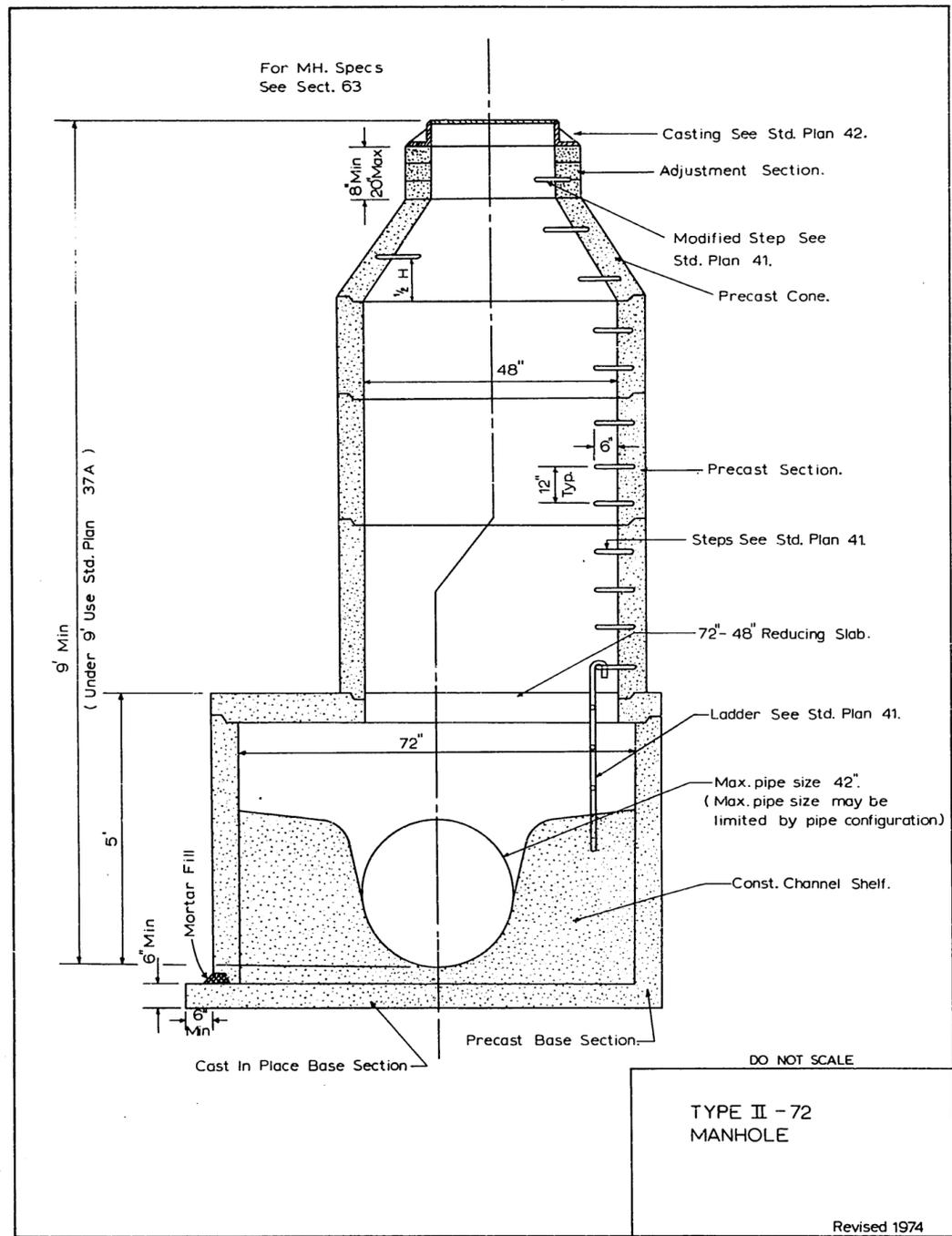


Standard Plan No.34

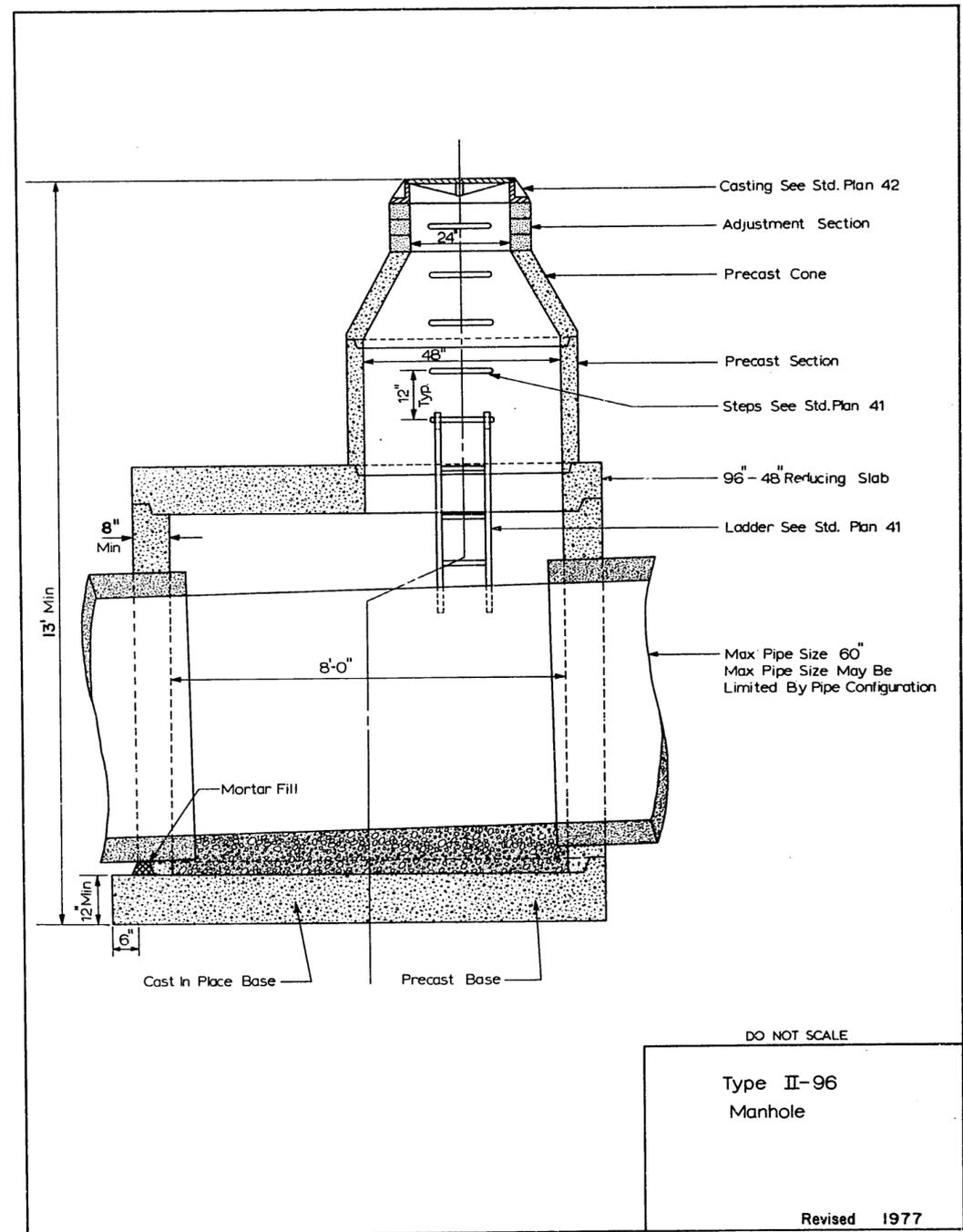


Standard Plan No. 35

Standard Drawings

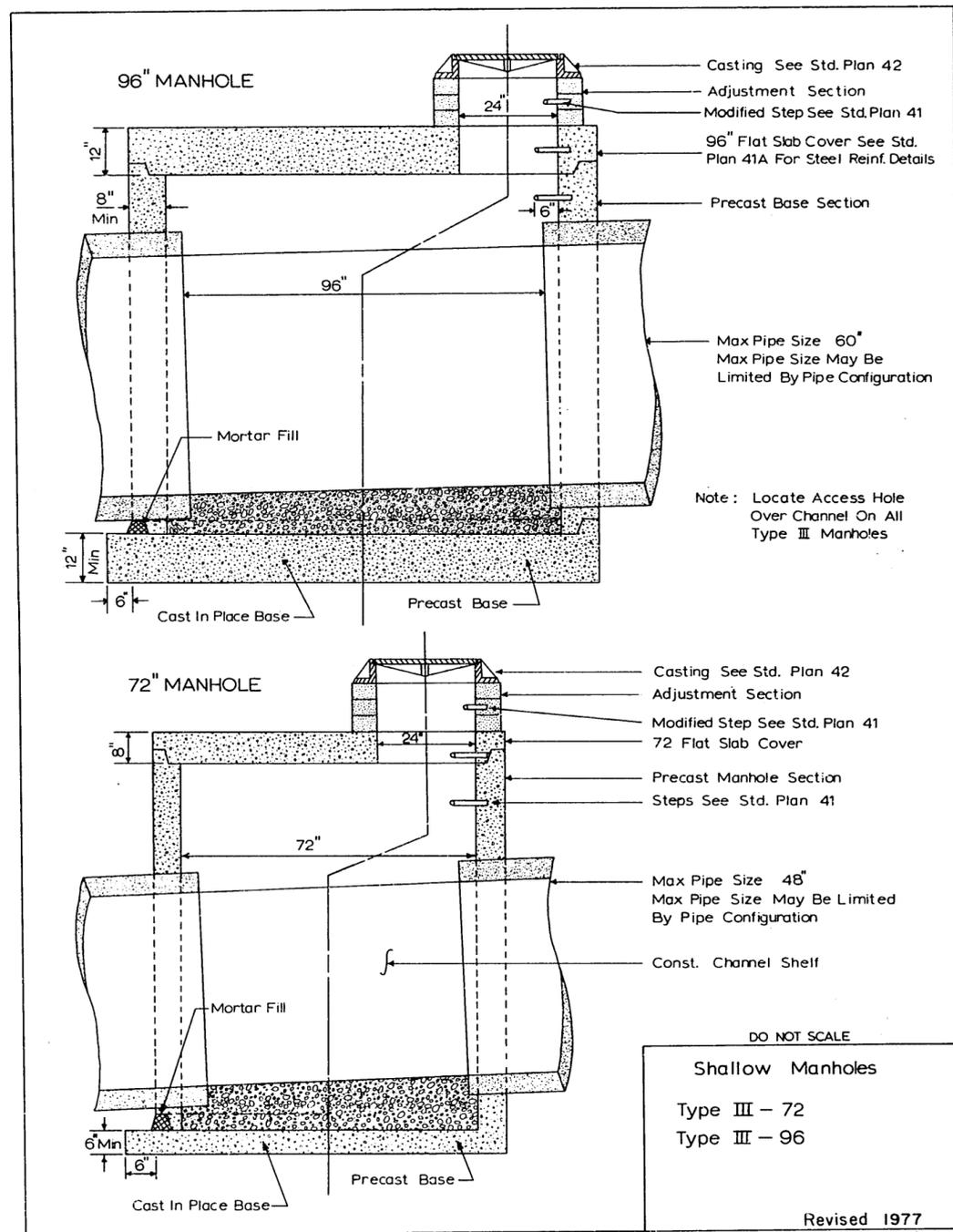
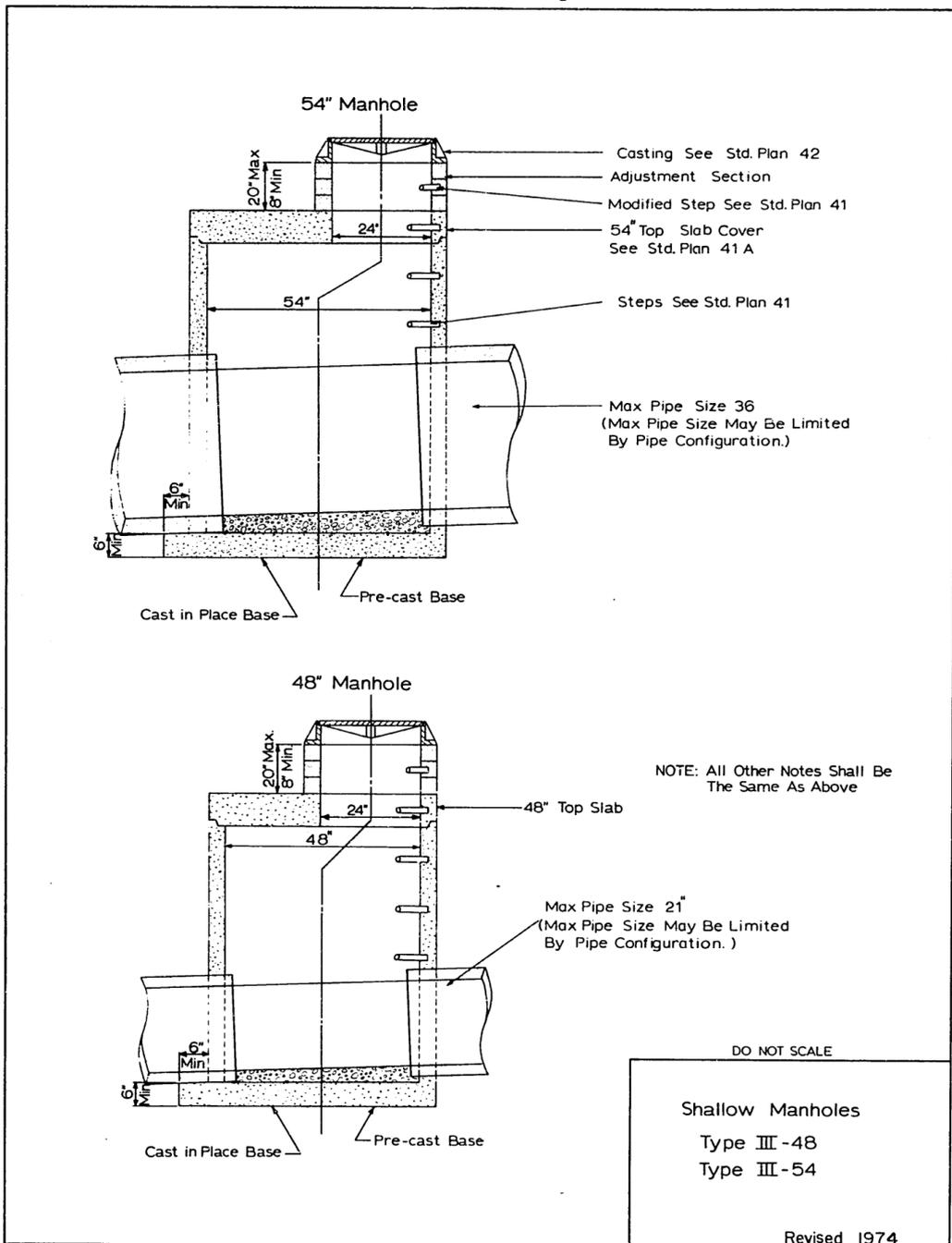


Standard Plan No. 36.

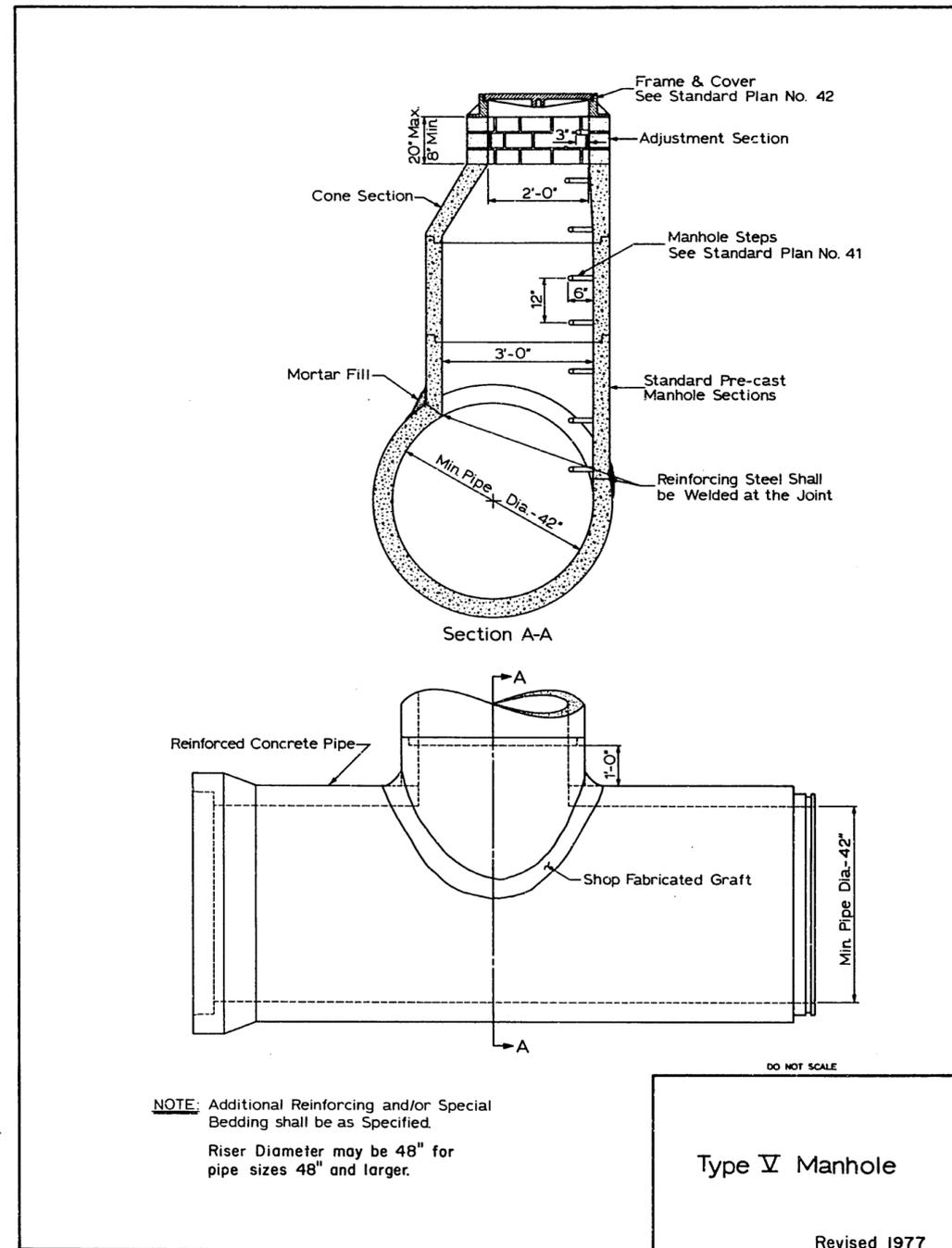
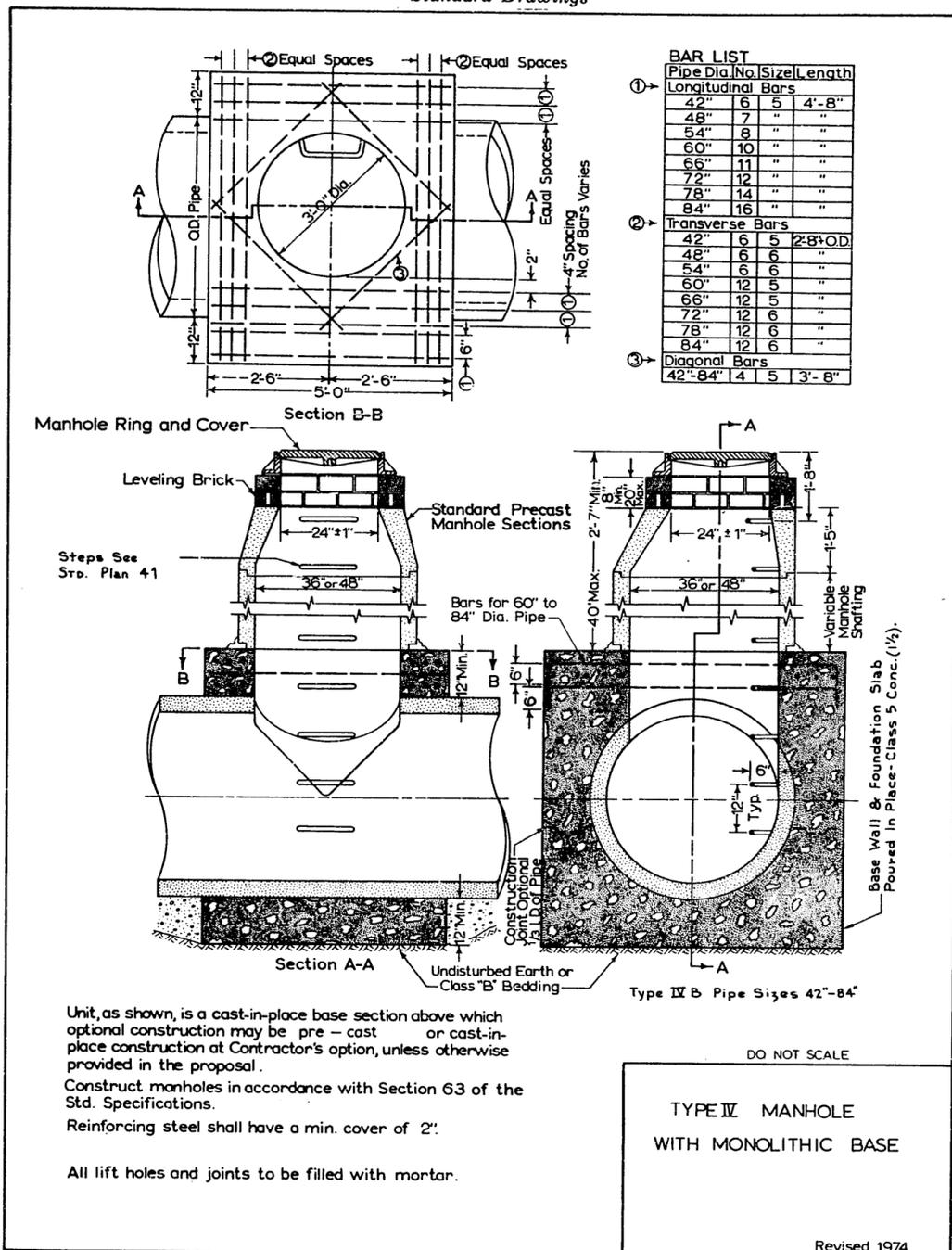


Standard Plan No 36A

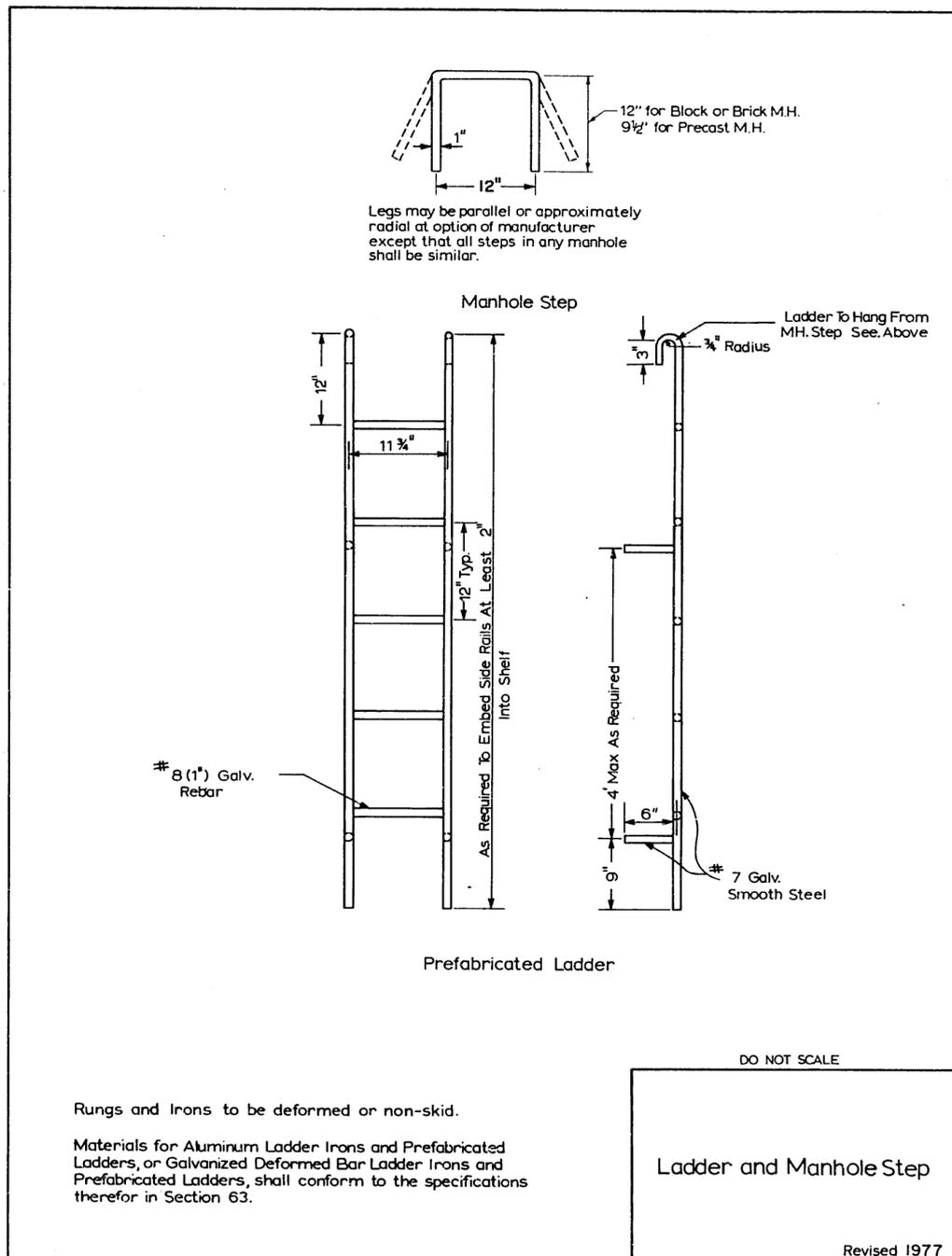
Standard Drawings



Standard Drawings

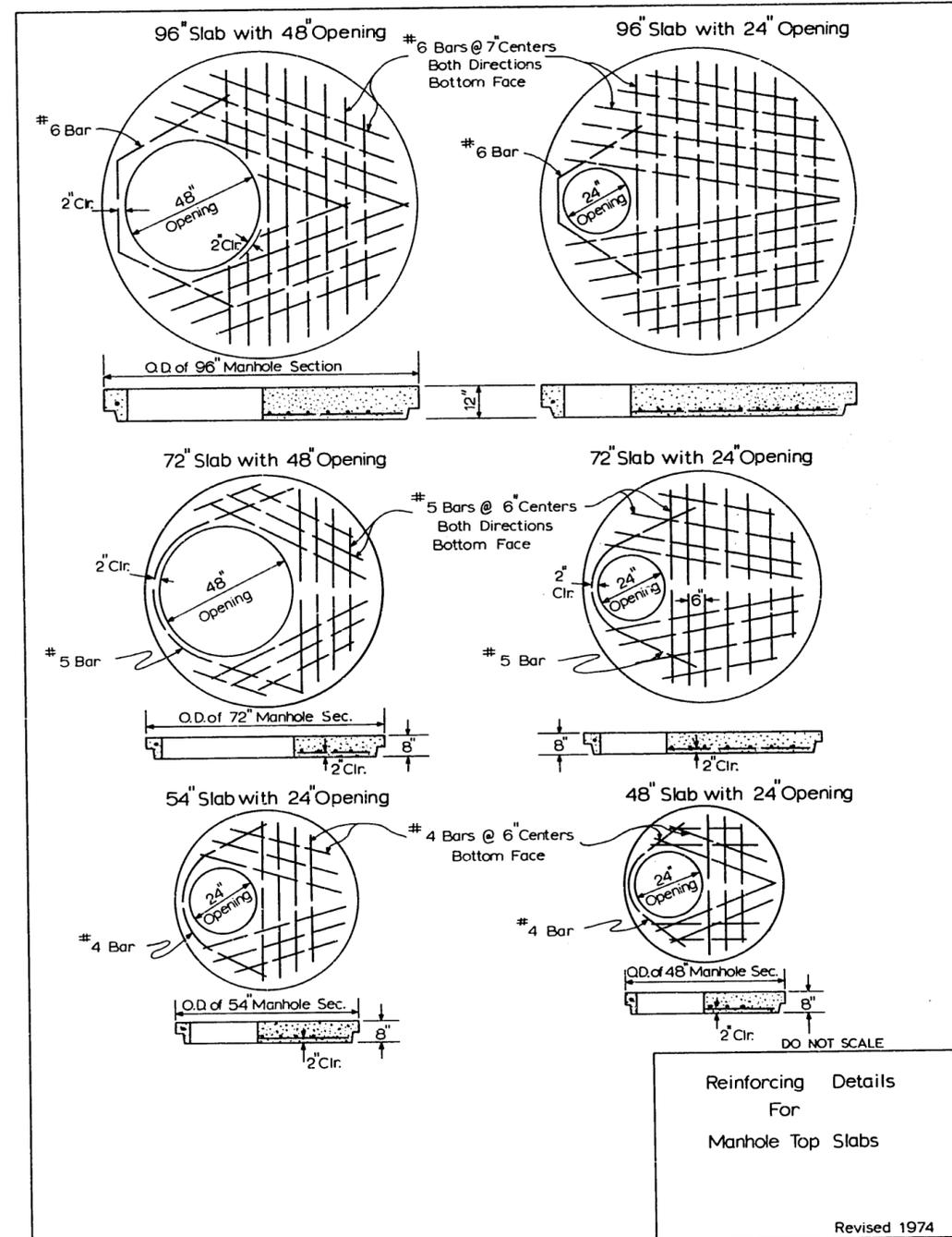


NOTE: Additional Reinforcing and/or Special Bedding shall be as Specified.
Riser Diameter may be 48" for pipe sizes 48" and larger.

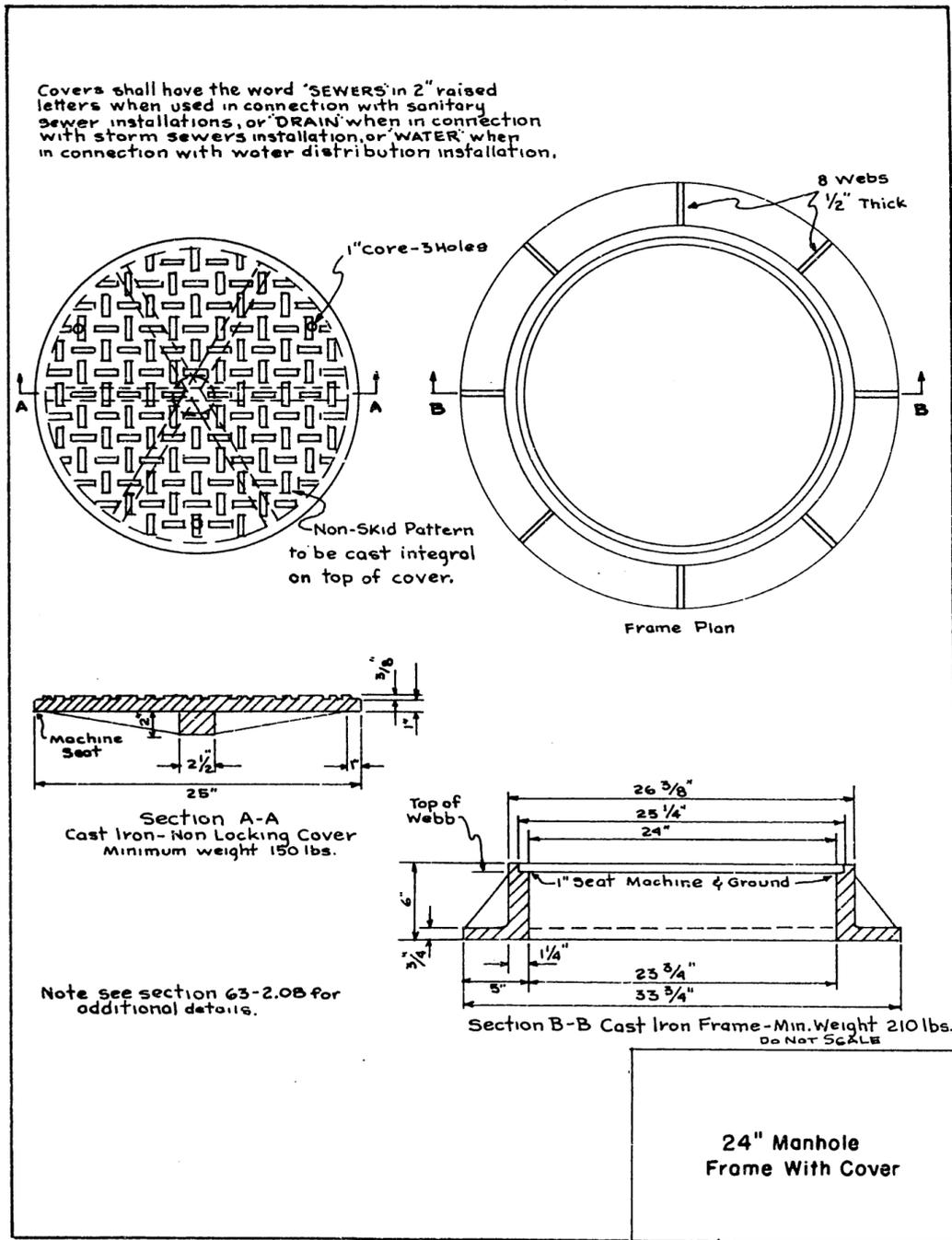


Standard Plan No. 41

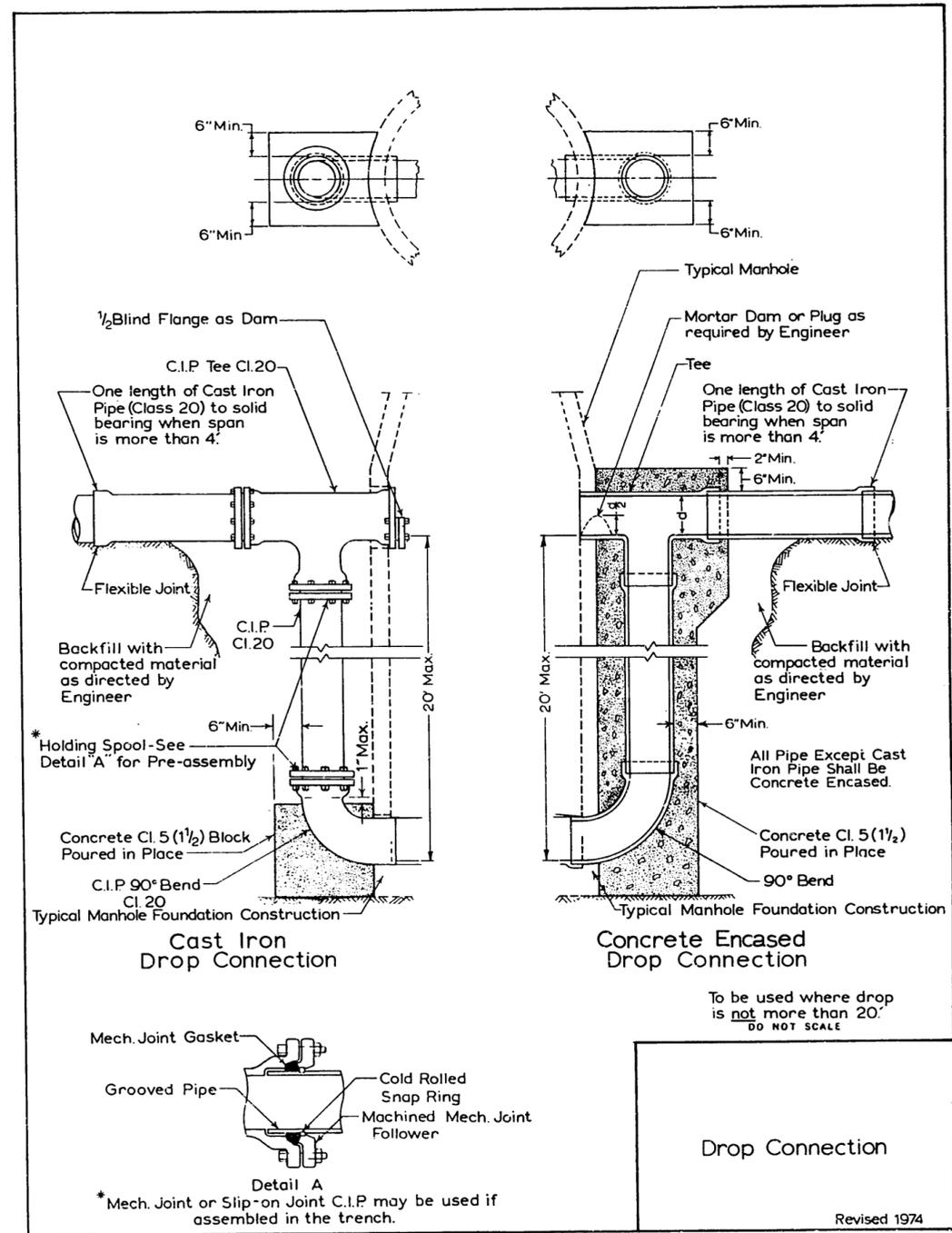
Standard Drawings



Standard Plan No. 41A

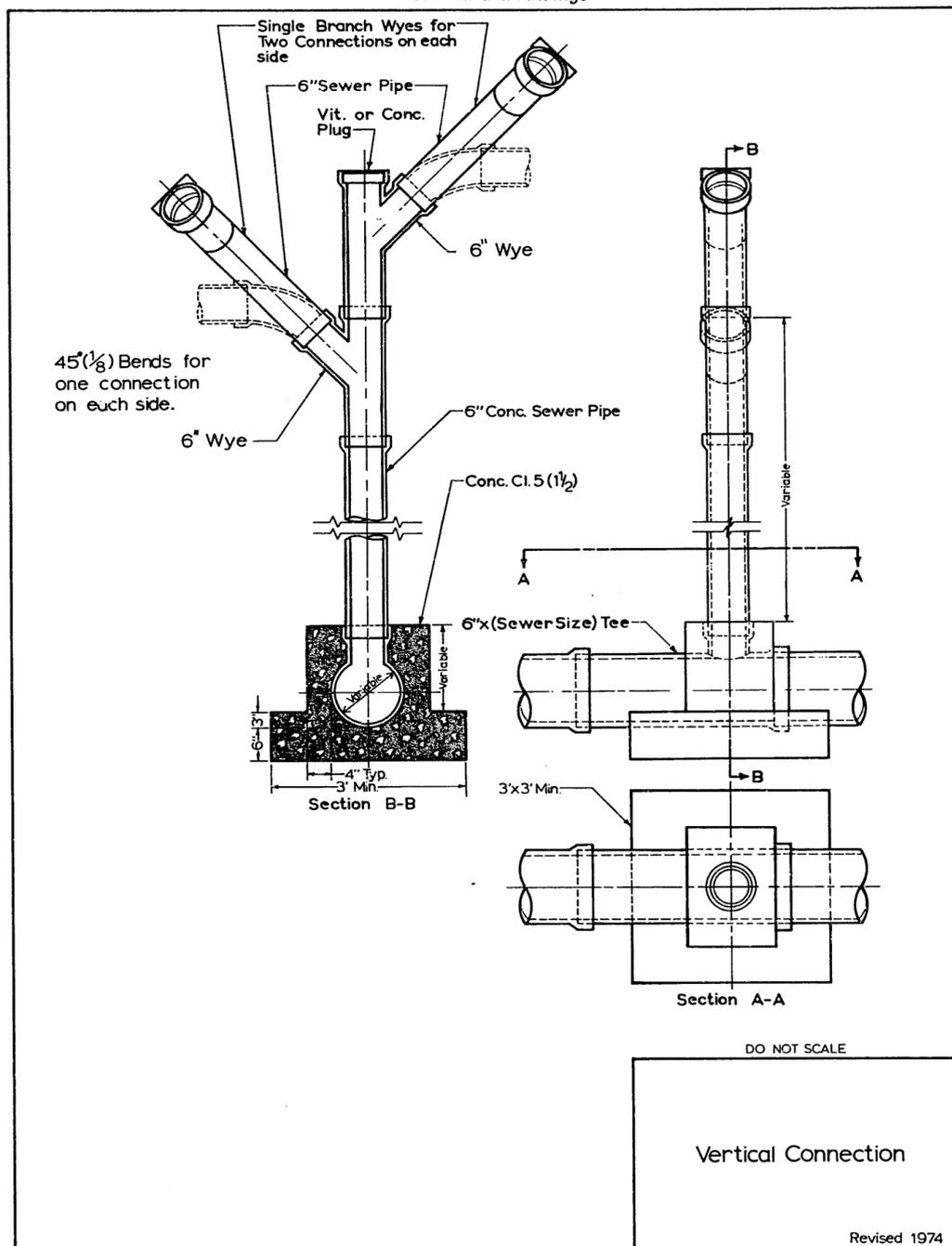


Standard Plan No.42



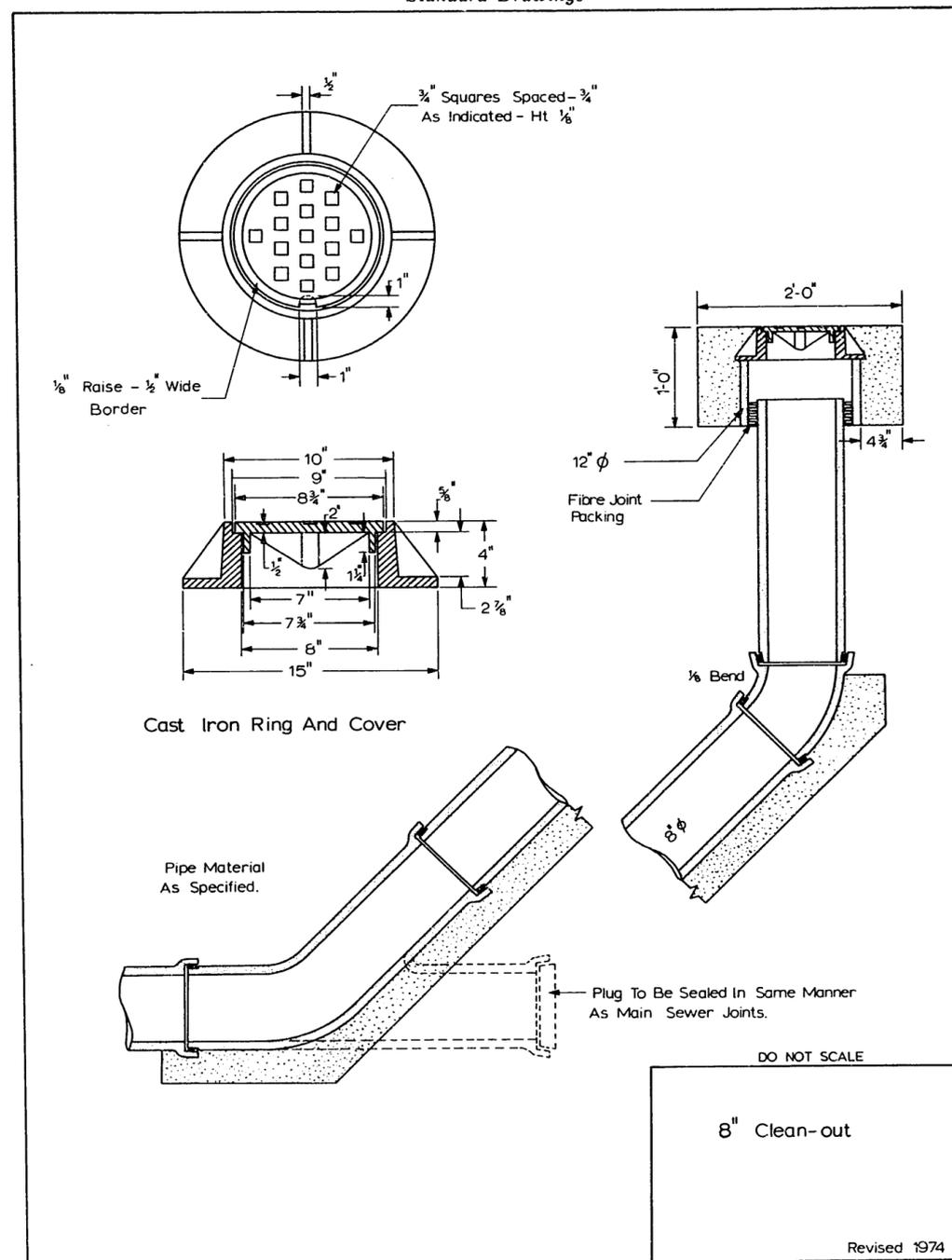
Standard Plan No. 43

Standard Drawings



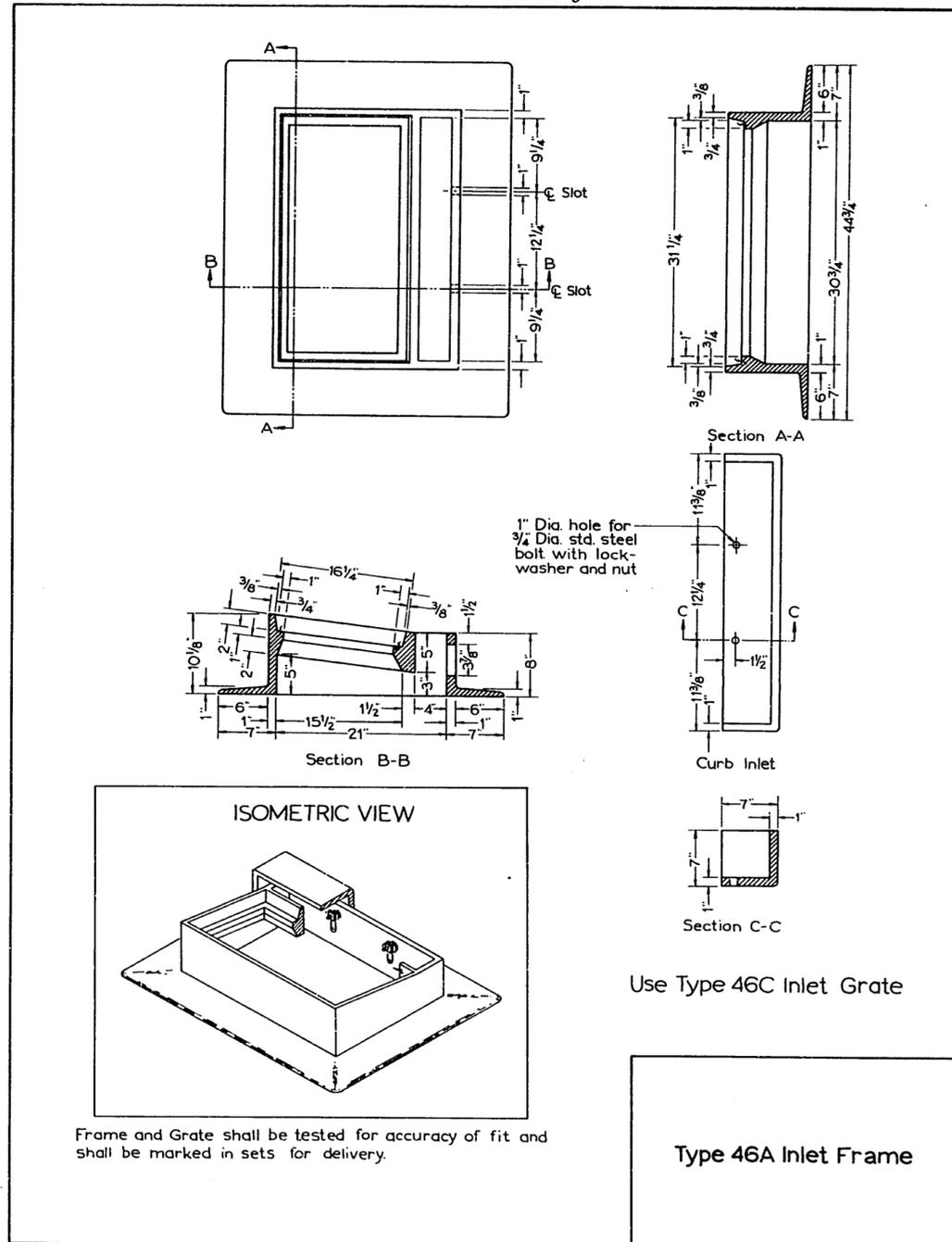
Standard Plan No. 44

Standard Drawings



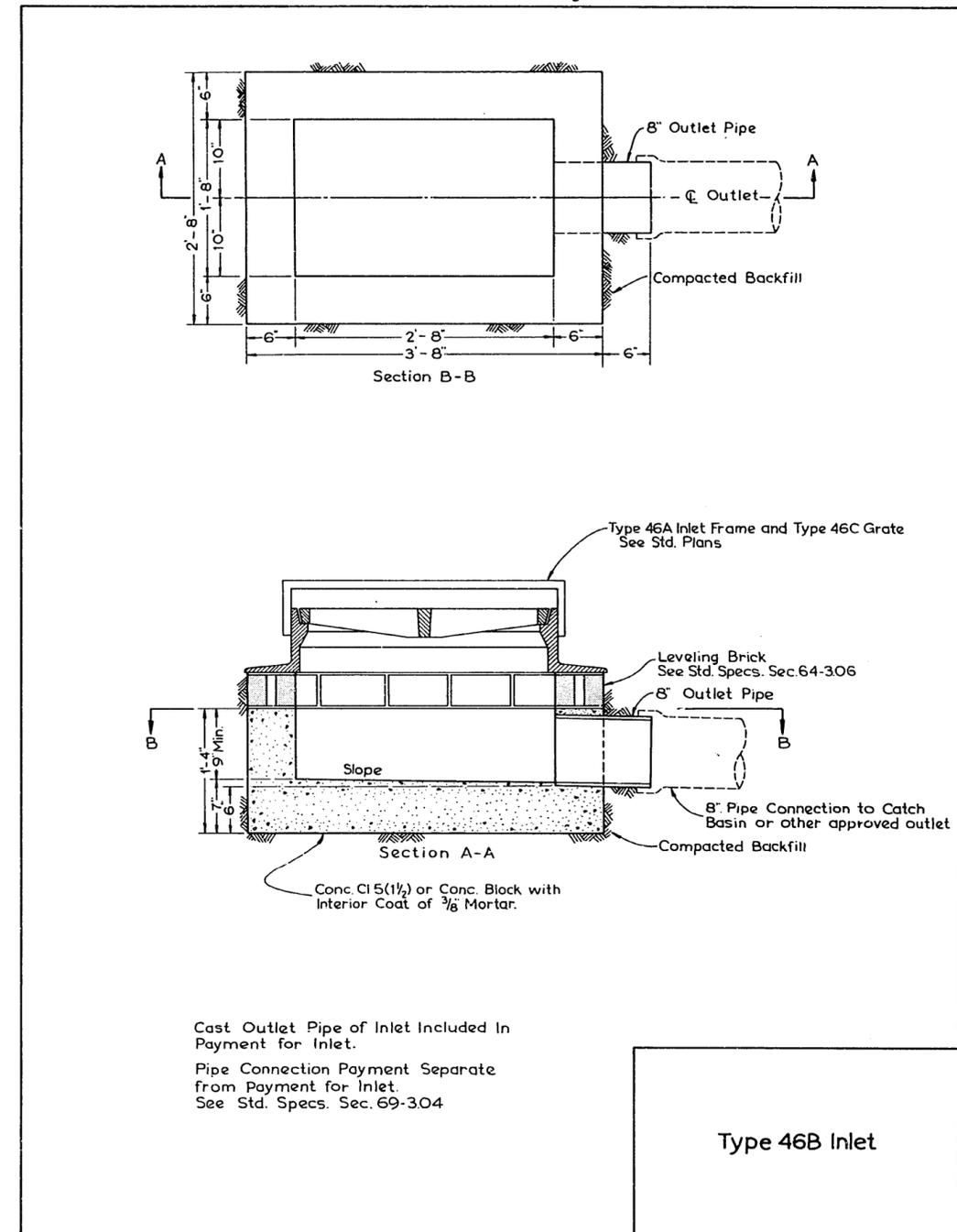
Standard Plan No. 45

Standard Drawings

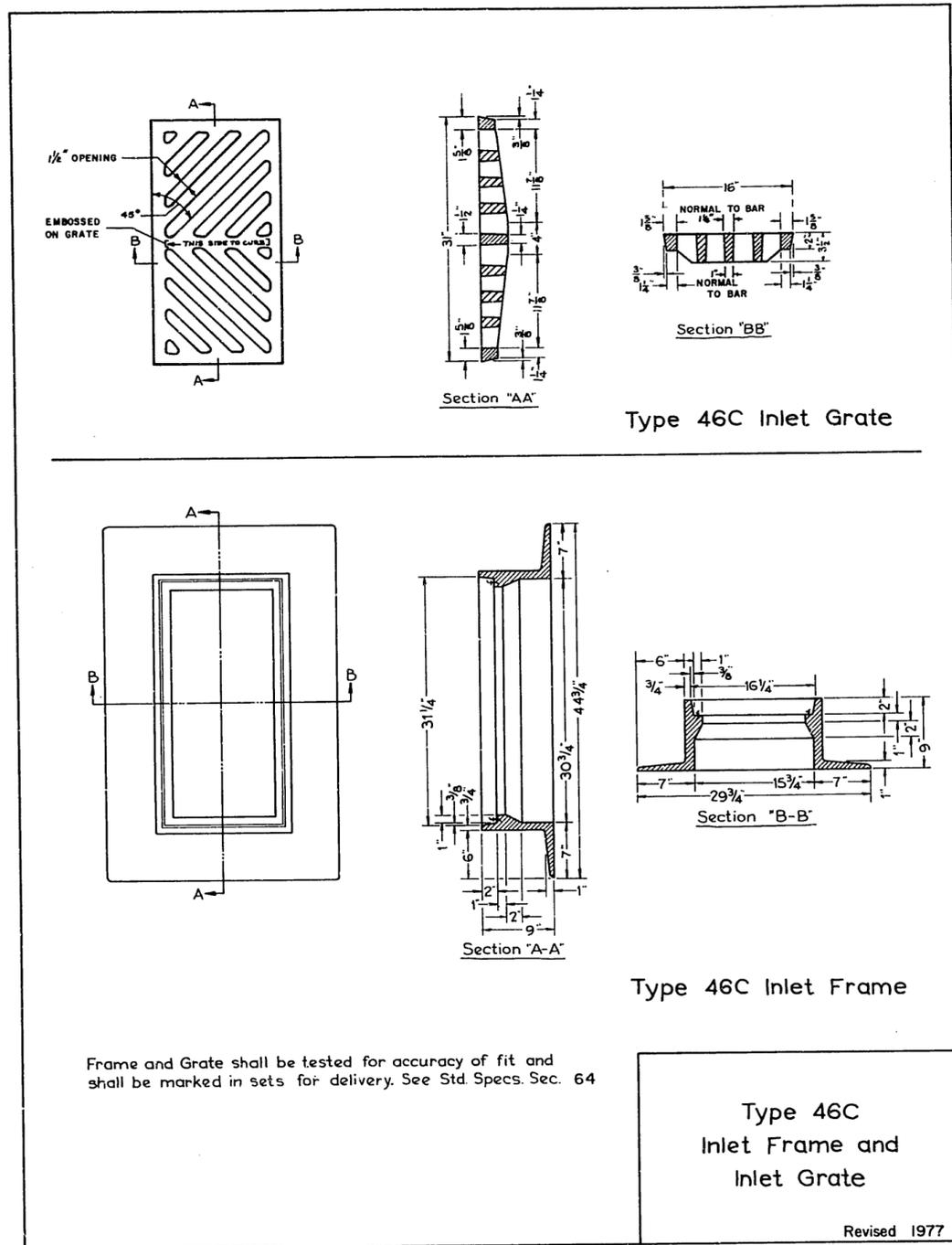


Standard Plan No. 46

Standard Drawings

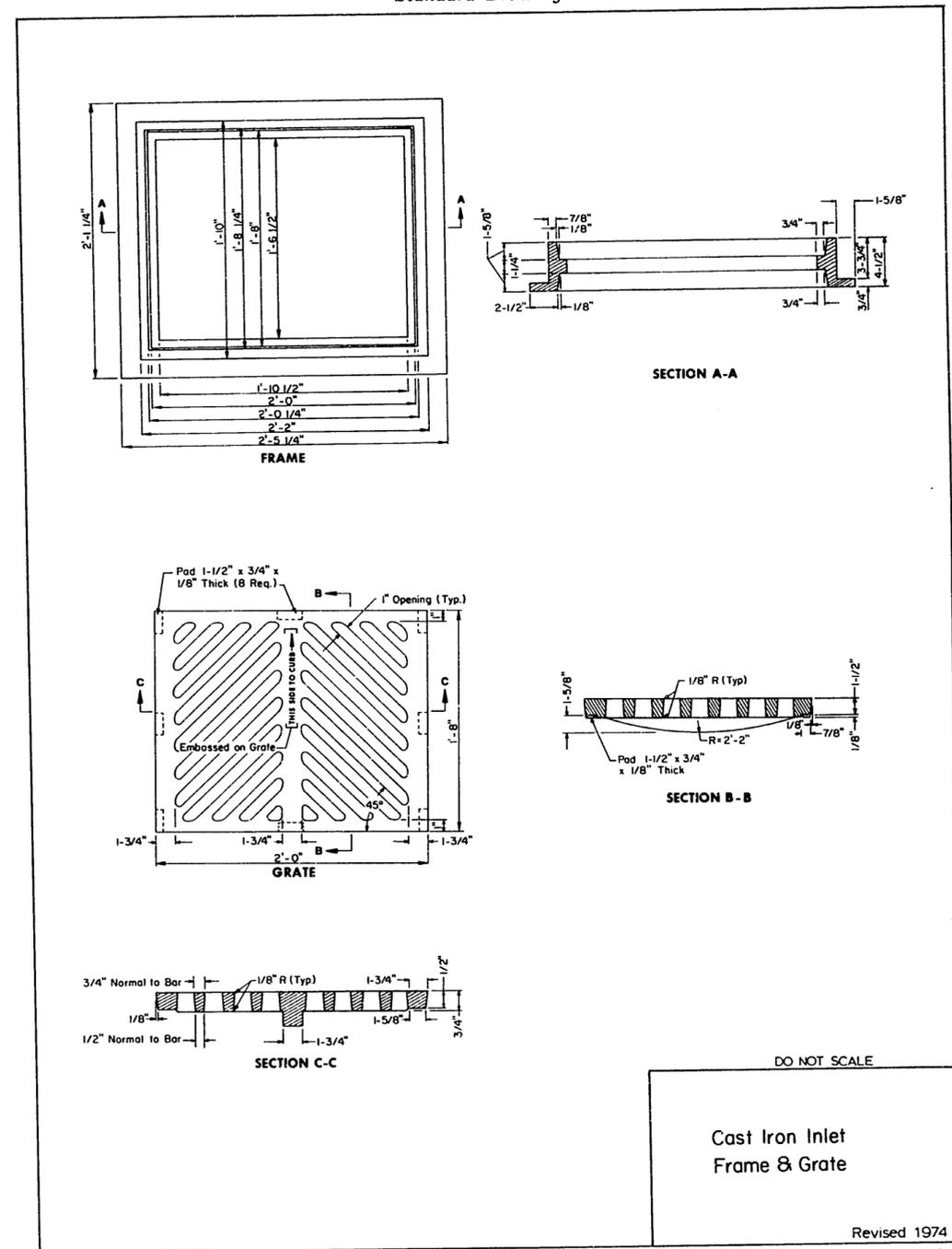


Standard Plan No. 47



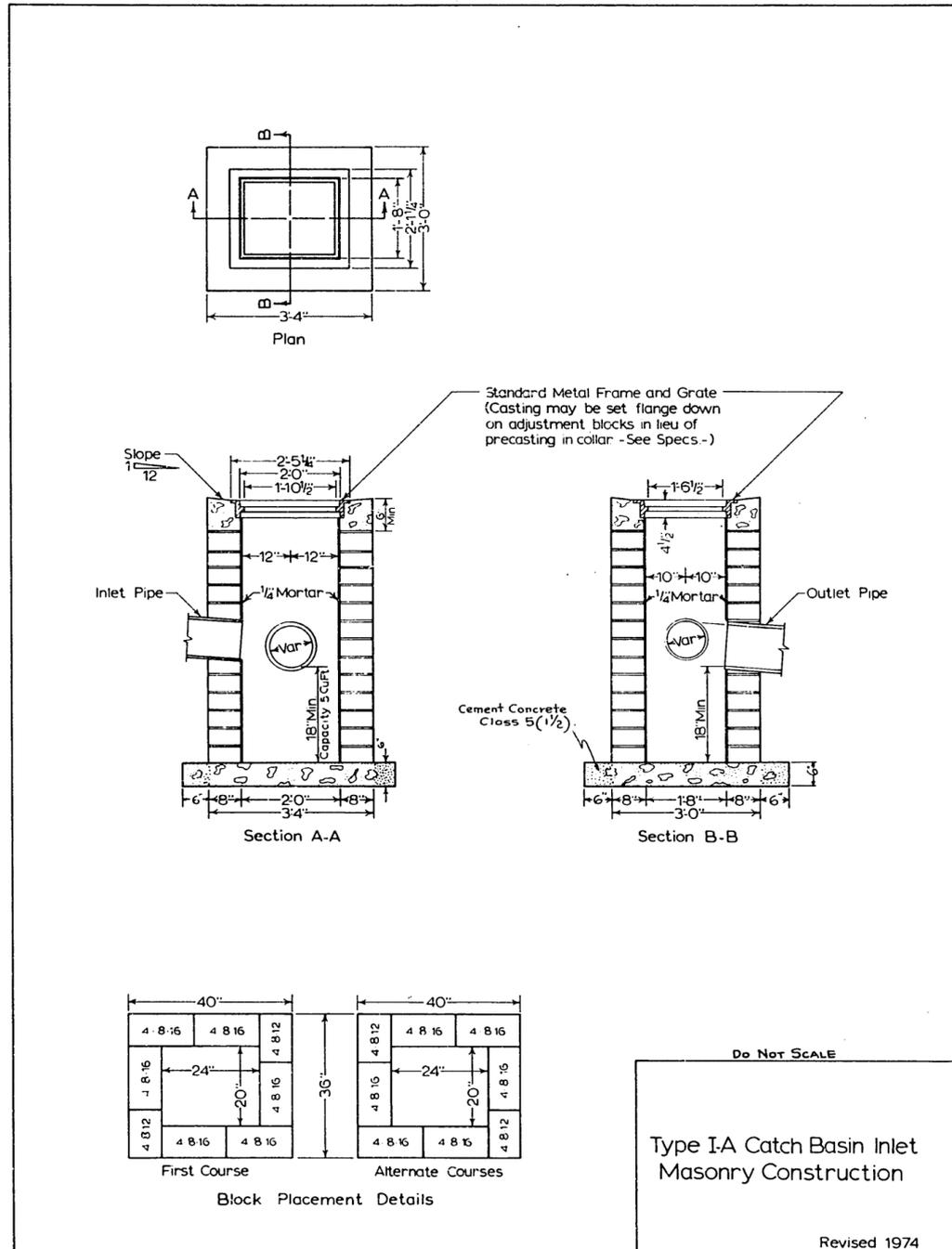
Standard Plan No. 48

Standard Drawings



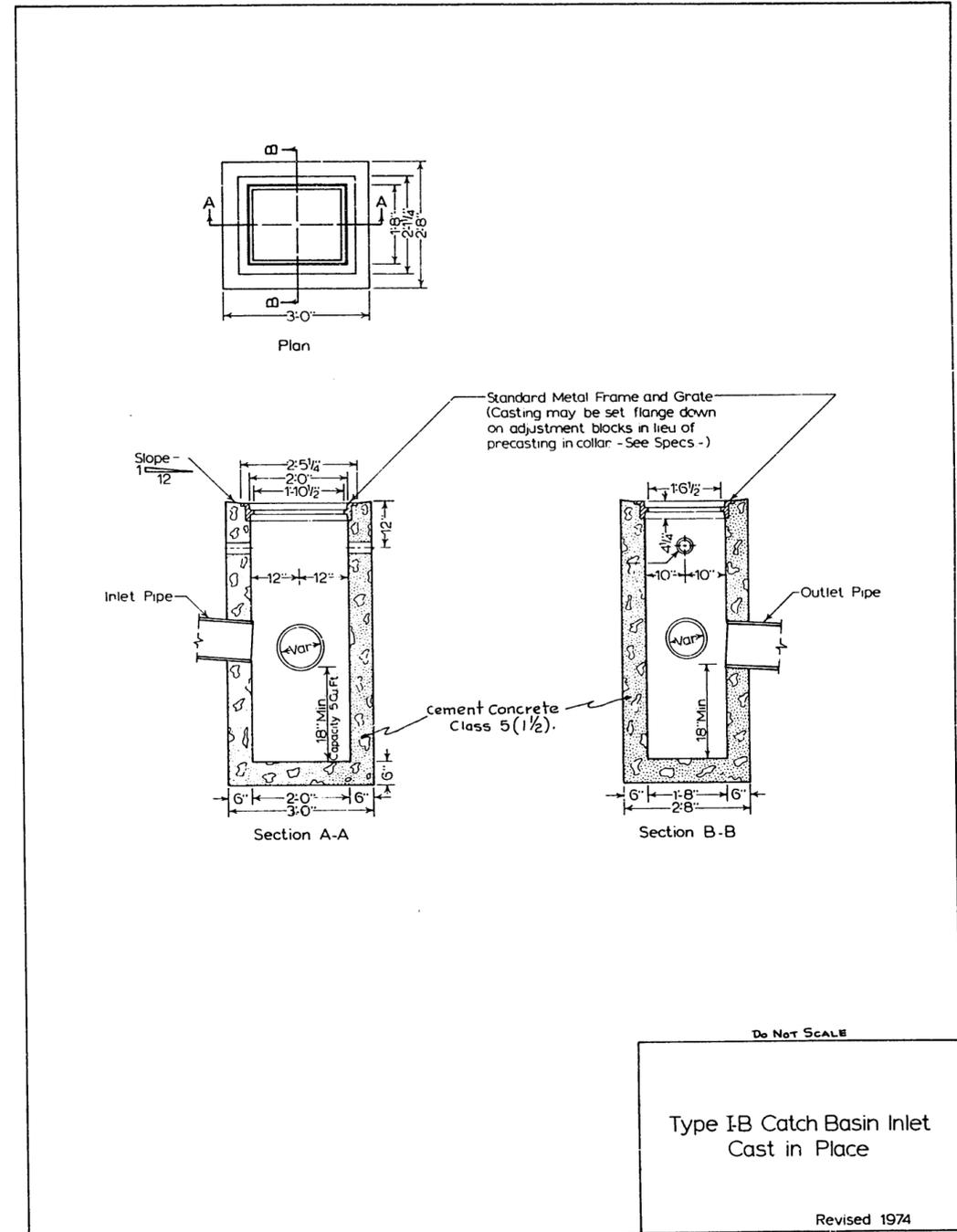
Standard Plan No. 49

Standard Drawings



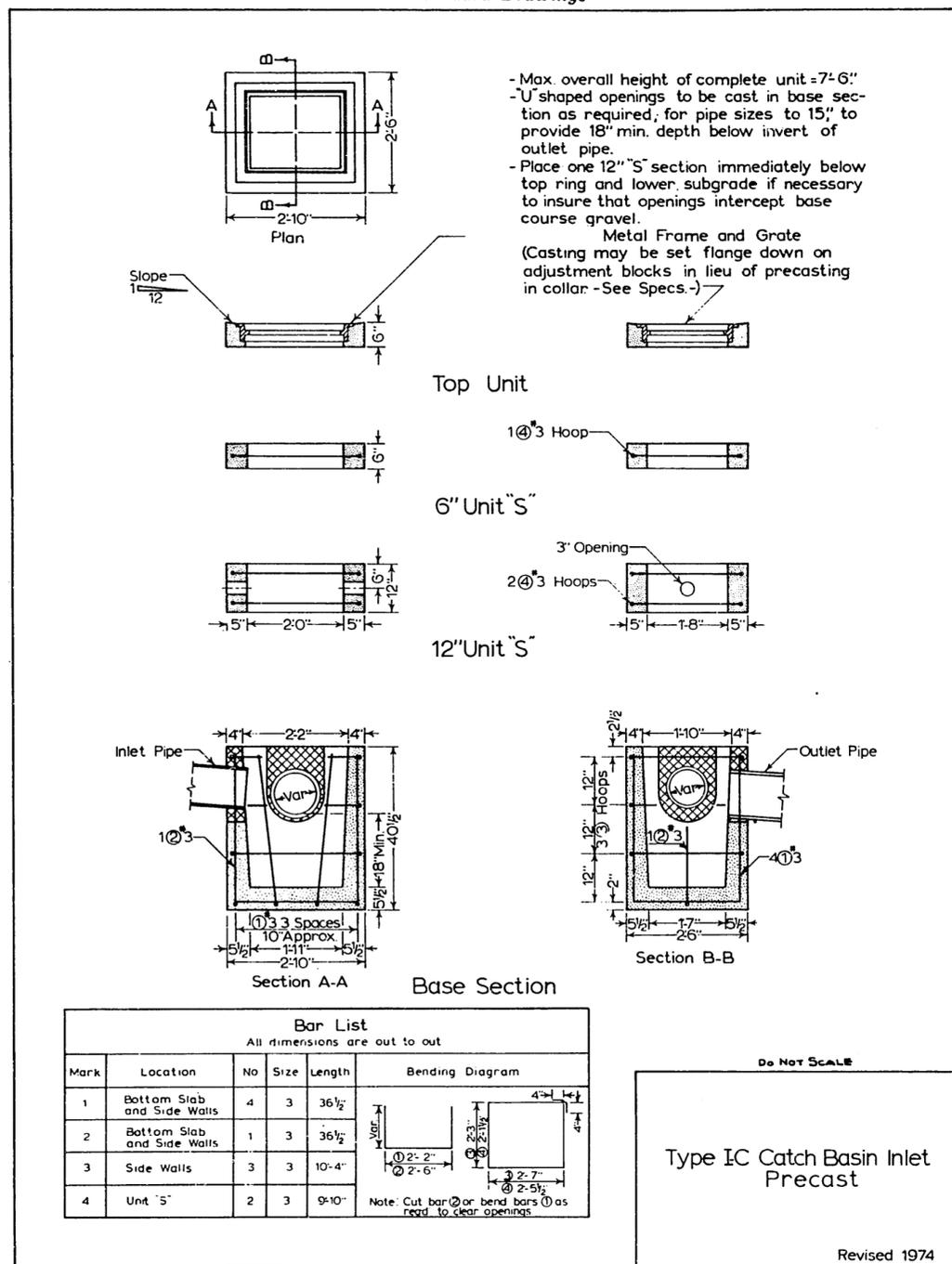
Standard Plan No. 50

Standard Drawings

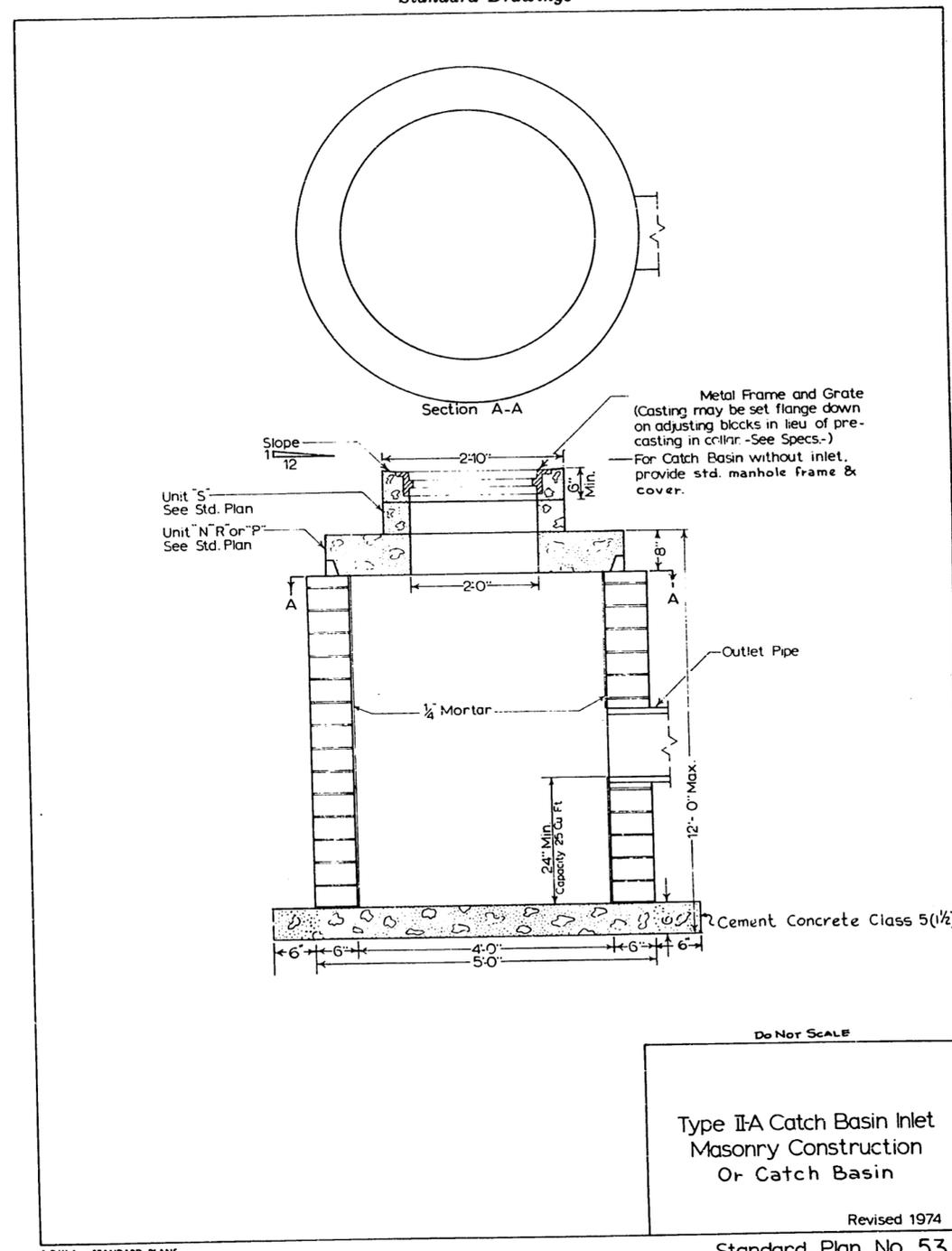


Standard Plan No. 51

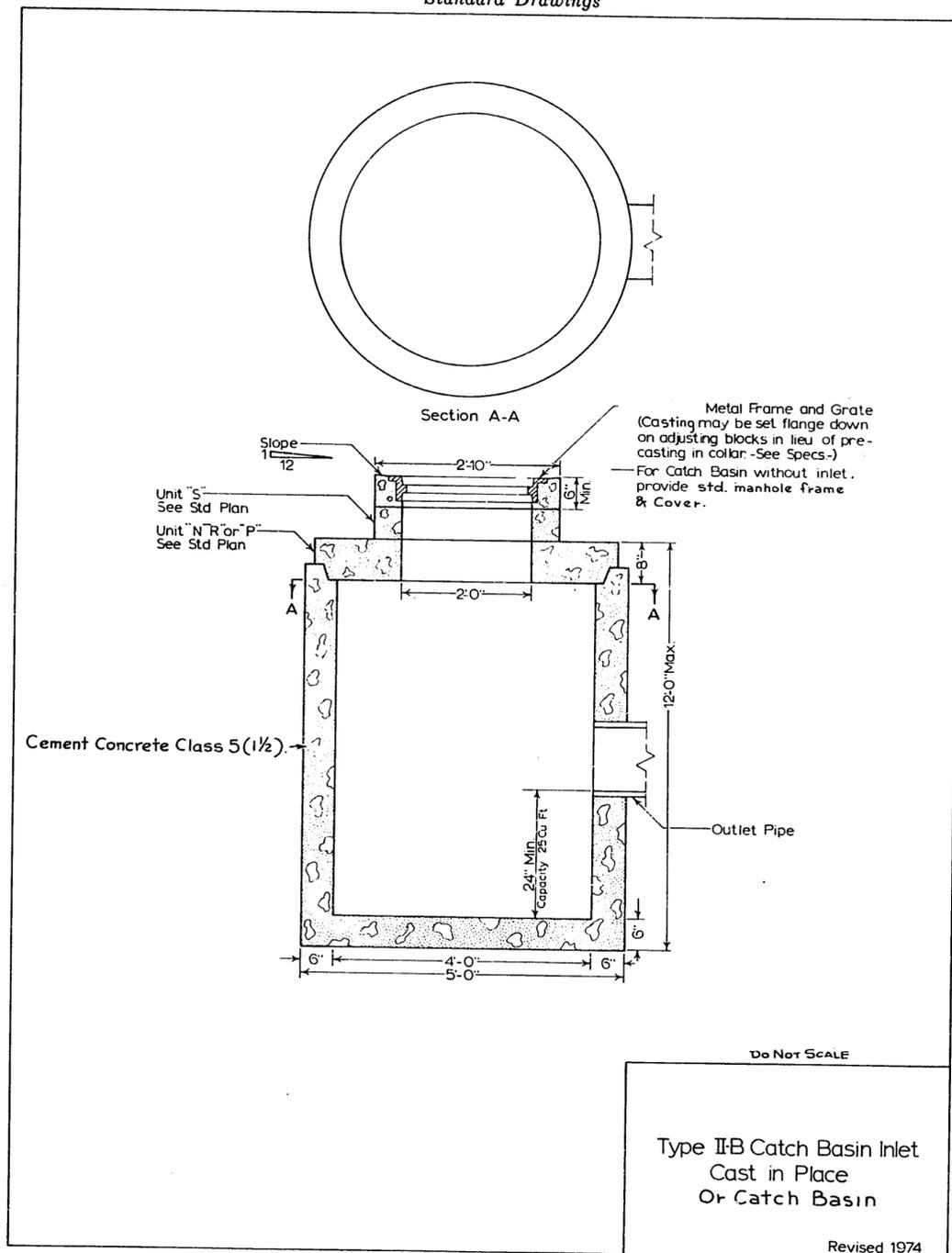
Standard Drawings



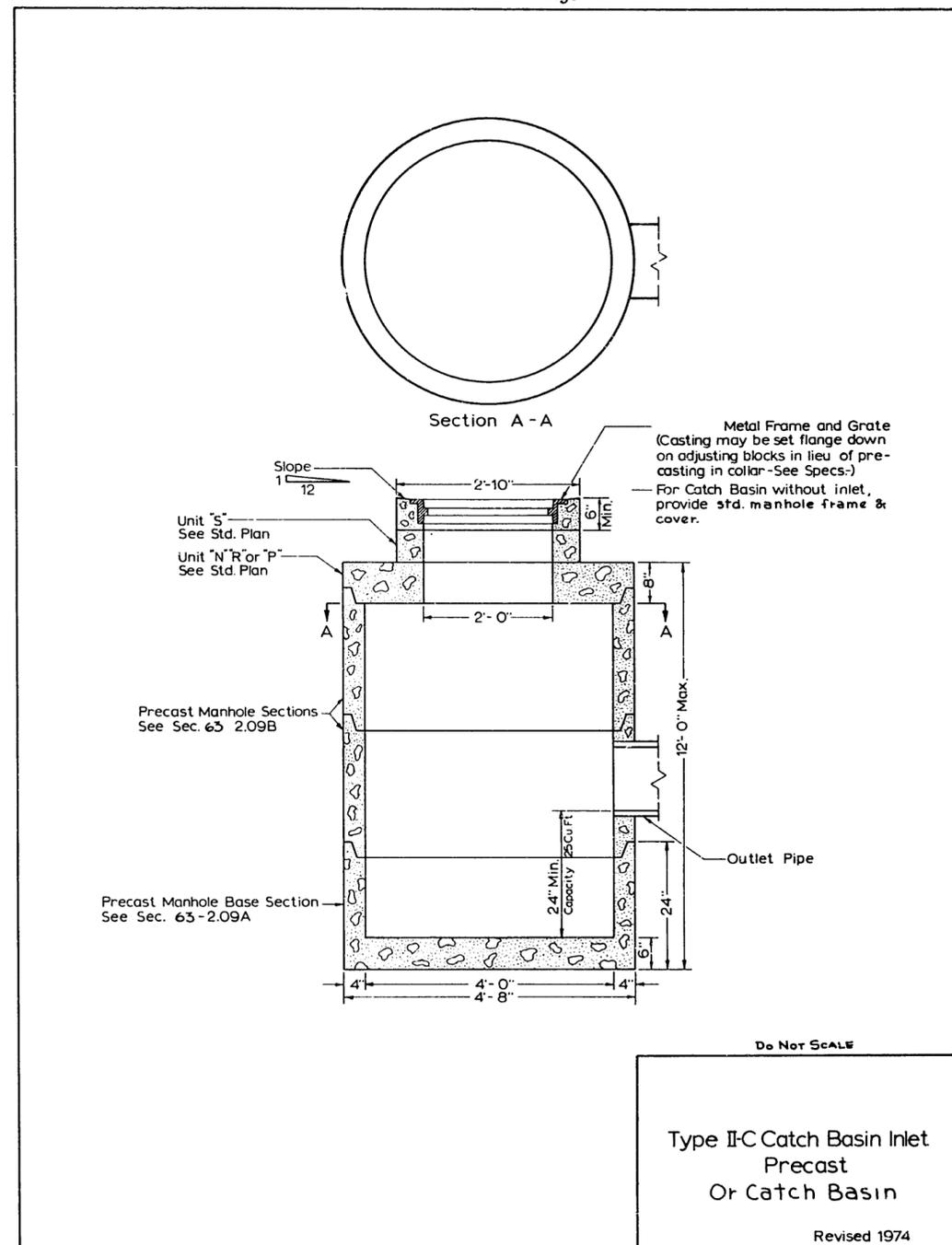
Standard Drawings



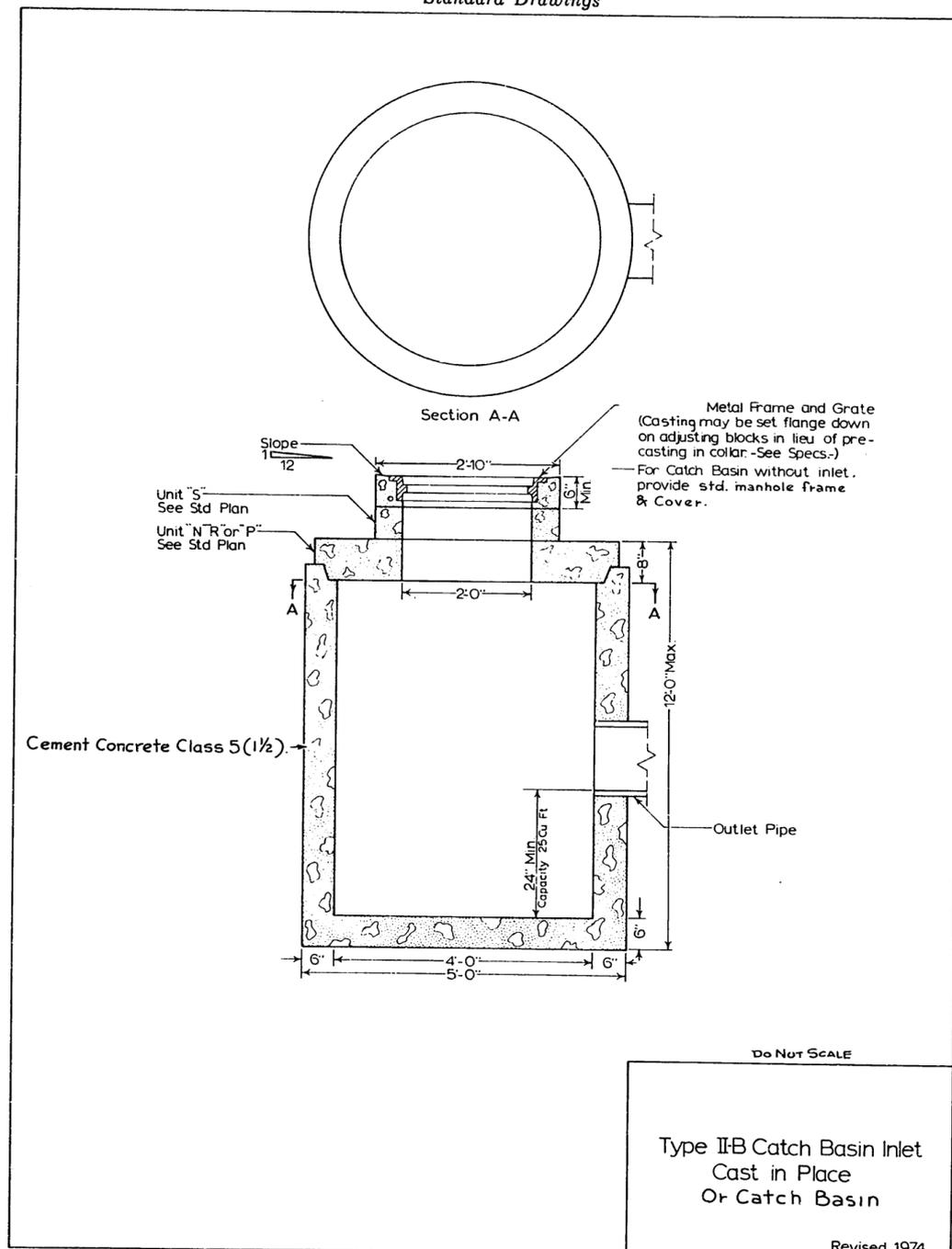
Standard Drawings



Standard Drawings



Standard Drawings

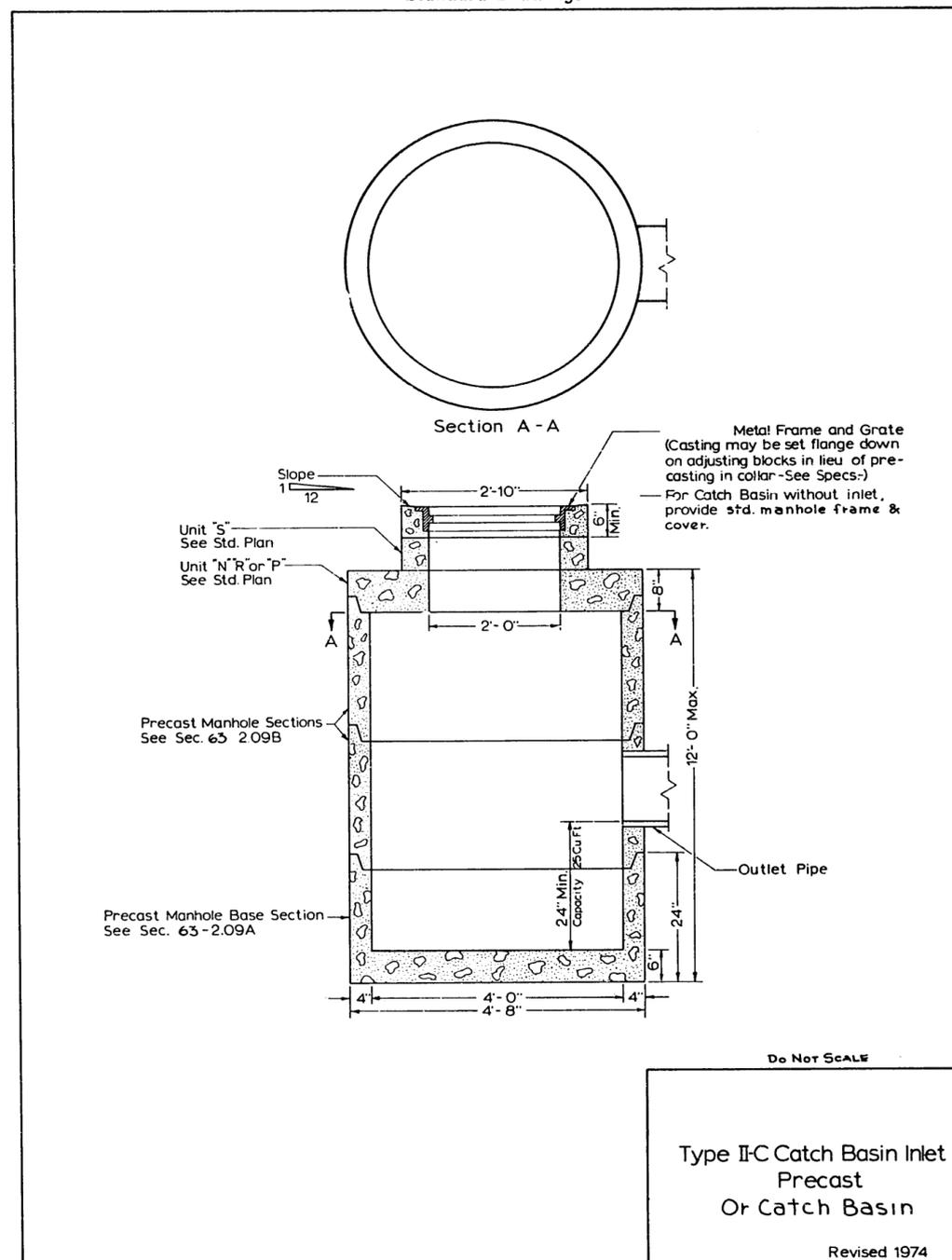


Type IIB Catch Basin Inlet
Cast in Place
Or Catch Basin

Revised 1974

Standard Plan No. 54

Standard Drawings



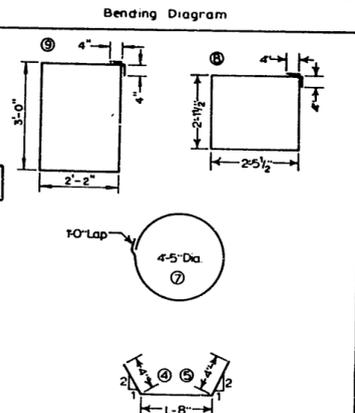
Type IIC Catch Basin Inlet
Precast
Or Catch Basin

Revised 1974

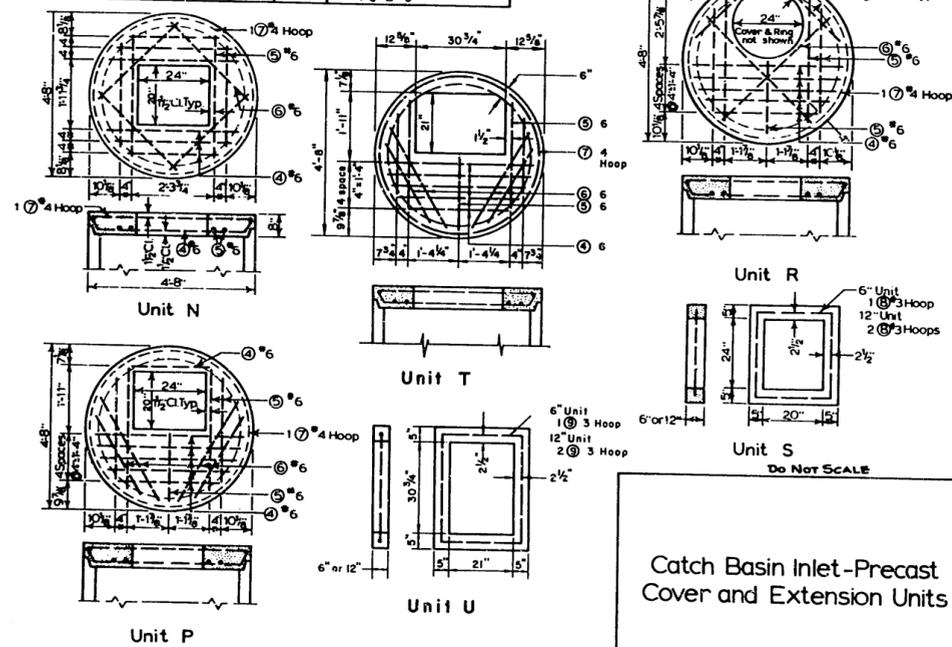
Standard Plan No. 55

Standard Drawings

Bar List					Bending Diagram	
All dimensions are out to out						
Mark	Location	No	Size	Length		
4	Cover Slab Unit N Bottom-Long	6	6	Var.	L:2ea @ 4-5; 4-1' & 3-6"	
5	Cover Slab Unit N Bottom-Transv.	4	6	Var.	L:2ea @ 4-2' & 3-8"	
6	Cover Slab Unit N Bottom-Diag.	4	6	3-2'	Str.	
7	Cover Slab Unit N Top	1	4	14-11"		
4	Cover Slab Unit P Bottom-Long	6	6	Var.	L:2 @ 4-9; 1ea @ 4-7; 4-3; 3-9; & 3-0"	
5	Cover Slab Unit P Bottom-Transv.	5	6	Var.	L:2ea @ 4-2; & 3-8; 1 @ 2-9"	
6	Cover Slab Unit P Bottom-Diag.	4	6	Var.	Str. 2ea @ 3-9; & 3-2"	
7	Cover Slab Unit P Top	1	4	14-11"		
4	Cover Slab Unit R Bottom-Long	5	6	Var.	L:1ea @ 4-9; 4-8; 4-6; 4-1' & 3-7"	
5	Cover Slab Unit R Bottom-Transv.	5	6	Var.	L:2ea @ 4-2; 3-8; 1 @ 2-5"	
6	Cover Slab Unit R Bottom-Diag.	4	6	Var.	Str. 2ea @ 4-4; & 2-5"	
7	Cover Slab Unit R Top	1	4	14-11"		
8	Unit S	2	3	9-10"		
4	Cover Slab Unit T Bottom-Long	5	6	Var.	L: 2 @ 4'-9" & 1ea @ 4'-7"; 4'-3"; 3'-9"	
9	Unit U	2	3	11'-0"		
5	Cover Slab Unit T Bottom-Transv.	5	6	Var.	L: 2 ea. @ 3'-8"; 2'-10" & 1 @ 2'-9"	



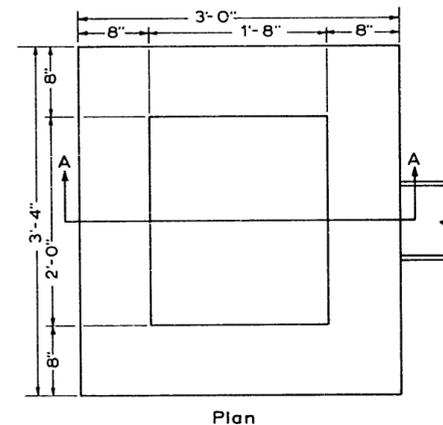
All steel to be deformed bars conforming to ASTM-A15 and shall have a minimum cover of 2".



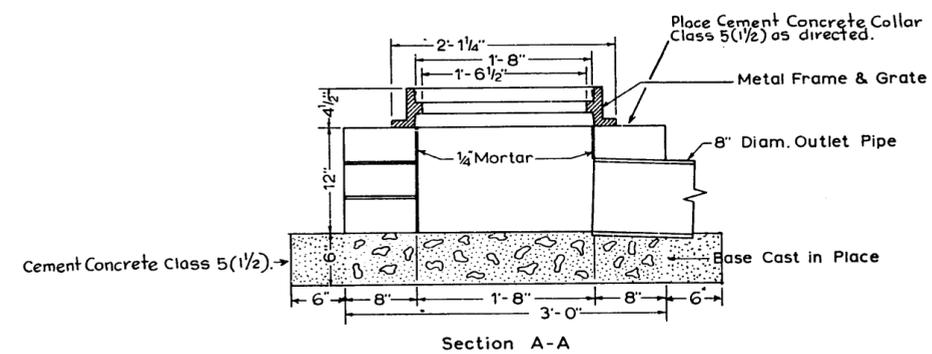
Catch Basin Inlet-Pre-cast Cover and Extension Units

Standard Plan No. 56

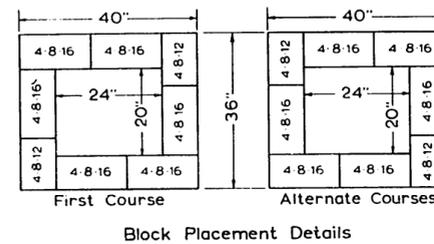
Standard Drawings



Plan



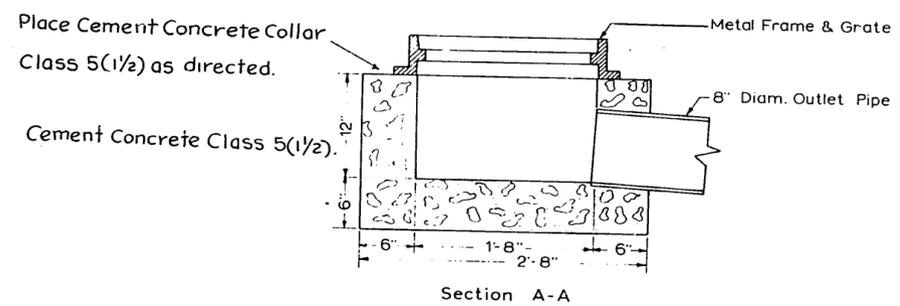
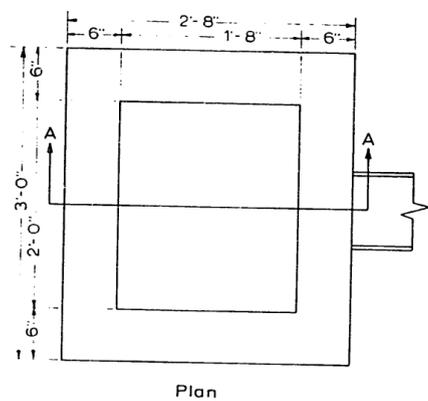
Section A-A



Block Placement Details

Do Not Scale
Type IV-A Curb Inlet
Masonry Construction

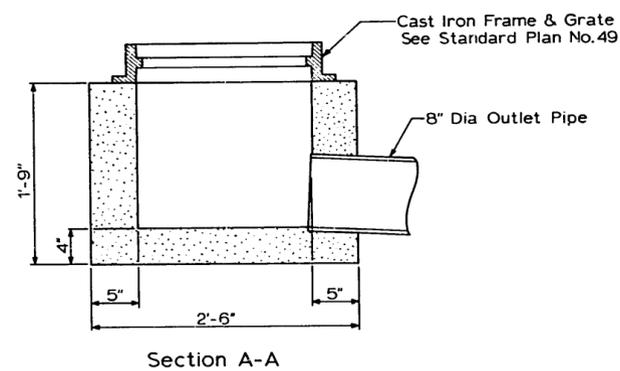
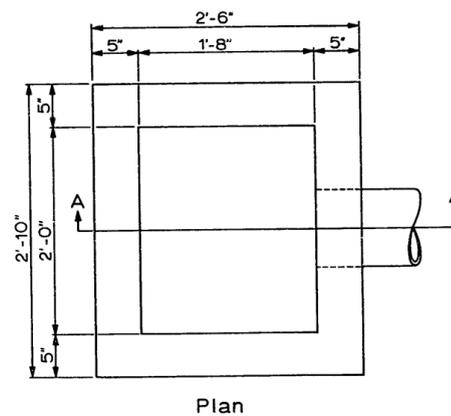
Standard Plan No. 57



Do Not Scale

Type IV-B Curb Inlet
Cast in Place

Standard Plan No. 58



Do Not Scale

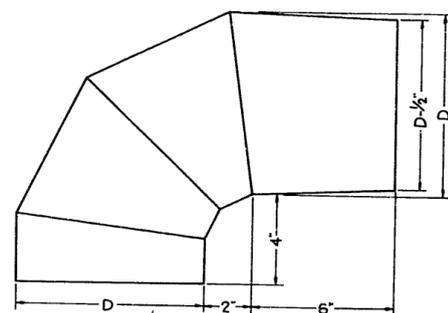
Type IV-C Curb Inlet
Precast

Revised 1974

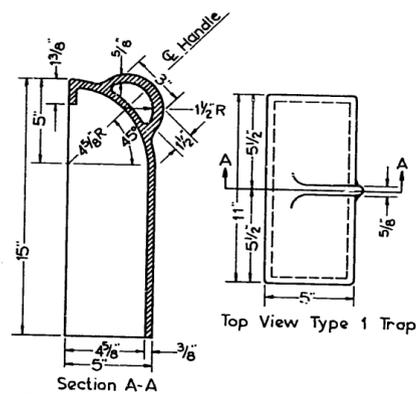
Standard Plan No. 59

NOTE:

Trap to be made of 22 Ga. Galvanized sheet metal.
All joints to be seamed and soldered.
All longitudinal joints to be riveted.
Dimension "D" is nominal diameter of outlet pipe.

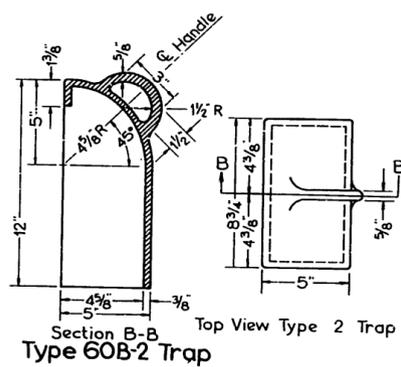


Type 60A Trap

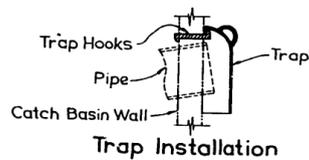


Type 60B-1 Trap

Trap Hook
Trap Hooks may be round or square in cross-section.



Type 60B-2 Trap

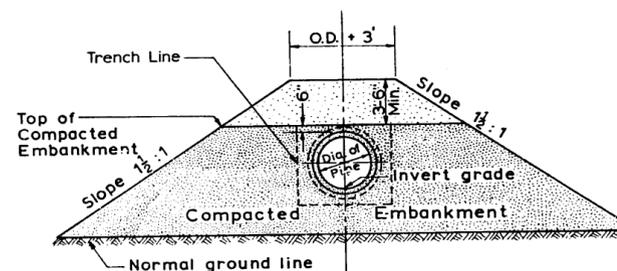


Trap Installation

Type 60B-1 Trap to be used with 8" I.D. Outlet Pipe.

Type 60B-2 Trap to be used with 4" or 6" I.D. Outlet Pipe.
Trap may be Cast Iron ASTM Designation A48 Class 25 or Cast Steel ASTM Designation A27 Grade 70-36.

Type 60A and Type 60B Outlet Trap

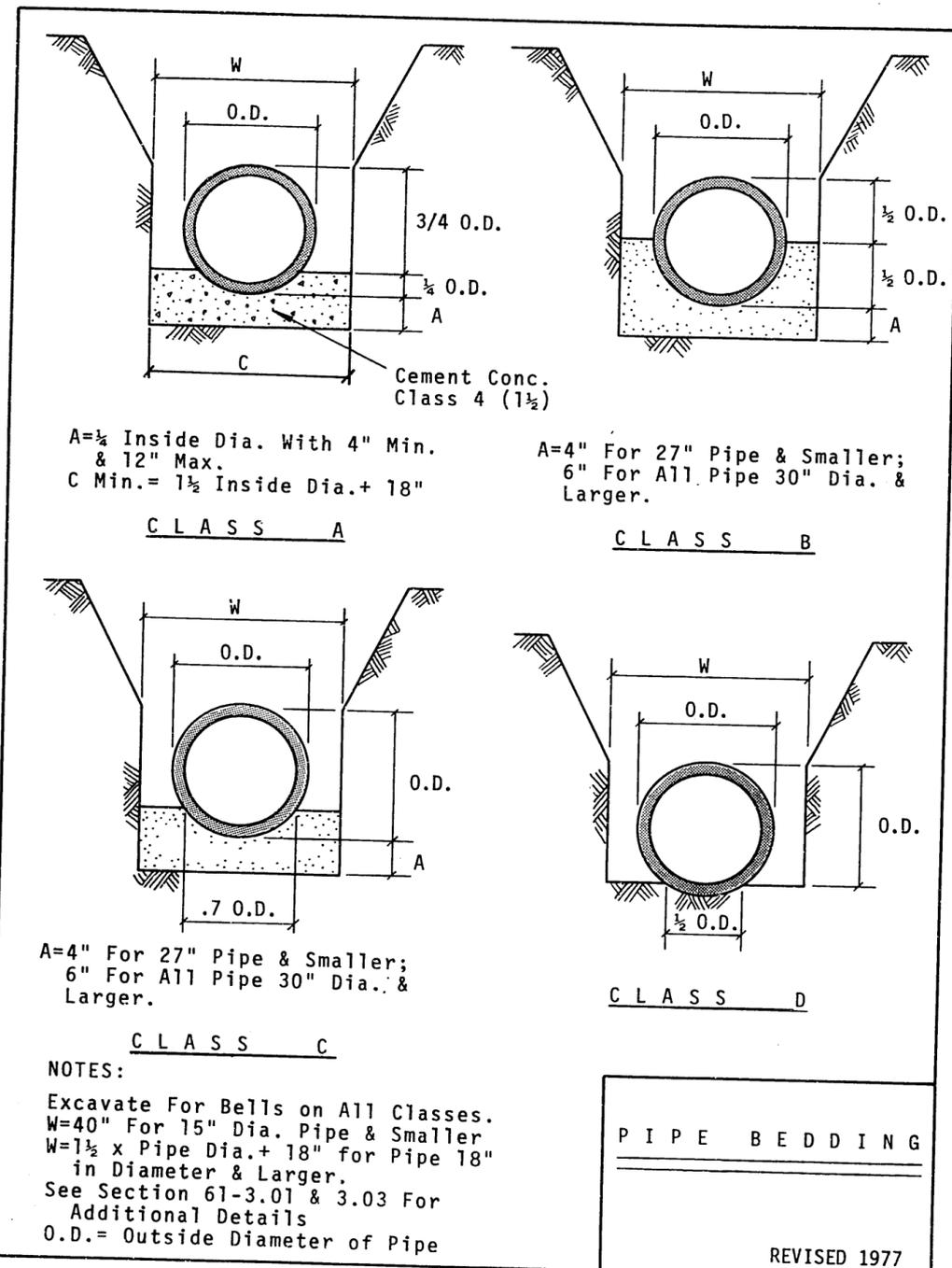


Note:
Normal ground line and depth of compacted embankment shall be determined by the City Engineer. After compaction of the embankment, a trench shall be excavated and the pipe installed as per specification.

DO NOT SCALE

Embankment
Sewer Construction Details

Revised 1974



A = 1/2 Inside Dia. With 4" Min. & 12" Max.
C Min. = 1 1/2 Inside Dia. + 18"

A = 4" For 27" Pipe & Smaller;
6" For All Pipe 30" Dia. & Larger.

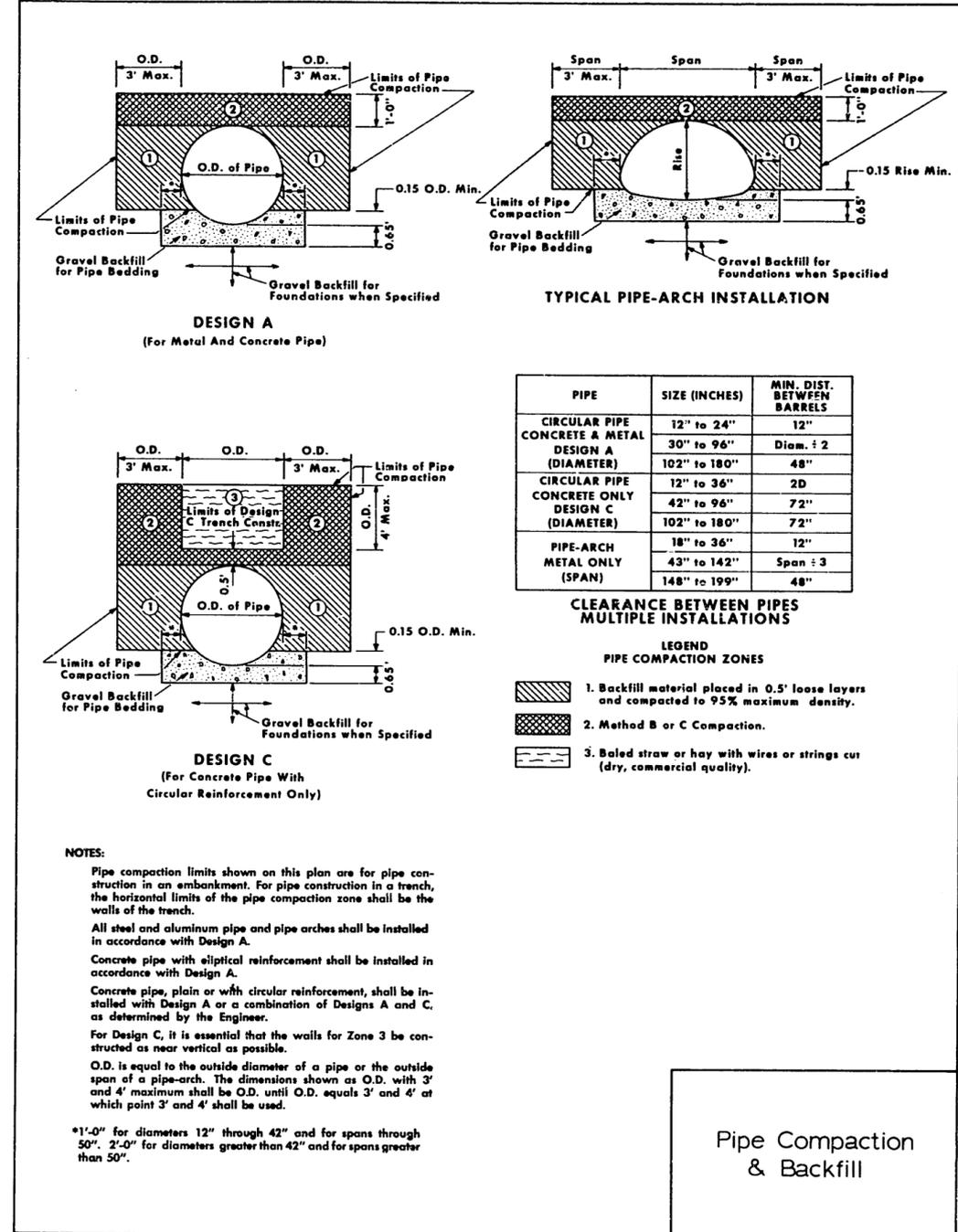
A = 4" For 27" Pipe & Smaller;
6" For All Pipe 30" Dia. & Larger.

NOTES:
Excavate For Bells on All Classes.
W = 40" For 15" Dia. Pipe & Smaller
W = 1 1/2 x Pipe Dia. + 18" for Pipe 18" in Diameter & Larger.
See Section 61-3.01 & 3.03 For Additional Details
O.D. = Outside Diameter of Pipe

PIPE BEDDING

REVISED 1977

Standard Plan No. 62



PIPE	SIZE (INCHES)	MIN. DIST. BETWEEN BARRELS
CIRCULAR PIPE	12" to 24"	12"
CONCRETE & METAL DESIGN A (DIAMETER)	30" to 96"	Diam. + 2
CIRCULAR PIPE CONCRETE ONLY DESIGN C (DIAMETER)	12" to 36"	2D
	42" to 96"	72"
PIPE-ARCH METAL ONLY (SPAN)	102" to 180"	72"
	18" to 36"	12"
	43" to 142"	Span ÷ 3
	148" to 199"	48"

CLEARANCE BETWEEN PIPES
MULTIPLE INSTALLATIONS

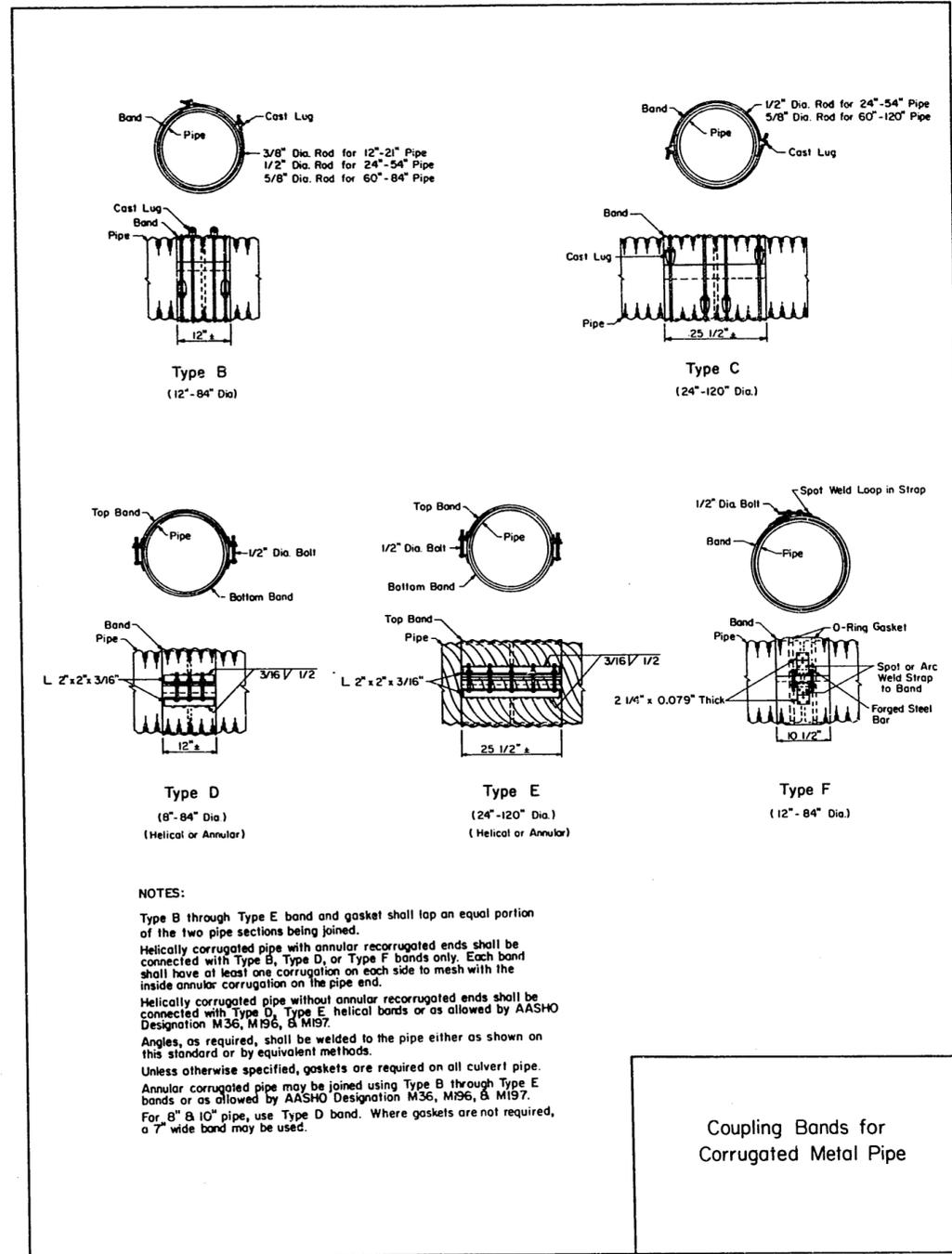
- LEGEND
PIPE COMPACTION ZONES
- 1. Backfill material placed in 0.5' loose layers and compacted to 95% maximum density.
 - 2. Method B or C Compaction.
 - 3. Baled straw or hay with wires or strings cut (dry, commercial quality).

NOTES:
Pipe compaction limits shown on this plan are for pipe construction in an embankment. For pipe construction in a trench, the horizontal limits of the pipe compaction zone shall be the walls of the trench.
All steel and aluminum pipe and pipe arches shall be installed in accordance with Design A.
Concrete pipe with elliptical reinforcement shall be installed in accordance with Design A.
Concrete pipe, plain or with circular reinforcement, shall be installed with Design A or a combination of Designs A and C, as determined by the Engineer.
For Design C, it is essential that the walls for Zone 3 be constructed as near vertical as possible.
O.D. is equal to the outside diameter of a pipe or the outside span of a pipe-arch. The dimensions shown as O.D. with 3' and 4' maximum shall be O.D. until O.D. equals 3' and 4' at which point 3' and 4' shall be used.
*1'-0" for diameters 12" through 42" and for spans through 50". 2'-0" for diameters greater than 42" and for spans greater than 50".

Pipe Compaction & Backfill

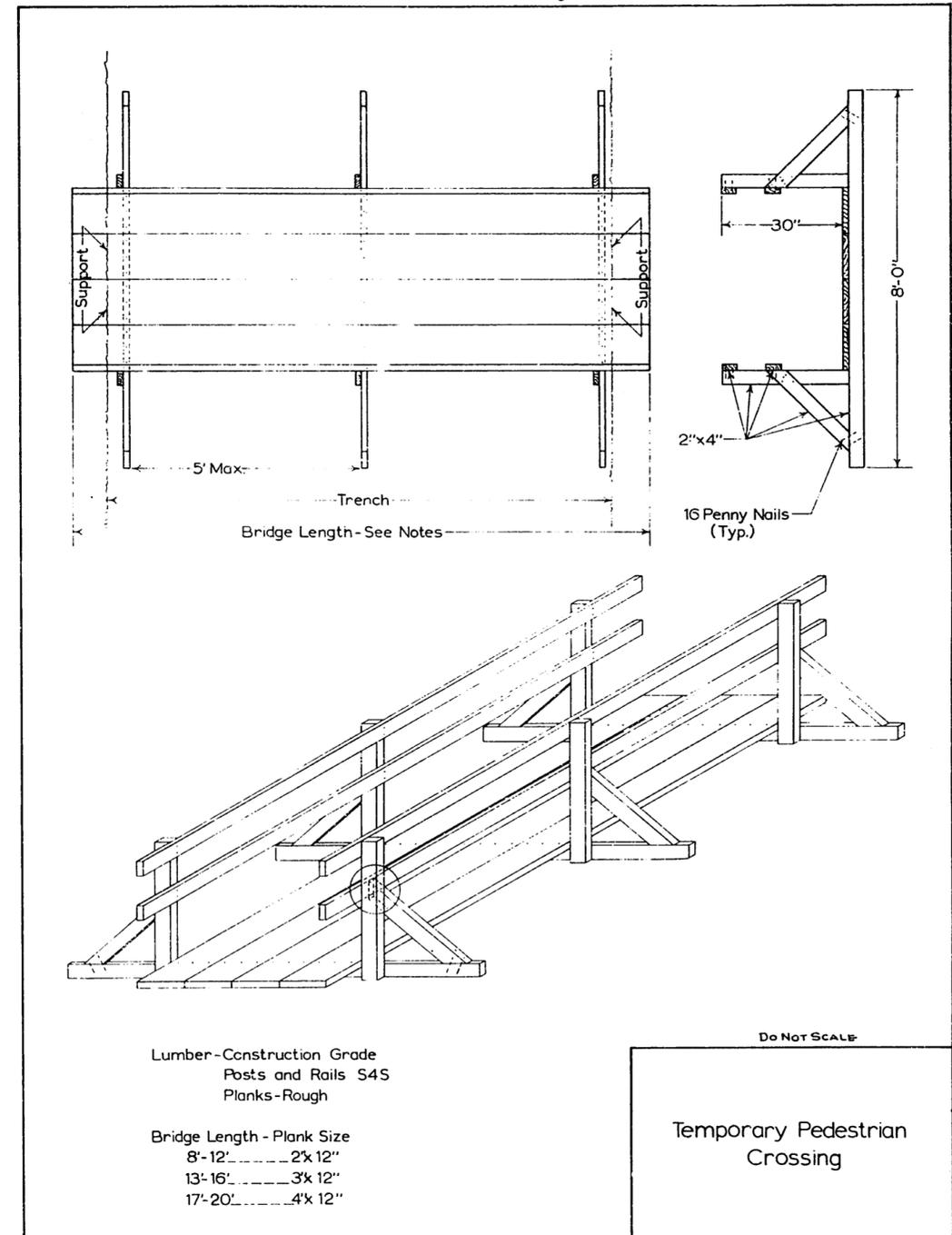
Standard Plan No. 62A

Standard Drawings



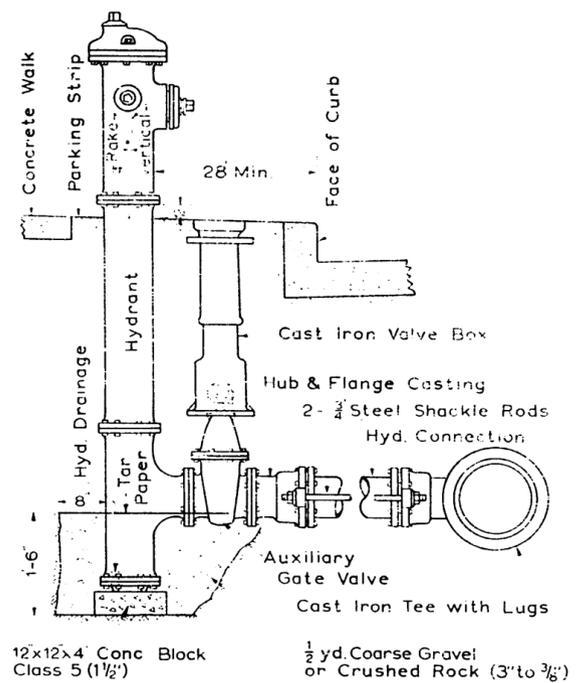
Standard Plan No. 62B

Standard Drawings



Standard Plan No. 63

Standard Drawings

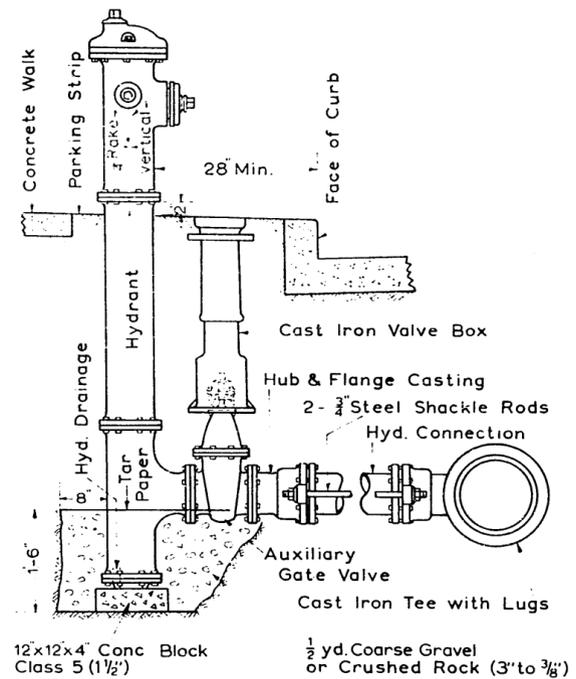


Do NOT SCALE

Hydrant Setting, Type A

Standard Plan No. 64

Standard Drawings

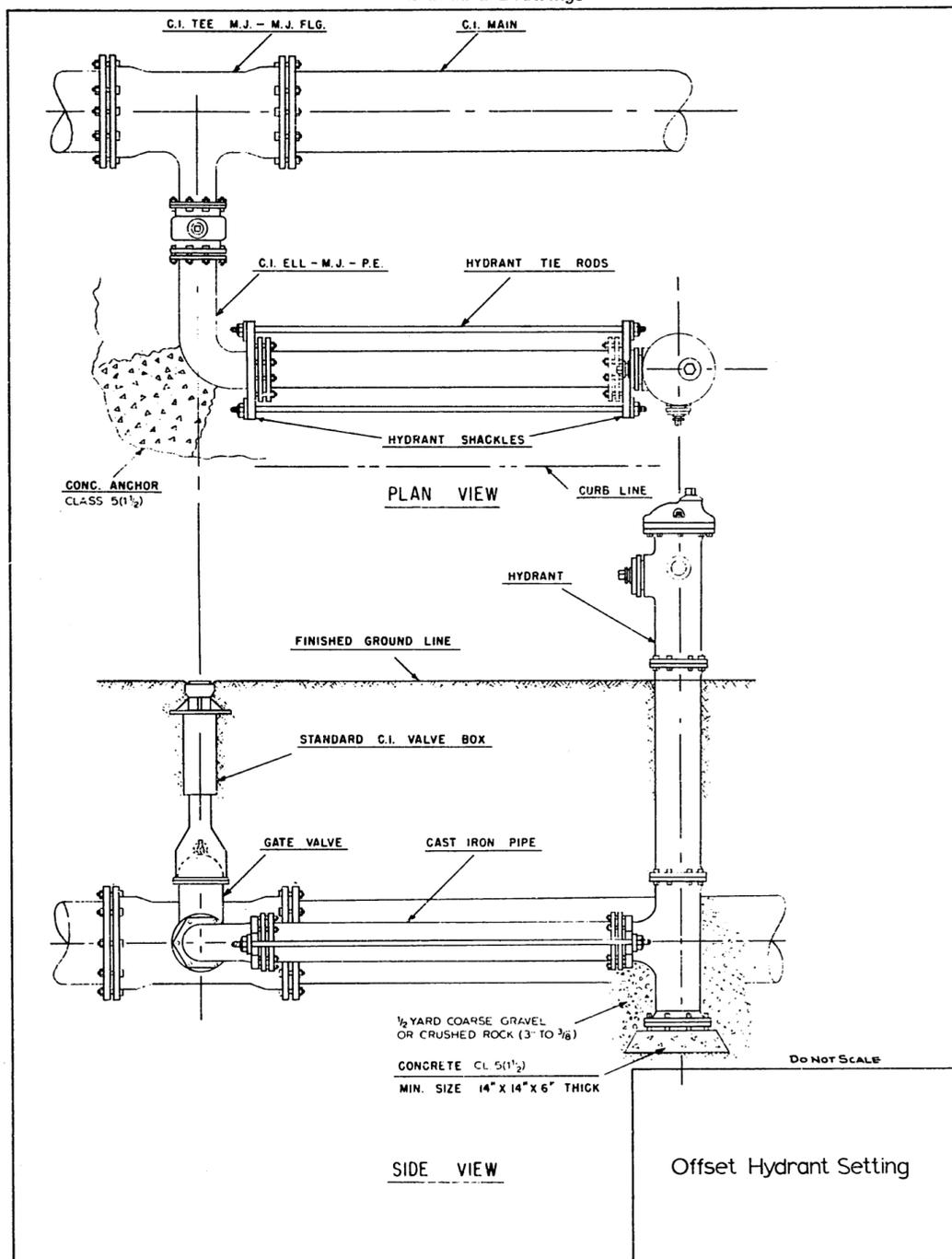


Do NOT SCALE

Hydrant Setting, Type B

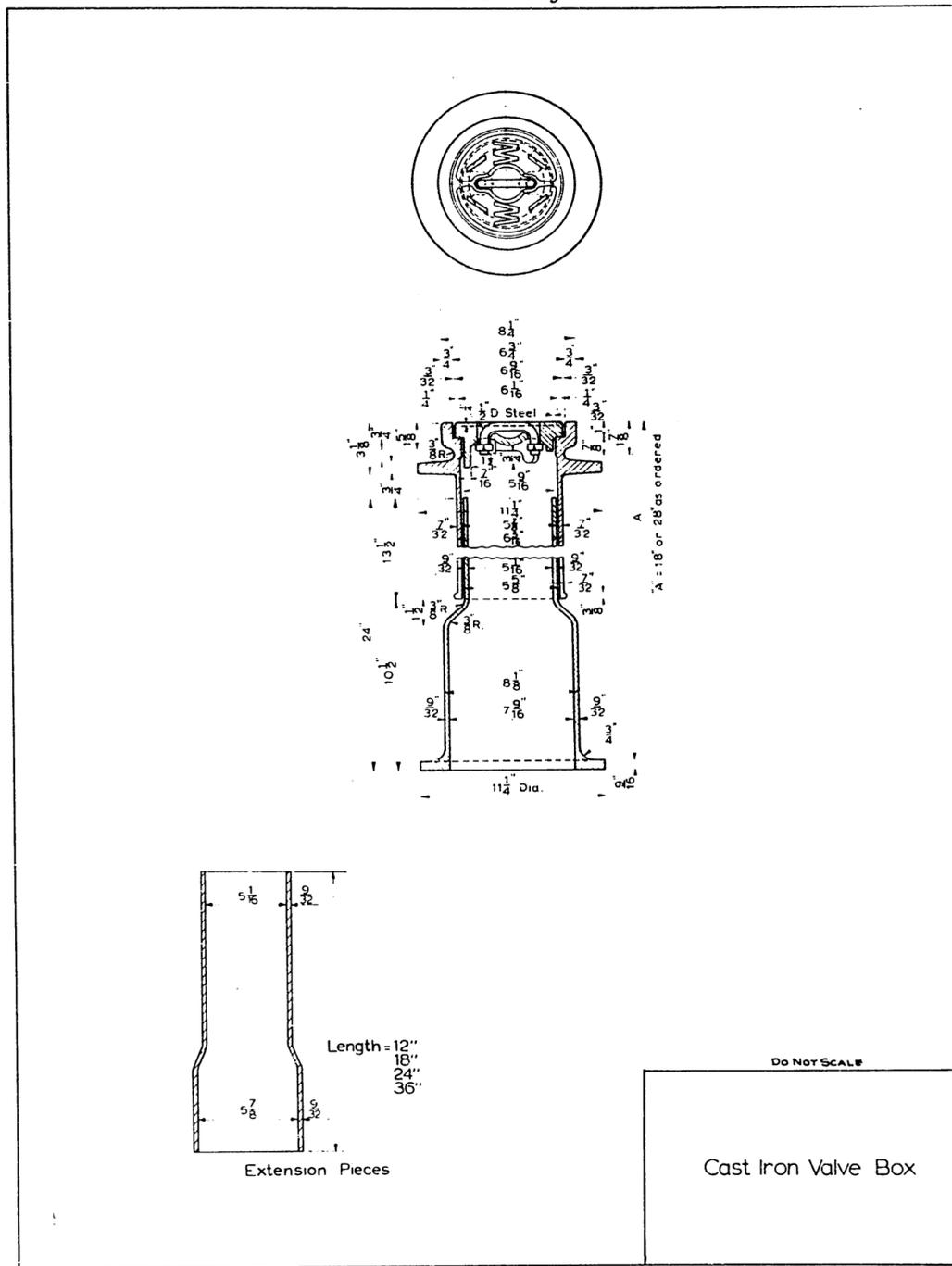
Standard Plan No. 65

Standard Drawings



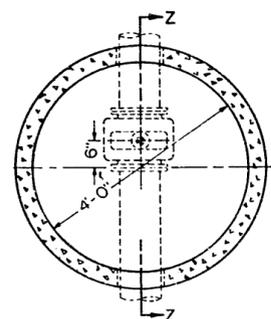
Standard Plan No.66

Standard Drawings



Standard Plan No.67

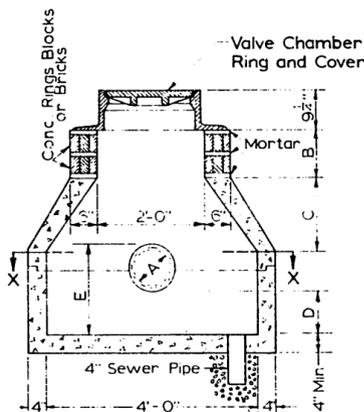
Standard Drawings



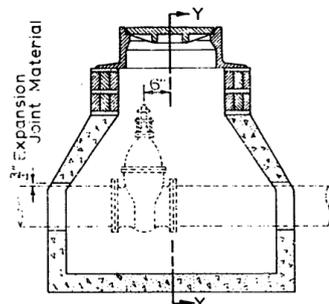
Section X-X

GENERAL NOTES

Valve Chamber Ring & Cover Standard Plan No. 43
 Concrete-Compressive strength 3,000 psi at 28 days
 Gravel Drain $\frac{1}{2}$ Cu. Yd. Gravel (3" to $\frac{3}{8}$ ")



Section Y-Y



Section Z-Z

When "A"-Pipe Dia. is 4", 6", or 8"
 "B"= 3" Min.
 "C"= 1'-4" Max.
 "D"= 10" Min.
 "E"= 1'-9" Max.

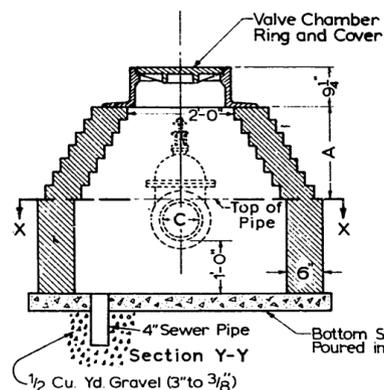
When "A"-Pipe Dia. is 12"
 "B"= 11" Min.
 "C"= 2'-1" Max.
 "D"= 12" Min.
 "E"= 2'-3" Max.

Do Not Scale

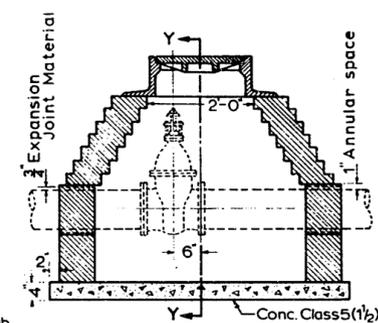
Valve Chamber, Standard
 Precast

Standard Plan No. 68

Standard Drawings



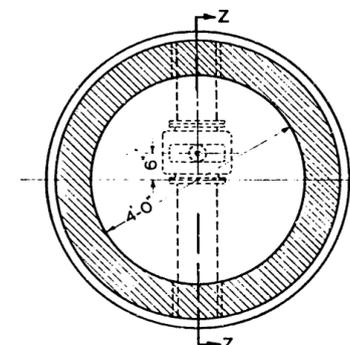
When C= 8" A= 21", not less
 " C= 12" A= 29", " "



Section Z-Z

GENERAL NOTES

Bottom Slab Class 5 (1 $\frac{1}{2}$ ") Concrete
 Valve Chamber Ring & Cover Standard Plan No. 43.
 Construction Alternates Precast Concrete (Plan No. 68).
 Cast in Place Concrete, Class 5 (1 $\frac{1}{2}$)
 Solid Concrete Blocks
 Gravel Drain $\frac{1}{2}$ Cu. Yd. Gravel (3" to $\frac{3}{8}$ ")

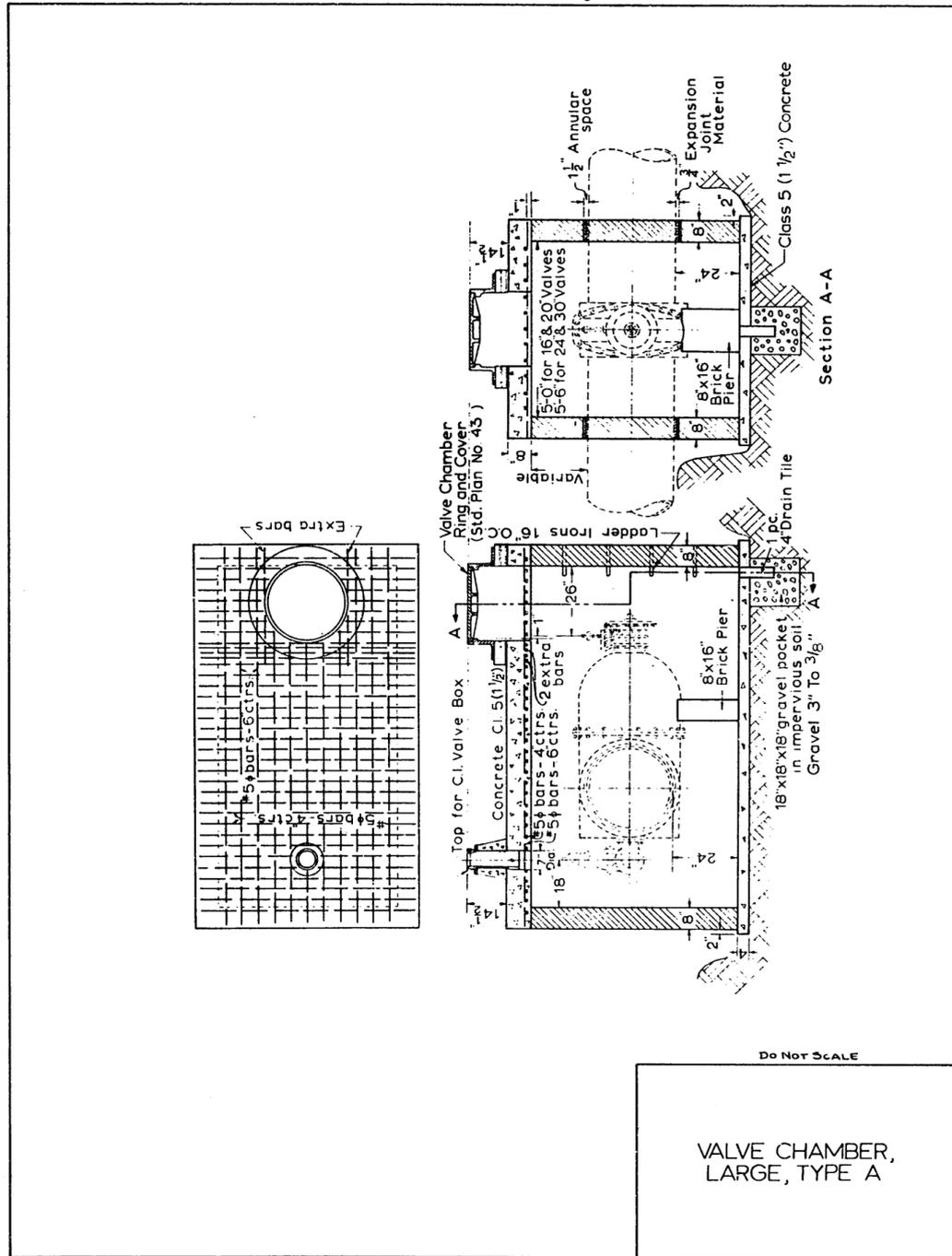


Section X-X

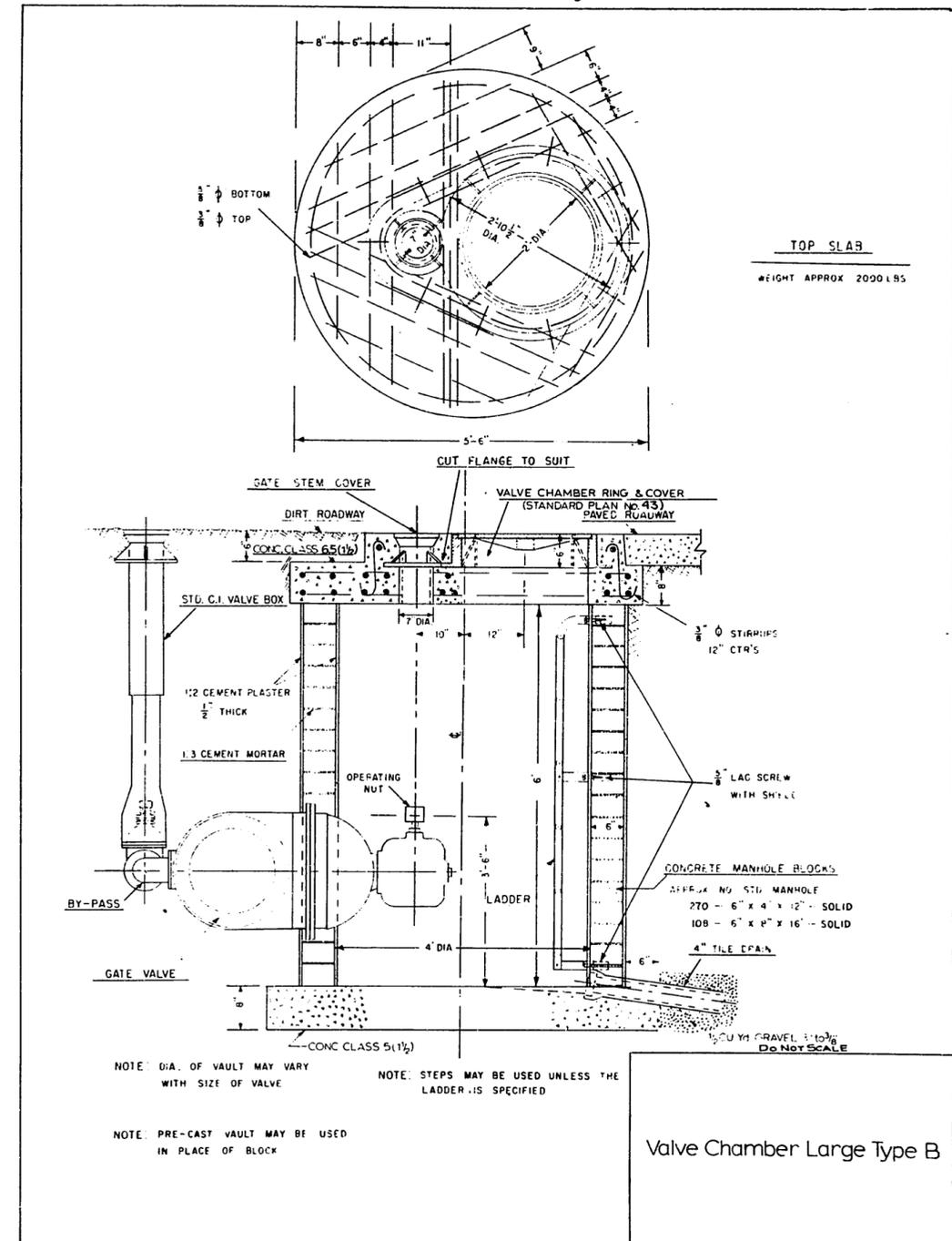
Do Not Scale

Valve Chamber, Standard
 Masonry Construction

Standard Plan No. 69



Standard Plan No. 70



Standard Plan No. 71

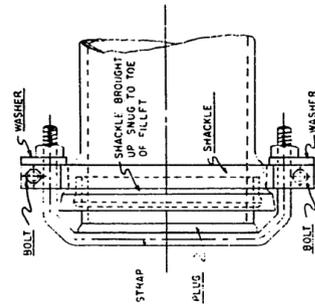
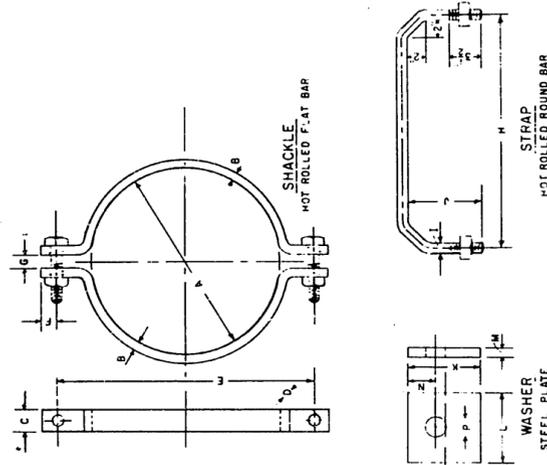


TABLE OF DIMENSIONS

SIZE OF PIPE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	BOLT	
4"	7 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	7	2 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1" x 3"
6"	9 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	9	3 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	1 1/2" x 4"
8"	11 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	11	4 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	2" x 4"
10"	14	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	13	5 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	2 1/2" x 5"
12"	16 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	15	6 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	3" x 5"
14"	18 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	17	7 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	3 1/2" x 6"
16"	21 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	19	8 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	4" x 6"
18"	24 1/2	8 1/2	8 1/2	8 1/2	8 1/2	8 1/2	8 1/2	8 1/2	8 1/2	21	9 1/2	8 1/2	8 1/2	8 1/2	8 1/2	8 1/2	4 1/2" x 7"
20"	27 1/2	9 1/2	9 1/2	9 1/2	9 1/2	9 1/2	9 1/2	9 1/2	9 1/2	23	10 1/2	9 1/2	9 1/2	9 1/2	9 1/2	9 1/2	5" x 7"



Plug and Shackle for Cast Iron Watermain

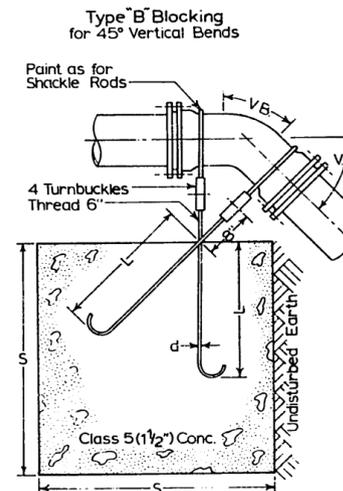
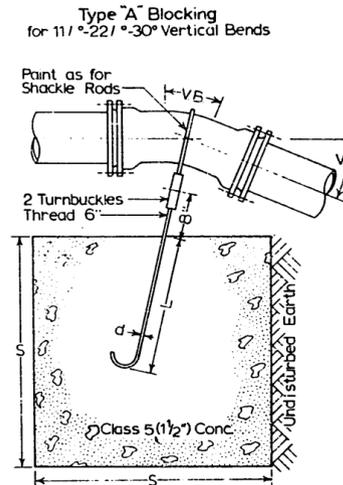
Standard Plan No. 72

Type "A" Blocking for 11 1/2"-22 1/2"-30" Vertical Bends

Pipe Size Norm. Diameter-inches	Test Pressure psi	VB Vertical Bend Degrees	No. of cu ft. of Conc. Blocking	S Side of Cube feet	d Diameter of Shackle Rods (2) inches	L Depth of Rods in Concrete feet
4"	300	11 1/2	8	2	5/8	15
		22 1/2	11	22		20
		30	17	26		
6"	300	11 1/2	11	22	5/8	20
		22 1/2	25	29		
		30	41	35		
8"	300	11 1/2	16	25	5/8	20
		22 1/2	47	35		
		30	70	41		
12"	250	11 1/2	32	32	5/8	20
		22 1/2	88	45	7/8	30
		30	132	51		
16"	225	11 1/2	70	41	7/8	30
		22 1/2	184	57	1 1/8	40
		30	275	65	1 1/4	
20"	200	11 1/2	91	45	7/8	30
		22 1/2	225	61	1 1/2	40
		30	330	69	1 3/8	45
24"	200	11 1/2	128	50	1"	35
		22 1/2	320	68	1 1/8	45
		30	480	79	1 3/8	5.5

Type "B" Blocking for 45° Vertical Bends

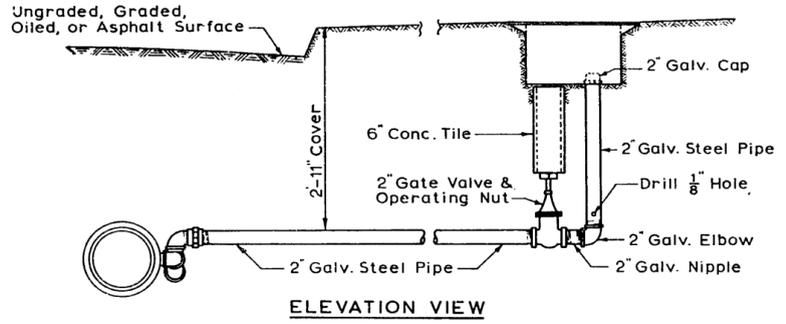
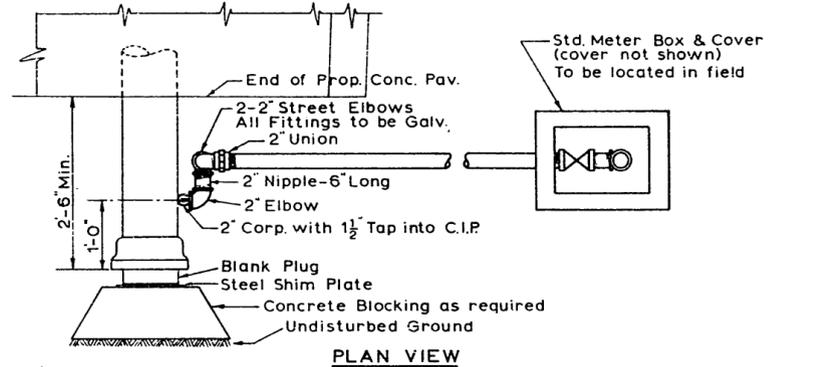
Pipe Size Norm. Diameter-inches	Test Pressure psi	VB Vertical Bend Degrees	No. of cu ft. of Conc. Blocking	S Side of Cube feet	d Diameter of Shackle Rods (4) inches	L Depth of Rods in Concrete feet
4"	300	45	30	3.1	5/8	20
6"	300		68	4.1		
12"	250		123	5.0		
16"	225		232	6.1	3/4	25
20"	200		478	7.8	1 1/8	40
24"	200		560	8.2	1 1/4	
			820	9.4	1 3/8	45



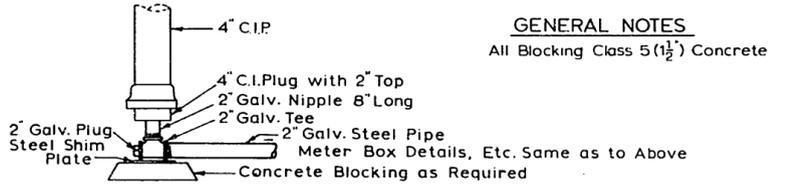
Blocking For Convex Vertical Bends

Standard Plan No. 73

Standard Drawings



2" BLOW-OFF DETAIL FOR C.I. PIPE LARGER THAN 4 INCHES



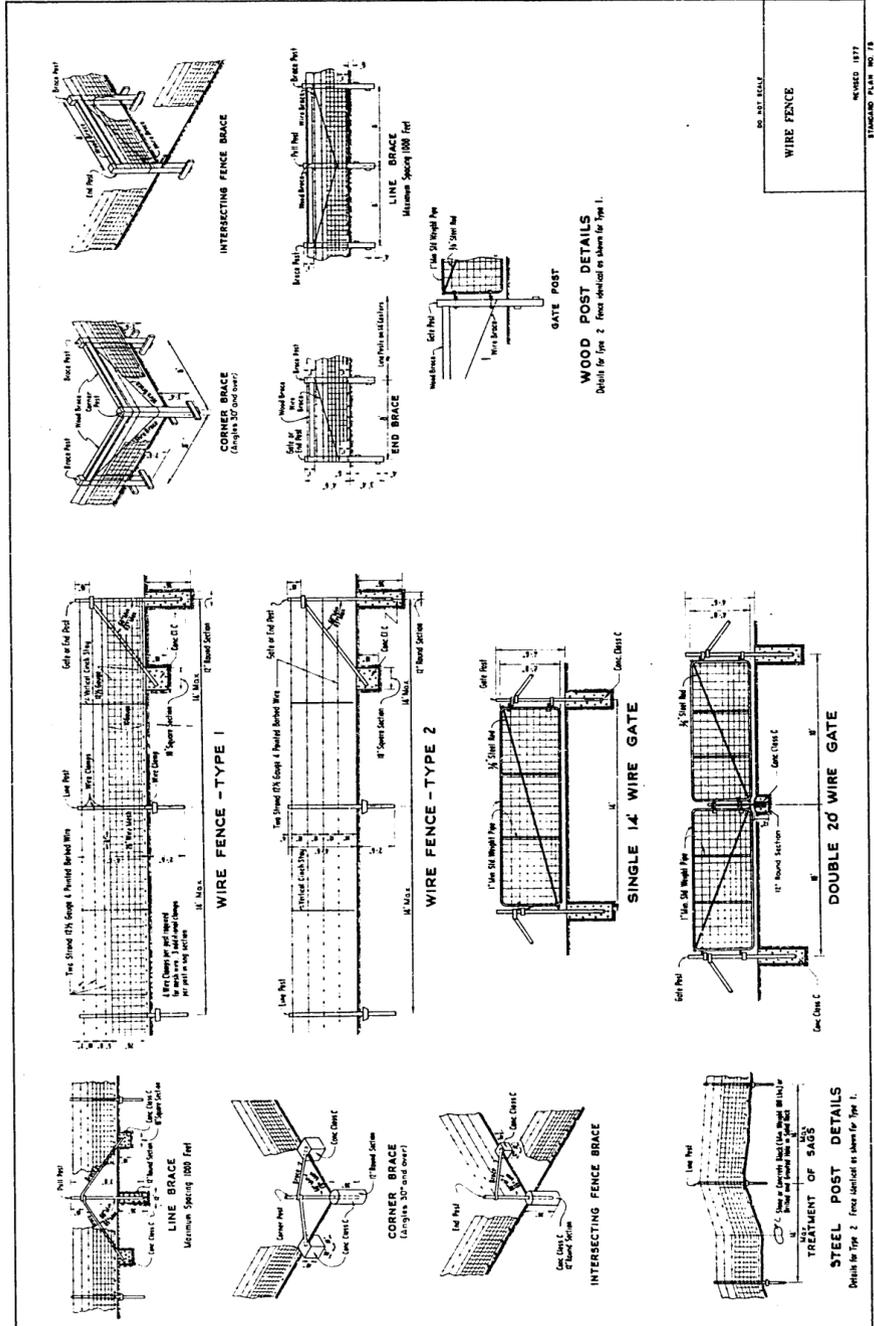
2" BLOW-OFF DETAIL FOR 4" C.I. PIPE

GENERAL NOTES
All Blocking Class 5 (1 1/2) Concrete

Do Not SCALE

2-inch Blow-off Assembly

Standard Plan No. 74



DO NOT SCALE

WIRE FENCE

STEEL POST DETAILS

Detail for Type 2 fence specified as shown for Type 1.

CHAIN LINK FENCE TYPE 1

CHAIN LINK FENCE TYPE 2 & 3

CHAIN LINK FENCE TYPE 4 & 5

CHAIN LINK FENCE TYPE 6

TYPE	BRACE RAIL & TOP RAIL		LINE & BRACE POST		HINGE CORNER & PULL POST		GATE POST	
	SECTION	WGT. PER FT.	SECTION	WGT. PER FT.	SECTION	WGT. PER FT.	SECTION	WGT. PER FT.
1	1.06	1.27	1.06	1.27	1.06	1.27	1.06	1.27
2	1.06	1.27	1.06	1.27	1.06	1.27	1.06	1.27
3	1.06	1.27	1.06	1.27	1.06	1.27	1.06	1.27
4	1.06	1.27	1.06	1.27	1.06	1.27	1.06	1.27
5	1.06	1.27	1.06	1.27	1.06	1.27	1.06	1.27
6	1.06	1.27	1.06	1.27	1.06	1.27	1.06	1.27

NOTES:

1. Concrete post bases shall be concrete Class C, 12" minimum diameter.

2. All posts shall be spaced at 10' maximum intervals unless otherwise directed by the Engineer.

3. Top or bottom hinges shall be placed within the limits of the first full fabric section.

4. Hinges shall be placed within the limits of the first full fabric section.

5. Hinges shall be placed within the limits of the first full fabric section.

6. Hinges shall be placed within the limits of the first full fabric section.

ROLL FORMED SECTIONS

DO NOT SCALE

CHAIN LINK FENCE

REVISED 1977
STANDARD PLAN NO. 74

Top Hinge (180° Swing)

Bottom Hinge (180° Swing)

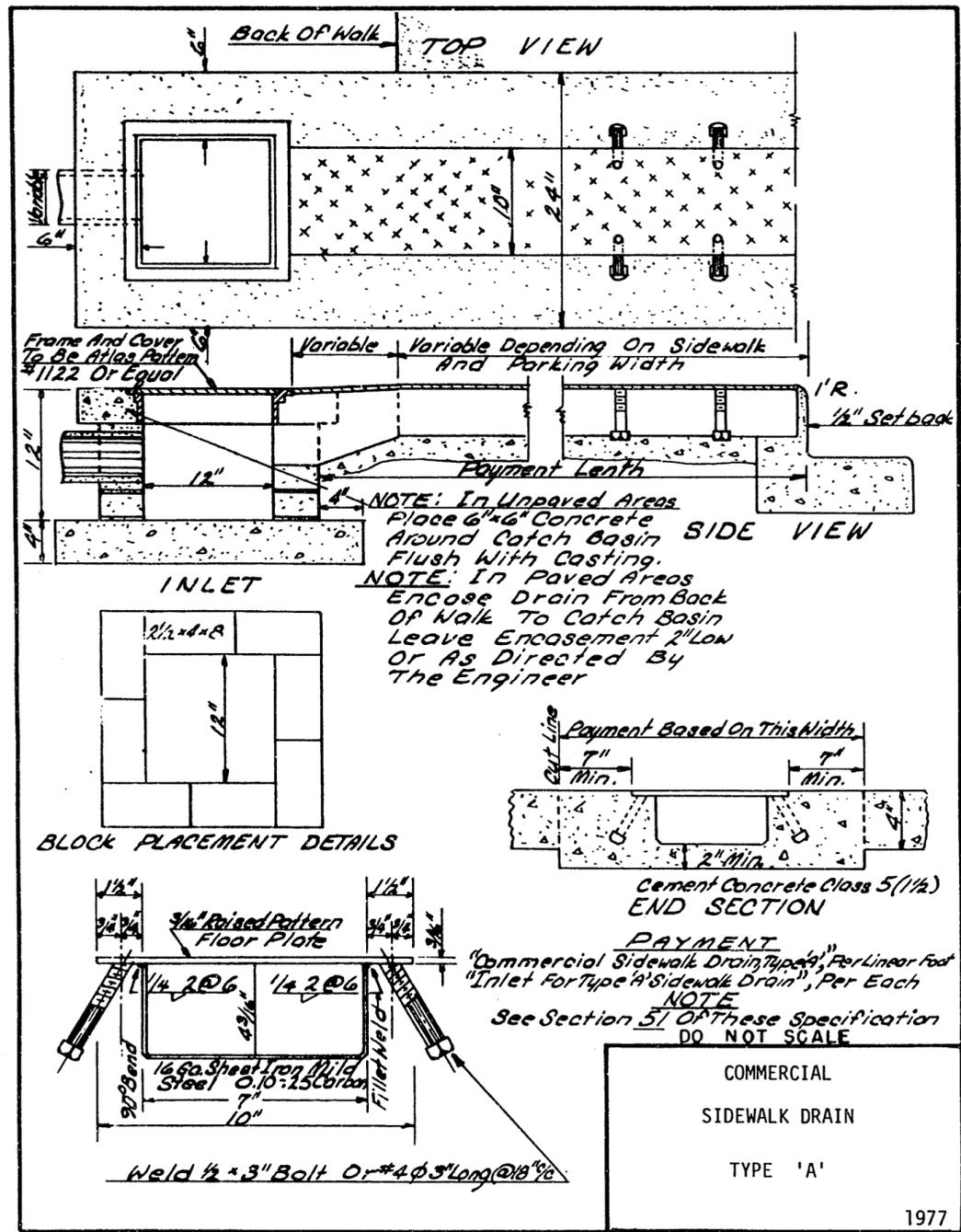
Top Hinge (90° Swing)

Bottom Hinge (90° Swing)

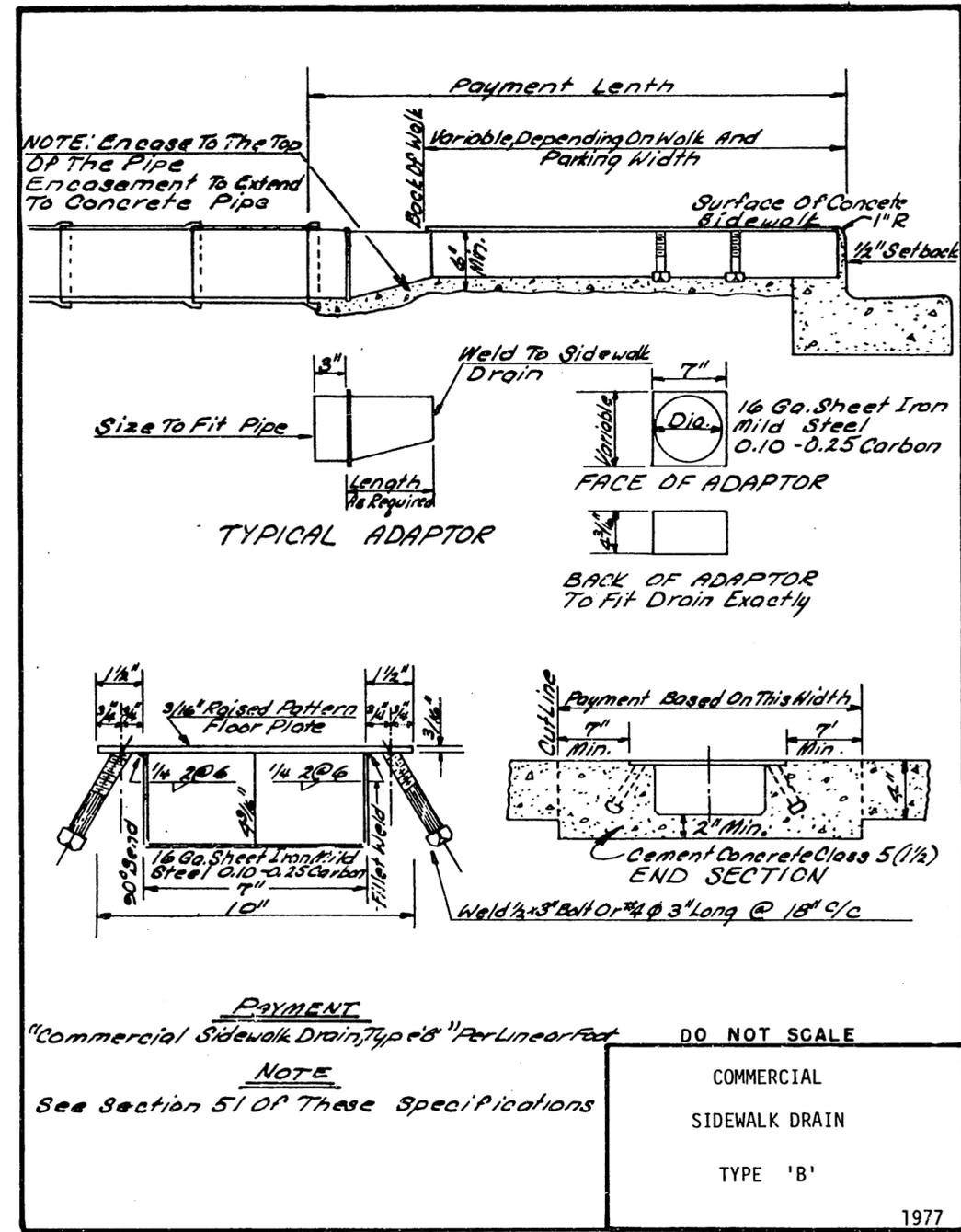
DO NOT SCALE

CHAIN LINK GATES

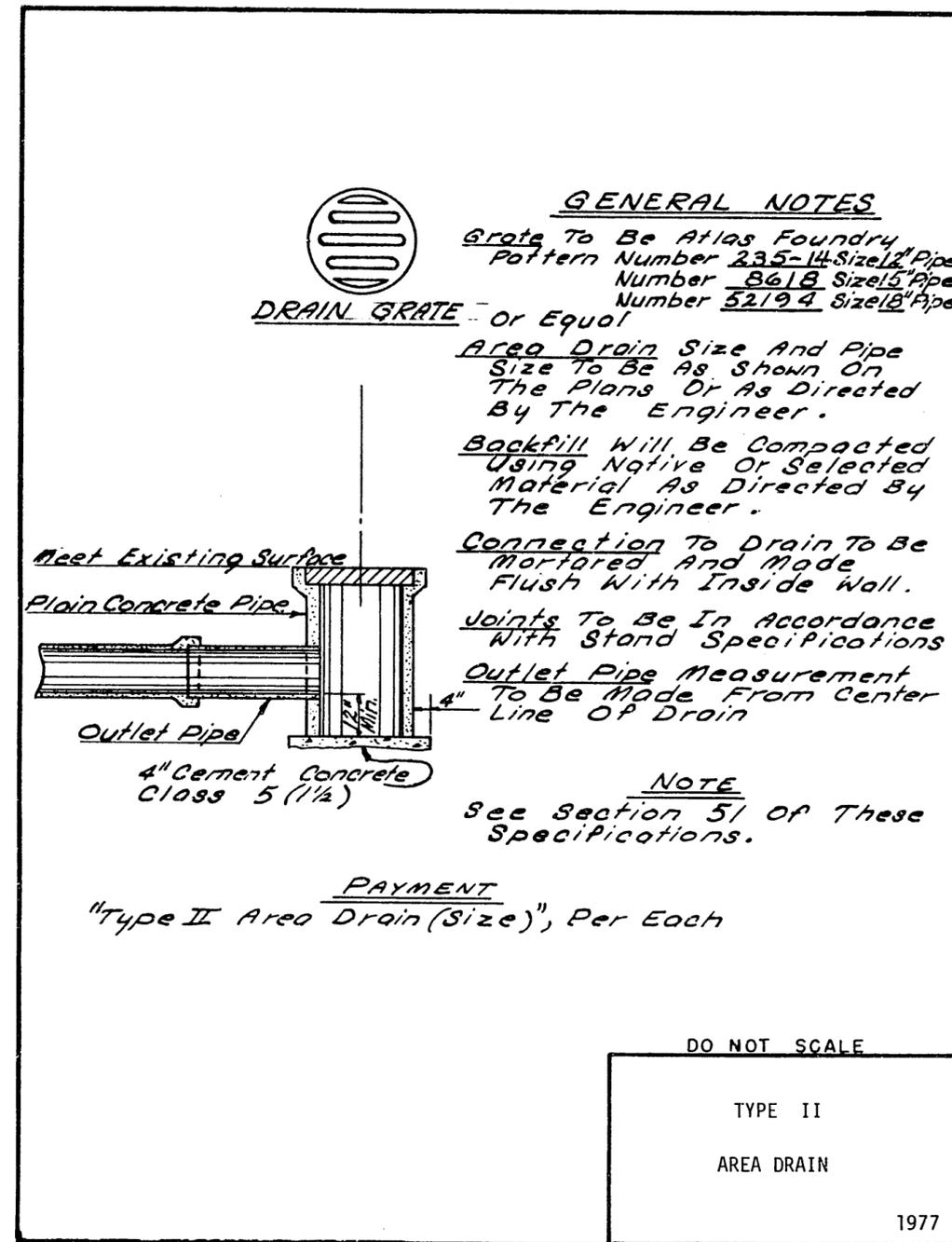
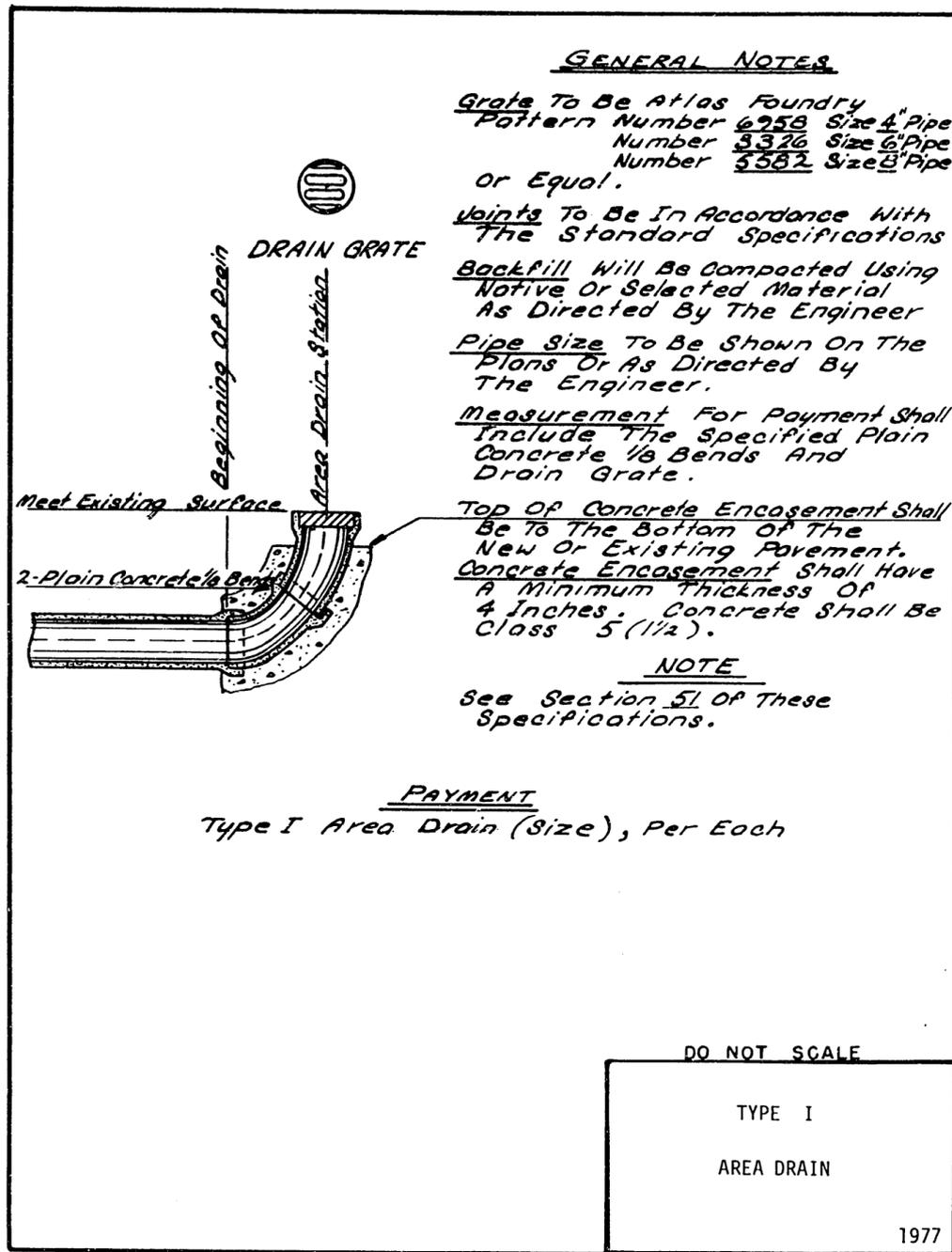
REVISED 1977
STANDARD PLAN NO. 77

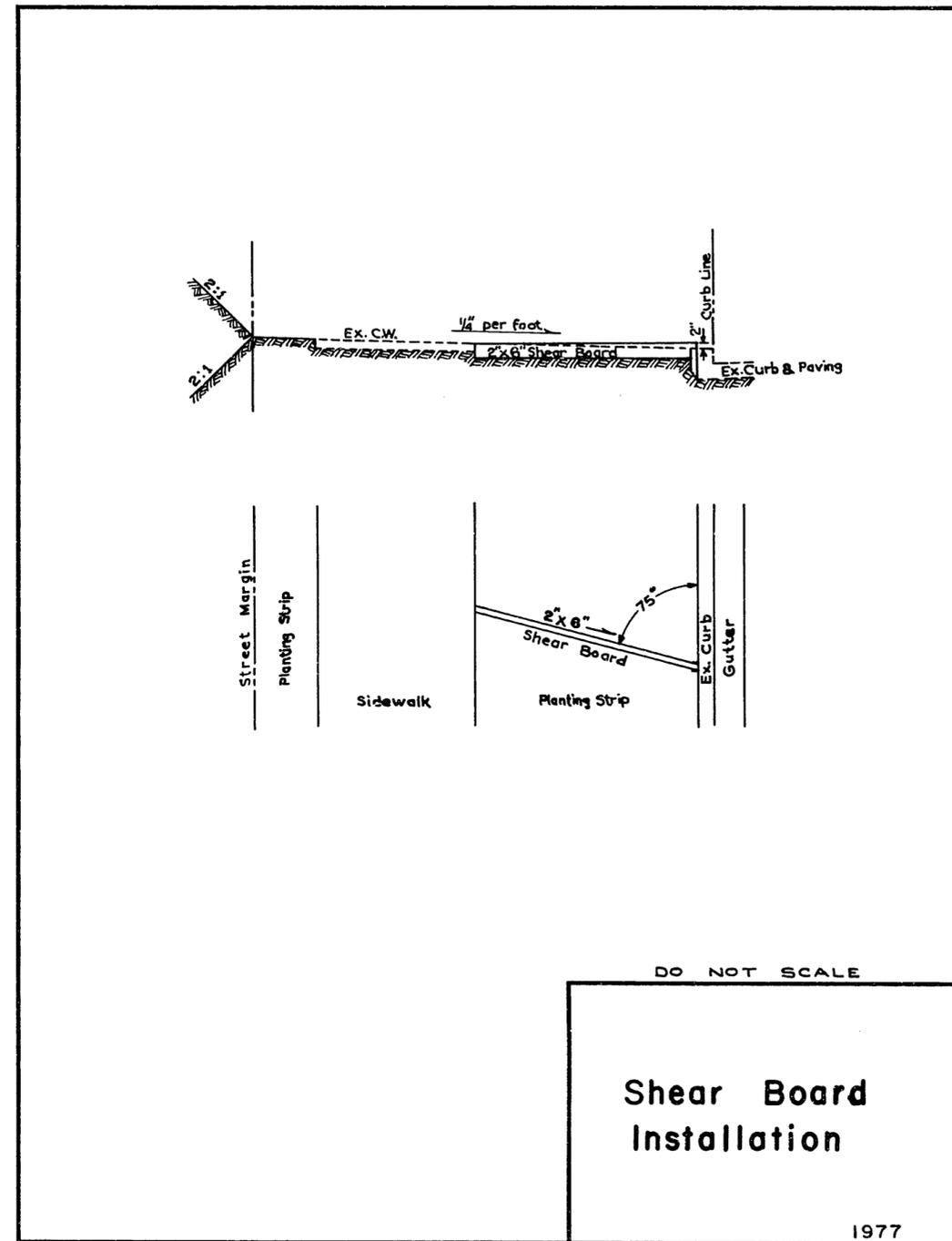
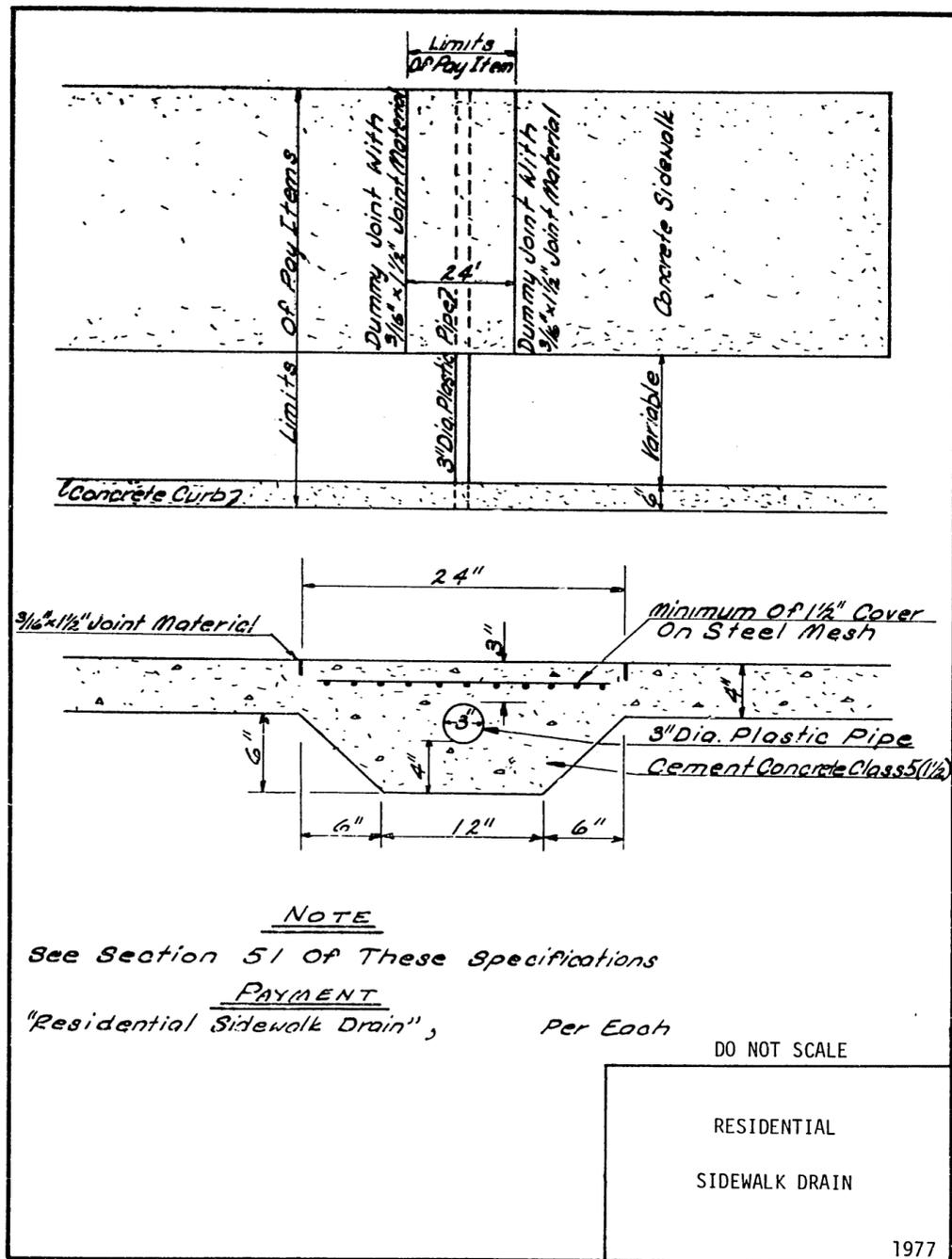


STANDARD PLAN NO. 80



STANDARD PLAN NO. 81





INDEX TO SPECIFICATIONS

NOTE:

Obviously, this index cannot include everything in the subsections of the Standard Specifications for Public Works Construction. If the reader is unable to find the particular item or subject he seeks in the index, he should refer to the related section and title in the Table of Contents at the beginning of the book.

Pages 1 and 2 of the Table of Contents contain a complete list of all sections by titles and in the order of consecutive section numbers. Pages 3 through 13 of the Table of Contents contain complete breakdowns of all sections into subsections of related subject matter.

The heavier and bolder type interspersed throughout the index denotes the complete titles of the various sections as they occur in their alphabetic order. An incomplete listing of subjects in each section follows in most cases by indentation immediately below the section title. In the case of some sections, the reader is merely referred to a specific page in the Table of Contents for the breakdown.

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