Department of Public Works

City of Salem, Oregon

Standard Construction Specifications

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Revisions. These Specifications are not maintained in printed form.

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Division I—General Requirements

101 Definitions and Abbreviations

APPLICABILITY OF DIVISIONS

Division 1 contains definitions and abbreviations contained throughout these Specifications. In addition, it provides for one of the processes by which the Owner contracts with the private sector, for the construction of Capital Improvements.

Division II contains the General Technical Requirements for all Capital Improvements which are to be operated and maintained by the Owner.

Division III contains specific requirements for the construction of streets which are to be operated and maintained by the Owner.

Division IV contains specific requirements for the construction of sanitary sewers and storm drains which are to be operated and maintained by the owner.

Division V contains specific requirements for the construction of water pipe lines which are to be operated and maintained by the Owner.

Division VI contains specific requirements for the construction of various kinds of installations and structures which are to be operated and maintained by the Owner.

Except as otherwise provided herein, projects conducted by City crews shall be required to comply with these Specifications.

Unless otherwise defined in the Contract Documents the following definitions and abbreviations shall apply wherever used.

The words ***directed, required, permitted, ordered, requested, instructed, designated, considered necessary, prescribed, approved, acceptable, satisfactory,*** or work of like import, refer to actions, expressions, and prerogatives of the Engineer.

Command type sentences are used throughout these Standard Specifications. In all cases the command ***expressed*** or ***implied*** is directed to the Contractor.

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The Specifications contained herein are divided into three categories:

(1) Division, (2) Section, and (3) Subsection, and are designated as in the following example:

(1) Division:

Standard Construction Specifications

Division 2—General Technical Requirements

(2) Section:

204 Excavation, Embankment, Bedding, and Backfill

(3) Subsection:

204.1.03 CLASSIFIED EXCAVATION

or:

204.1.03A ROCK EXCAVATION

101.01 DEFINITIONS

Acceptance of Work—All work required by the Contact Documents will be considered accepted upon approval of the Certificate of Acceptance by Owner.

Acts of God—An act of God is to be construed to mean and earthquake, flood, cloudburst, tornado, hurricane, or other phenomenon of nature of catastrophic proportions or intensity.

Advertisement—The public announcement inviting bids for work to be performed or materials to be furnished.

Approved Equal—A product, component or process whose use in or on a particular project is specified as a standard for comparison purposes only. The *equal* product, component, or process shall be the same or better than that named in functions, performance, reliability, quality, and general configuration. Determination of equality in reference to the project design requirements will be made by the Engineer, pursuant to Subsection 106.08.

Attorney—The City Attorney of the City of Salem, Oregon.

Bid Bond—The bond required to be submitted with each Proposal as described in Subsection 102.06 as a Proposal Guaranty, which assures that the bidder will enter into a Contract if his/her Proposal is accepted.

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Bidder—Any individual, firm, co-partnership, corporation, or combination thereof, submitting a Proposal in response to the advertisement calling for bids on the work contemplated in the Contract Documents.

Certificate of Acceptance—Standard Owner's form which must be signed by those employees of Owner who have been assigned specific duties relative to performance of the Contract, with ultimate approval and acceptance of the Owner's execution of the Certificate of Acceptance.

Change Order—A written order, approved by Owner, and issued by Engineer to the Contractor, covering changes in either the Plans, Specifications or other conditions within the scope of the Contractual Documents as further described elsewhere in these Specifications.

Code—The Salem Revised Code and Charter.

Contract—A part of the Contract Documents which stipulates conditions on which the work is agreed to be performed, executed by the Owner and the Contractor.

Contract Price—The total amount of money for which the Contract is awarded.

Contract Documents—The Contract, authorizing ordinance, the advertisement calling for Bids, the Proposal, Plans, Shop Drawings, all Specifications, Addenda, Permits, Performance Bond, Insurance Certificate, and Change Orders for any approved revisions made during the performance of the work to any of the above listed documents.

Contact Item—A specific unit of work for which a price or basis of payment is provided in the Contract.

Contractor—Any individual, firm, co-partnership, corporation, or any combination thereof who has or have entered into a Contract with the Owner for a particular project.

Day—Calendar day, any and every day shown on the calendar, Sundays and holidays included.

Department of Public Works—The Department of Public Works of the City of Salem, Oregon, acting directly or through properly authorized officials, employees, and agents limited to the particular duties entrusted to them.

Developer—Any individual, partnership, corporation, joint venture or other legal entity in the primary business of developing real property for commercial gain.

Easement—The right to use a defined area of property for a specific purpose or purposes as set forth in a document which has been made a part of the Contract Documents.

Engineer—The City Engineer, Traffic Engineer, or any authorized consultant who represents the Owner, under whose direction the work will be performed, acting directly or through properly authorized officials, employees, and agents limited to the particular duties entrusted to them.

NEWER VERSION PUBLISHED

Foreign Contractor—Contactor who is not domiciled in or registered to do business in the State of Oregon.

Improvement—General term encompassing all phases of the work to be performed under the Contract and is synonymous to the term Project.

Inspector—The authorized representative of the Engineer whose instructions and decisions shall be limited to the particular duties and responsibilities entrusted to him/her in making detailed inspections of any or all portions of the work or materials there for.

Lump Sum—A method of payment providing for one all-inclusive payment for the work described to be done, complete and accepted without further measurement, as such work is covered under the applicable lump sum pay item.

Notice—A written communication delivered by hand or by mail to the authorized individual, member of the firm or officer of the corporation for which it is intended. If delivered or sent by mail, it shall be addressed to the last know business address of the individual firm, or corporation. In the case of a Contract with two (2) or more persons, firms, or corporations notice to one shall be deemed notice to all.

OSHD Standard Specification—The latest edition of the Specification Document published by the State of Oregon entitled Standard Specifications for Highway Construction, Oregon State Highway Division. This document is available from the Oregon State Highway Division, Salem, Oregon.

Owner—The City of Salem, acting through its legally constituted City Council.

Performance Bond—The bond submitted by the Contractor and his/her Surety as specified in the Contract and as more fully described in Subsection 103.06.

Plans—The official Plans, profiles, cross sections, elevations, details, and other working, supplementary, and detail drawings, or reproductions thereof, signed by the Engineer, which show the location, character, dimensions, and details of the work to be performed. Plans may either be bound in the same book as the balance of the Contract Documents or bound in separate sets, and are a part of the Contract Documents, regardless of the method of binding.

Prequalification—Process for pre-screening Contractors to assure that they have the ability to perform certain types of work.

Project—General term encompassing all phases of the work to be performed under the Contract and is synonymous to the term Improvement.

Proposal—The written offer of a Bidder which is the basis of the Contract, submitted on Owner's official Proposal form, to perform stated work at prices quoted.

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Proposal Guaranty (Bid Bond)—The security furnished with a Proposal to assure that the Bidder will enter into the Contract if his/her Proposal is accepted.

Provide—When related to an item of work, the word ***provide*** shall be understood to mean furnish and install the work complete in place.

Reference Specifications—Bulletins, standards, rules, methods of analysis or test, Codes and Specifications of other agencies, engineering societies, or industrial associations referred to in the Contract Documents. All such references specified herein refer to the latest edition thereof, including any amendments thereto which are in effect and published at the time of advertising for bids or of issuing the permit, unless specifically referred to by edition, volume, or date.

Right-of-way—A general term denoting public land, property, or interest therein, acquired for or devoted to a public street, public access, or public use.

Roadway—That portion of a street and its appurtenances between curbs, gutters, or ditches, primarily used for vehicular traffic.

Shop Drawings—Supplementary Plans or data which the Contract requires the Contractor to submit to the Engineer, including but not limited to: steel bending details, erection plans, cofferdam plans, and catalog data explaining equipment proposed for use.

Shown—As used herein, the word ***shown,*** or ***as shown,*** shall be understood to refer to work shown on the Plans in the Contract Documents.

Special Specifications—Requirements peculiar to the project and changes and modifications of the Standard Specifications.

Specified—As used herein, the word ***specified,*** or ***as specified,*** means as required by the Contract Documents.

Standard Plans or Drawings—Details of structures, devices, or instructions adopted by Owner as a standard and referred to in the Contract Documents.

Standard Specifications—The terms, directions, provisions, and requirements set forth herein.

Station—A distance of 100 feet measured horizontally along the established centerline of a street, sewer, or other work, unless specified otherwise.

Street—Any street, avenue, boulevard, alley, lane, bridge, bicycle path, road, public thoroughfare, or public way, and any land over which a right-of-way has been obtained or granted for any purpose of public travel.

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Subcontractor—An individual, partnership, firm, corporation, or other legal entity entering into a Contract with the Contractor to perform a portion of the work, with the written consent of the Owner.

Ton—The short ton of 2,000 pounds avoirdupois.

Unit Price—A Contract item of work providing for payment based on a specific unit of measurement; e.g., linear foot or cubic yard.

Use of Pronoun—As used herein, the singular shall include the plural, and the plural the singular; any masculine pronoun shall include the feminine or neuter gender; and the term ***person*** includes natural person or persons, firm, co-partnership, corporation or association, or combination thereof.

Utility—Tracks, overhead or underground wires, pipelines, conduits, ducts, or structures, owned, operated, or maintained in or across a public right-of-way or easement.

Work—All material, labor, tools, equipment, and all appliances, machinery, transportation, and appurtenances necessary to perform and complete the Contract, and such additional items not specifically indicated or described which can be reasonably inferred as belonging to the item described or indicated and as required by good practice to provide a complete and satisfactory system or structure.

101.02 ABBREVIATIONS

AAN—American Association of Nurserymen
AASHTO—American Association of State Highway and Transportation Officials
ACI—American Concrete Institute
AGA—American Gas Association
AGC—Associated General Contractors of America
AIA—American Institute of Architects
AISC—American Institute of Steel Construction
AISI—American Iron and Steel Institute
ANSI—American National Standards Institute
APWA—American Public Works Association
ASCE—American Society of Civil Engineers
ASME—American Society of Mechanical Engineers
ASTM—American Society for Testing and Materials
AWPA—American Wood Preservers Association
AWS—American Welding Society
AWWA—American Water Works Association
CRSI—Concrete Reinforced Steel Institute
DEQ—Department of Environmental Quality
EPA—Environmental Protection Agency
FHWA—Federal Highway Administration
ITE—Institute of Traffic

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NEC—National Electrical Code
NEMA—National Electrical Manufacturer's Association
NLMA—National Lumber Manufacturer's Association
ORS—Oregon Revised Statutes
OSHA—Occupational Safety and Health Administration
OSHD—Oregon State Highway Division
PCA—Portland Cement Association
UBC—Uniform Building Code
UL—Underwriters' Laboratories, Inc.
USASI—United States of America Standards Institute
WWPA—Western Wood Products Association

102 Proposal Requirements

102.01 EQUAL EMPLOYMENT OPPORTUNITY

The attention of bidders is directed to the provisions of Chapter 97, Salem Revised Code, concerning unlawful employment practices. Violation of such provisions shall be grounds for immediate termination of the Contract without recourse by the Contractor.

It is the policy of the City of Salem to promote equal opportunity to all persons in matters affecting, but not limited to, recruitment, employment, compensation benefits, promotions, training, discipline, transfer, and layoff practices without regard to a person's race, color, religion, national origin, disability, sex, or age (except where sex, age, or nondisability are bona fide occupational qualifications). This policy extends to all Contractors receiving public money for the fulfillment of public Contracts with the City of Salem.

102.02 PREQUALIFICATION OF BIDDERS

a) Prequalification of bidders will normally not be required for public improvement projects. Contractors may submit bids on any or all projects for which they can comply with the bonding requirements as stated in the bid documents. Award of a Contract for a public improvement project will require compliance with the performance security requirements as indicated within the bid documents.

There may be special projects for which prequalification is determined to be in the Owner's best interest. When this is required, the user department and the Purchasing Division will review the prequalification applications of all prospective bidders on public improvement projects. If it appears that a bidder should be disqualified or a prequalification application rejected, the Purchasing Supervisor shall review the circumstances with the Director of General Services, who shall bring it to the attention of the City Manager.

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b) When Prequalification is Required

When prequalification is required, Chapter 2 of the Owner's Purchasing manual, as revised July 7, 1986, is incorporated by reference, beginning on page 15, paragraph 2.2 Disqualification from Bidding, and ending in the middle of page 23, and is to be considered as though written in its entirety herein.

CONDITIONS COVERED IN THE PURCHASING MANUAL ARE:

2.2 Disqualification from Bidding

A) Debarment or denial of prequalification
B) The debarment process
C) Appeal of debarment
D) When prequalification is required what information is needed
E) How is the prequalification information to be submitted
F) How is prequalification application approved or disapproved
G) Notification of approval or denial
H) For how long is prequalification in effect
I) Appeal of prequalification denial

102.03 FORM OF PROPOSAL

Enclose the Proposal, bid bond, certified check, or cashier's check in a sealed, labeled, and addressed envelope as required in the Instructions to Bidders, and filed as required therein. The outside of the envelope shall plainly identify: (1) the Project name, (2) the Bid Opening date, and (3) the Bid Number.

All Proposals must be clearly and distinctly typed or written with ink or indelible pencil.

All Proposals shall be on the form furnished by Owner, and in addition to necessary unit price items and total prices in the column of totals to make a complete bid, all applicable blanks giving general information must be filled in and the bid signed by the Contractor or a duly authorized agent. Any statement accompanying and tending to qualify a bid may cause rejection of such bid, unless such statement is required in a Proposal embracing alternative bids.

Unless otherwise specified, bidders shall bid on all bid items included in the Proposal and the low bidder shall be determined as noted in ***Subsection 103.01 Award of Contract***. Except as provided herein, Proposals which are incomplete, or fail to reply to all items required in the Proposal, will be rejected.

102.04 WITHDRAWAL, MODIFICATION, OR ALTERATION OF PROPOSAL

A Proposal may be withdrawn on written or telegraphic request of the bidder prior to the scheduled closing time for filing bids. Negligence on the part of the bidder in preparing his/her

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Proposal confers no right to withdraw his/her Proposal after the scheduled closing time for filing bids.

Prior to Bid Opening, changes may be made provided the change is initialed by the bidder or his/her agent. If the intent of the bidder is not clearly identifiable, the interpretation most advantageous to Owner will prevail.

102.05 LATE PROPOSALS

Proposals received after the scheduled closing time for filing bids, as set forth in the Invitation to Bidders will be rejected and returned unopened to the bidder unless such closing time is extended by Owner.

102.06 PROPOSAL GUARANTY AND SIGNATURE

Unless covered by an annual bid bond, in an unencumbered amount sufficient to cover all pending bids, filed with Owner, all Proposals must be accompanied by a Proposal Guaranty in the form of a certified check or cashier's check payable to the order of the Owner, or a bidder's bond for the single bid submitted, in an amount of at least 10 percent of the amount of the Proposal. Such Proposal Guaranty shall be forfeited as liquidated damages in case the bidder shall fail or neglect to furnish a Performance Bond and insurance, if required, and to execute the Contract within ten days after receiving said Contract from the Owner for execution.

State whether business is being done as an individual, a co-partnership, a corporation, or a combination thereof, and if incorporated, in what state, and if a co-partnership, state names of all partners. The person signing on behalf of a corporation, a co-partnership or combination thereof shall state his/her position with the firm or corporation, and state whether the corporation is licensed to do business in the State of Oregon.

102.07 EXAMINATION OF CONTRACT DOCUMENTS AND SITE OF WORK

Bidders shall determine for themselves all the conditions and circumstances affecting the project or the cost of the proposed work by personal examination of the site, Contract Documents, and by such other means as they may choose. It is understood and agreed that information regarding underground or other conditions or obstructions indicated in the Contract Documents has been obtained by Owner from data at hand. There is no express or implied agreement that such conditions are fully or correctly shown and the Bidder must take into consideration the possibility that conditions affecting the cost or quantity of work may differ from those indicated.

Refer to Subsections 104.05, 105.05, 105.06, and 105.13 for additional provisions relative to site conditions.

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102.08 INTERPRETATION OF CONTRACT DOCUMENTS

If it should appear to a Bidder that the work to be done or matters relative thereto are not sufficiently described or explained in the Contract Documents or the Contract Documents are not definite and clear, the Bidder shall make written inquiry regarding same to the Engineer at least ten days before the scheduled closing time for filing bids. Then if, in the judgment of the Owner, additional information or interpretation is necessary, such information will be supplied in the form of an addendum to all individuals, firms and corporations who have taken out Contract Documents. Such addendum shall have the same binding effect as though contained in the main body of the Contract Documents. Oral instructions or information concerning the Contract Documents or the project given out by officers, employees, or agents of the Owner to prospective bidders shall not bind the Owner.

102.09 ADDENDA TO CONTRACT DOCUMENTS

Neither the Owner nor the Engineer will five verbal answers to inquiries regarding the meanings of drawings and Specifications, or verbal instructions previous to the award of the Contract. Any explanation desired by Bidders must be requested from the Owner or Engineer in writing and if explanation is necessary, a reply will be made in the form of an addendum, a copy of which will be forwarded to each Bidder who has received a set of Contract Documents.

All addenda issued to Bidders prior to date of receipt of Proposals shall become a part of the Contract Documents, and all Proposals are to include the work therein described. Any Proposal which is not in compliance with this Section shall be rejected.

102.10 FAMILIARITY WITH LAWS AND ORDINANCES

The Bidder is presumed 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 Contract Documents which is contrary to or inconsistent with any law, ordinance or regulation, he/she shall immediately report it to the Owner in writing.

102.11 AMOUNT OF WORK TO BE DONE

Owner reserves the right to increase or decrease the amount of any class or portion of the work. No such change in the work shall be considered as a waiver of any condition of the Contract nor shall such change invalidate any of the provisions thereof.

The estimate of quantities of work to be done under unit price bids is approximate and is given only as a basis of calculation for comparison of bids and award of the Contract. The Owner does not by implication agree that the actual amount of work will correspond precisely to the amount as shown or estimated. Payment will be a specified in Subsection 104.04.

102.12 BID PRICES TO COVER ENTIRE WORK

Bidders must include in their bid prices the entire cost of each item of the work set forth in the Proposal, and when, in the opinion of the Owner, the prices in any Proposal are obviously unbalanced, such Proposal may be rejected.

102.13 ACCEPTANCE OR REJECTION OF PROPOSAL

Owner reserves the right to accept or reject any or all bids in whole or in part of waive irregularities not affecting substantial rights, as the best interests of the City may require.

102.14 SITE INVESTIGATION

The Contractor acknowledges that he/she has investigated and satisfied himself/herself as to the conditions affecting the work, including but not restricted to those bearing upon: transportation, disposal handling, and storage of materials; availability of labor, water, electric power, and access to the site; uncertainties of weather, river stages, or similar physical conditions at the site; the conformation and conditions of the ground; and the character of equipment and facilities needed preliminary to and during prosecution of the work. The Contractor further acknowledges that he/she has satisfied himself/herself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Owner, as well as from information presented by the drawings and Specifications made a part of this Contract. Any failure by the Contractor to acquaint himself/herself with the available information will not relieve him/her from responsibility for estimating properly the difficulty or cost of successfully performing the work. The Owner assumes no responsibility for any conclusions or interpretations made by the Contractor o the basis of the information made available by the Owner.

102.15 CONDITIONS AFFECTING THE WORK

The Contractor shall be responsible for having taken steps reasonably necessary to ascertain the nature and location of the work, and the general and local conditions which can affect the work or the cost thereof. Any failure by the Contractor to do so will not relieve him/her from the responsibility for successfully performing the work without additional expense to the Owner. The Owner assumes no responsibility for any understanding or representations concerning conditions made by any of its officers or agents prior to the execution of the Contract, unless such understanding or representations by the Owner are expressly stated in the Contract Documents.

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103 Award and Execution of Contract

103.01 AWARD OF CONTRACT

The award will be made by Owner to the Bidder submitting the lowest acceptable bid. In determining the lowest acceptable bid, Owner may take into account, among other factors, the prices bid, discounts, if any, time of completion or delivery proposed, as between equal bids, the relative merits and performance of any item specifically proposed by the Bidder, any variation is maintenance and guaranty period specially proposed by the Bidder in excess of any minimums specified, the realistic balance of prices in the Proposals for various parts or units of work and the experience and ability of Bidder to perform the work.

The Owner reserves the right to reject any or all bids to its own best interests.

While price extensions are required as a matter of convenience, in the event of error in extensions, the unit prices bid shall govern. In the event of discrepancy between the written and numerical amounts, the written prices will govern.

Determination of the lowest acceptable Bidder and award are subject to review and determination by the Attorney as to legal sufficiency of any bid submitted.

Award and tender of Contract, if it be awarded, shall be made within thirty (30) calendar days after the date of opening bids.

103.02 EXECUTION OF CONTRACT

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 Owner within ten (10) days after Notice of Award Contract.

103.03 FAILURE TO EXECUTE CONTRACT

Failure on the part of the Bidder to whom the Contract is awarded to execute the Contract and to deliver the Contract and required Performance Bond, as provided for in Subsection 103.06, shall be just cause for cancellation of the award, withdrawal of the Contract and forfeiture of the Proposal Guaranty. The forfeited Proposal Guaranty shall become property of the Owner, not as a penalty, but in liquidation of damages sustained. Award may then be made to the next lowest acceptable Bidder, or the work may be re-advertised, or otherwise, as the Owner may decide.

103.04 RETURN OF PROPOSAL GUARANTY

The Owner reserves the right to retain the bid security of the three lowest bidders until the successful bidder has signed and delivered the Contract and furnished a 100 percent Performance Bond.

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103.05 TRANSFER OF CONTRACT AND INTERESTS THEREIN

Do not transfer the Contract or any interest therein to any other party or parties without the prior written consent of Owner. In case of such attempted transfer without permission, Owner may refuse to carry out the Contract either with the transferor or the transferee, but all rights of action for any breach of the Contract by said Contractor are reserved to the Owner. No officer of Owner, nor any person employed in its service is or shall be permitted any share or part of the Contract or is or shall be entitled to any benefit which may arise there from. Do not assign any of the monies payable under the Contract or claims thereto without the prior written approval of Owner.

Any assignment of money shall be subject to all proper setoffs and withholdings in favor of Owner and to all deductions provided for in the Contract, and particularly all money withheld, whether assigned or not, shall be subject to being used by Owner for completion of the work in the event Contractor should be in default therein.

103.06 PERFORMANCE BOND

At the time of execution of the Contract, furnish Performance Bond or Bonds approved by the Owner and Attorney in an amount equal to the amount of the Contract based upon the estimate of quantities or lump sum as set forth in the Proposal, conditioned upon a compliance with and fulfillment of all terms and provisions of the Contract, including maintenance, repair and replacement and all applicable laws and prompt payment, as due, to all persons supplying labor and/or material for prosecution of the work.

103.07 PROOF OF CARRIAGE OF INSURANCE

Work shall not commence until all insurance required in the Contract has been obtained and a certificate thereof has been approved by the Attorney. Maintain insurance throughout the life of the Contract which will hold Owner harmless and shall indemnify Owner for any and all losses to third persons or o Owner arising out of the operations, including any contingent liability arising therefrom.

103.08 FOREIGN CONTRACTOR

When a Foreign Contractor is awarded a Contract with a price exceeding $10,000, under provisions of ORS Chapter 279, promptly report to the Department of Revenue on forms to be provided by the Oregon Department of Revenue the total Contract price, terms of payment, length of Contract and such other information as my be required before final payment can be received on the public Contract. The Owner shall satisfy itself that the requirement of the Subsection has been complied with before it issues a final payment on a public Contract.

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104 Scope of Work

104.01 PLANS AND SPECIFICATIONS

Plans, Specifications, and other Contract Documents will govern the work to be done. Anything mentioned in the Specifications and not shown on the Plans and detailed drawings, or shown on the Plans and detailed drawings and not mentioned in the Specifications, shall be of like effect as though shown or mentioned in both.

Specifications and Plans referred to in any of the Contract Documents shall be considered as being included in the document in which such reference is made. A reference to a particular Specification or Standard Plan in a contract Document shall exclude any earlier or later modification thereof. When a particular Standard or Specification is referred to, such reference shall be to the Standard or Specification including officially adopted revisions or amendments thereto which is in force at the time of advertising for bids.

104.02 PRECEDENCE OF CONTRACT DOCUMENTS

In case of conflict, the order of precedence of the following documents in controlling the work shall be:

1. Contract
2. Proposal
3. Permits from outside agencies required by law
4. Special Specifications (Provisions)
5. Plans
6. Standard Plans
7. Standard Specifications
8. Reference Specifications

Change Orders, supplemental agreements, and approved revisions to Plans and Specifications will take precedence over Contract Documents listed above. Detailed Plans shall take precedence over general plans. In case of any ambiguity or dispute over interpretation of the provisions of the Contract, the decision of the Owner shall be final.

104.03 SHOP DRAWINGS

Plans furnished and included with Specifications show details necessary to comprehensively indicate the work proposed and the results that are intended to be accomplished. Supply and bear the cost of any shop drawings required in connection with the prosecution or construction of any part of such work.

Furnish the specified number of copies of all layout, detail, shop, and working drawings requested by the Engineer. Shop drawings shall be of sufficient size and scale to clearly show

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details. After review and approval by the Engineer, two copies will be returned to the Contractor.

The approval by the Engineer of the Contractor's drawings is a general approval relating only to compliance with the intent of the Contract Documents, and shall not constitute a waiver of errors, misfits, discrepancies, or omissions. No materials shall be furnished or work done on items requiring shop drawings prior to approval.

104.04 CHANGES IN THE WORK

104.04.01 CHANGES REQUESTED BY THE CONTRACTOR

General. Changes in specified methods of construction may be made at the Contractor's request when approved in writing by the Engineer.
Changes in the Plans and Specifications, requested in writing by the Contractor, which do not materially affect the work and which are not detrimental to the work or to the interests of the Owner, may be made to facilitate the work, when approved in writing by the Chief Engineer.

Payment for Changes Requested by the Contractor. If such changes are granted, they shall be made at a reduction in cost or at no additional cost to the Owner. Nothing herein shall be construed as granting a right to the Contractor to demand acceptance of such changes.

104.04.02 CHANGES INITIATED BY THE OWNER

General. The Owner may change the Plans, Specifications, character of the work or quantity of work, provided the total arithmetic dollar value of all such changes, both additive and deductive, does not exceed 25 percent of the Contract price. Should it become necessary to exceed this limitation, the change shall be by written supplemental agreement between the Contractor and Owner.
Change Orders shall be in writing and state the dollar value of the change or establish method of payment, any adjustment in Contract time and when negotiated prices are involved, shall provide for the Contractor's signature indicating acceptance.

The Contractor is referred to page 1-53, Subsection 109.03.

104.05 DIFFERING SITE CONDITIONS

a) The Contractor shall promptly, and before such conditions are disturbed, notify the Engineer in writing of any of the following:

   1) Subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents;

   2) Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered in the area of the project;

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3) Unknown physical conditions of an unusual nature, differing materially from those generally recognized as inherent in work of the character provided for in this Contract.

b) The Engineer shall promptly investigate the conditions. If he/she finds that conditions are as described in the Contractor's written notice, and that those differing conditions would cause a substantial change in the Contractor's cost or time to complete the work, the Engineer shall recommend an appropriate adjustment to the Contract price, the time for completion, or both. Final determination of any adjustment to price or time shall be made by the Owner. The Engineer's recommendation shall not be binding on the Owner.

c) No claim of the Contractor under this clause shall be allowed unless the Contractor has given the notice required in (a) above: provided, however, the time prescribed for notification may be extended by the Engineer.

d) No claim by the Contractor for an adjustment to the Contract shall be allowed if asserted after payment for the affected work has been made.

e) The Contractor shall not be relieved from his/her obligation to resume construction operations on the site pending a decision on the validity of any claim, or pending the execution of a negotiated agreement to cover additional cost recognized under the provisions of this Section, unless permitted otherwise by the Engineer.

f) If an agreement cannot be reached under this Section, the Contractor may proceed with a claim under ***Subsection 105.03 Disputed Work***.

g) If the Contractor proceeds with his/her performance without following the requirements of (a) above, it shall constitute acceptance by the Contractor of the condition encountered and shall waive any right for a subsequent modification to the Contract.

h) ***Promptly*** in this Section means not later than the following work day, i.e., 24 hours. If conditions are encountered on Friday, the written notice shall be delivered by the Contractor to the Engineer not later than the end of the following Monday or Tuesday if Monday is a holiday.

104.06 EXTRA WORK

Owner shall have the right to require, and Contractor agrees, to do Extra Work over and above that which is indicated by the Contract Documents and covered by the unit prices of the Contract, or negotiated price or prices, which is logically part of the Contract, arising from reasonably unforeseeable conditions, changed requirements, or new information. Such additional work shall be undertaken only upon written instructions from the Engineer. Payment for Extra Work will be made pursuant to Subsection 109.05.

104.07 FORCE ACCOUNT WORK

Force Account work is Extra Work that is not covered under unit price or lump sum items in the Contract Documents and where negotiated price or prices have not been agreed upon. Payment for Force Account work will be made pursuant to Subsections 109.06

Maintain records in such a manner as to provide a clear distinction between direct cost of Extra Work paid for on Force Account basis and costs of other operations performed in connection with the Contract Documents.

Furnish to Engineer signed daily reports in duplicate of Extra Work to be paid for on a Force Account basis. Itemize materials used and set forth the direct cost of labor and charges for equipment rental, whether furnished by Contractor, or Subcontractor. Provide names, identifications, and classifications of worker, the hourly rate of pay and hours worked, and the size, type, and identification number of equipment and hour of equipment operation.

Substantiate material charges by vendors' invoices, submit such invoices with the reports; or, if not available, submit with subsequent reports. In the event said vendors' invoices are not submitted within 15 days after acceptance of the work, Owner reserves the right to establish the cost of such materials at the lowest current price at which said materials are available in the quantities concerned, delivered to the location of the work.

Engineer will compare his/her records with the reports furnished by Contractor, make any necessary adjustments, and then compile the costs of Extra Work paid for on a Force Account basis on forms furnished by Owner. When these Extra Work reports are agreed upon and signed by both parties, they shall become the basis of payment for work performed.

104.08 SALVAGE

Cover sets, gratings, and other steel components (except reinforcing bars) of removed or abandoned structures shall be salvaged. The Contractor shall contact the Owners, and if required, shall deliver to and load such material in the Owner's truck at the site of the work. Otherwise, such material shall become the property of the Contractor and shall be disposed of by him/her away from the site of work.

104.09 GENERAL ITEMS OF WORK

In all Contacts the following items of work are understood to be included as described in ***Division 2 General Technical Requirements***:

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Section	Item of Work
201	Mobilization
202	Temporary Traffic Control
203	Clearing and Grubbing
208	Restoration and Cleanup

If no pay item is shown in the Proposal for the above items of work, payment shall be considered to be incidental to or included in the other items of work in the Contract.

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105 Control of Work

105.01 AUTHORITY OF THE ENGINEER

Subject to such authority as is delegated by the Owner, the Engineer will decide all questions, excepting Change Orders and time extensions, which may arise as to the quantity, quality, and acceptability of materials furnished and work performed, the rate of progress of the work; interpretation of the Plans and Specifications; the measurement of all quantities; and the acceptable fulfillment of the Contract on the part of the Contractor. The Engineer's estimates and decisions in these matters shall be final, binding, and conclusive upon all parties to the Contract.

It is further understood that all work to be done under the Contract will not be considered completed until it has passed final inspection by the Engineer and is accepted by Owner. It is further understood that the authority of the Engineer is such that Contractor shall, at all times, carry out and fulfill the instructions and directions of the Engineers insofar as they concern the work to be done under the Contract.

Upon failure on the part of the contractor to comply with any reasonable order made under the provisions of this Subsection, the Engineer shall have the authority to cause unacceptable work to be remedied or removed and replaced, and unauthorized work to be removed, and to deduct the costs thereof from any monies due or to become due the Contractor.

Engineer has the authority to suspend work for cause as set forth in Section 108, particularly Subsection 108.05.

Approval by Engineer signifies favorable opinion and qualified consent; it does not carry with it certification, nor assurance of completeness, quality, or accuracy concerning details, dimensions, and quantities. Such approval will not relieve Contractor from responsibility for errors, improper fabrication, nonconformance to requirements, or for deficiencies within his/her control.

105.02 AUTHORITY AND DUTIES OF INSPECTORS

The work will be conducted under the general direction of the Engineer and is subject to inspection by the appointed Inspectors to insure strict compliance with the terms of the Contract. No Inspector is authorized to change any provisions of the Specifications without written authorization of the Engineer, nor shall the presence or absence of an Inspector relieve the Contractor from any requirement of the Contract. Failure of the Inspector or Engineer to call the Contractor's attention to faulty workmanship or deviation from Plans and Specifications prior to written Notice of Final Acceptance of the project as a whole, shall not constitute acceptance of said work.

105.03 DISPUTED WORK

Except as otherwise provided in this Contract, any dispute concerning the application of the Contract shall be determined as provided for in the Owner's "Department of Public Works Policy and Procedure for Resolution of Disputes and Appeals". This policy and procedure is hereby specifically referred to and by this reference is made a part hereof, and shall by such reference have the same force and effect as though fully reproduced herein. If the Contractor considers any work demanded of him/her to be outside the scope of the Contract, or considers any ruling by the Engineer to be contrary to the meaning of the Contract, the Contractor shall, nevertheless, proceed without delay to perform the work as directed, without affecting his/her right to claim compensation for any Extra Work or expense in the event the Engineer's direction is found to be erroneous; provided such right shall be contingent upon the Contractor's adherence to the procedure herein referenced. The Contractor, in connection with any Proposal he/she makes for a Contract modification, shall furnish a price breakdown, itemized in sufficient detail to permit an analysis of all material, labor, subcontract, and overhead costs, as well as profit, and shall cover all work involved in the modification, whether such work was deleted, added, or changed. Any amount claimed for subcontracts shall be supported by a similar price breakdown. In addition, if the Proposal included a time extension, a written justification thereof shall also be furnished. The Proposal, together with the price breakdown and time extension justification, shall be furnished by the date specified in the Policy and Procedures. Except for such protests or objections as are made of record in the time and manner referenced herein, the records, rulings, instructions, or decisions of the Engineer will be final and conclusive.

The Owner's "Department of Public Works Policy and Procedure for Resolution of Disputes and Appeals" has been revised effective July 15, 1989. A copy of this revised Policy and Procedure is included for you convenience in these documents and is entitled, "GM 2-14 – INSPECTION: RESOLUTION OF CONSTRUCTION DISPUTES AND REVIEW".

105.04 RESPONSIBILITY OF THE CONTRACTOR

Do all work and furnish all labor, materials, equipment, tools, and machines necessary for the performance and completion of the project in accordance with Contract Documents within the specified time.

Material and construction details of plants, forms, shoring, false work, and other structures built by Contractor, but not a part of the permanent project, shall meet approval of the Engineer, but such approval shall not relieve Contractor from responsibility for their safety and sufficiency.

Owner shall not be liable or responsible for any accident, loss, or damage happening to work referred to in the Contract Documents prior to completion and acceptance thereof.

Assume all responsibility for the work, and bear all losses and damages directly or indirectly resulting to Contractor, to Owner, or to others on account of the character or performance of the work, unforeseen difficulties, accidents, or any other cause whatsoever. Assume the

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defense of, indemnify and save harmless the Owner, its officers and employees from all claims, liability, loss, damage and injury of every kind, nature and description, directly or indirectly resulting from activities in the performance of the Contract, the ownership maintenance or use of motor vehicles in connection therewith, or the acts, omissions, operations or conduct of the Contractor or any Subcontractor under the Contract or in any way arising out of the Contract, irrespective of whether fault is the basis of the liability or claim, and irrespective of whether any act, omission, or conduct of the Owner connected with the Contract is a condition or contributory cause of the claimed liability, loss, damage or injury and irrespective of whether act, omission, or conduct of the Contractor or Subcontractor is merely a condition rather that a cause of the claim, liability, loss, damage, or injury. Contractor shall not be liable for nor be required to defend or indemnify the Owner relative to claims for damage or damages resulting solely from acts or omissions of the Owner, its officers, agents, or employees.

105.05 NOTIFICATIONS RELATIVE TO CONTRACTOR'S ACTIVITIES

Obtain prior approval from the City traffic Engineer for closing or partial closing of any street. Give at least 24 hours advance notice of such closure to all agencies providing emergency services, including police, fire, and ambulance services.

If the project or work thereunder involves the crossing of any railroad line or encroachment of any railroad right-of-way, give adequate notice prior to construction as contained in the approved program as required in ***Subsection 107.19 Railroad Crossings or Right-of-way***.

Notification of Utilities for Sewer, Conduit, or Water Main Construction

Notify the following utilities and agencies at least 24 hours before commencing work:

Northwest Natural Gas Co.	3123 Broadway NE
U.S. West Communications	700 State Street
Portland General Electric Co.	310 High Street SE
Salem Electric	633 7th Street NW
Water, Sewer, Traffic	City of Salem 555 Liberty Street SE
U.S. Sprint	11824 North Creek Parkway Suite 110 Bothell WA 98011
Viacom Cablevision	1710 Salem Industrial Drive NE Salem OR 97303

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Utilities may not be located as shown on existing drawings as the location is established form records and not from on-site inspection. Request on-site utility locations by phone and confirm by letter at least two working days prior to commencing work of the date on which work will commence, and adhere to above notification requirements during the progress of the work, where the work is such that on-site location of utilities is necessary as the work progresses.

When performing work in streets and easements, whether inside or outside Owner's legal boundaries, notify all of the affected local agencies about the operations so as to properly coordinate and expedite the work in such a manner as to cause the least amount of conflict and interference between the operations and those of other agencies.
Notification shall include, but not be limited to, the time of commencement and completion of work, names of streets, or location of alleys to be closed, schedule of operations and routes of detours where possible.

Any or all damages or claims resulting from improper of insufficient notification of the affected agencies shall be the responsibility of the Contractor.

Notification of Utilities for Street Construction Projects

Owner shall relocate or cause to be relocated all privately or publicly owned utility conduits, lines, poles, mains, pipes, and such other facilities within the jurisdiction and control of Owner where such relocation is necessary in order to conform said utility and other facilities with the Plans and ultimate requirements of the project.

If desirable for specific reasons, or for convenience of field operations, contact the above listed utilities.

Contractor shall notify all utilities at least 48 business day hours prior to excavating, through the Salem-Keizer Utility Notification System (1-800-332-2344). He/she shall comply with all specific requirements of ORS 757.541 to 757.571. The Contractor shall be responsible for all coordination with appropriate utility companies to maintain the facility during construction. All costs of such notification and coordination shall be incidental to other Contract pay items.

105.06 UTILITIES AND EXISTING IMPROVEMENTS

Information shown as to location of existing water courses, drains, sewer lines, or utility lines, which cross or are adjacent to the project, has been compiled from the best available sources, but is not guaranteed to be accurate.

Provide for the flow of sewers, drains, or water courses interrupted during the progress of the work, and restore such drains or water courses as approved by the Engineer.

Be responsible for all costs for the repair of any and all damage to Contract work or to any utility, whether previously know or disclosed during the work, as may be caused by operations. Maintain in place utilities not shown on the drawings to be relocated or altered by others. Maintain utilities which are relocated by others in their relocated positions in order to avoid

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interference with structures which cross the project work. All costs fur such work shall be included in the prices bid for the various items of work.

Additional Conditions During Construction

Make excavations and borings ahead of work, as necessary, to determine the exact location of interfering utilities or underground structures.

Ordinarily, utility companies responsible for facilities located within the right-of-way will be required to complete an installation, relocation, or repair, or replacement prior to the commencement of work by the Contractor. However, when this is not feasible or practicable or the need for such work was not foreseen, such utility owners or the Owner shall have the right to enter upon the right-of-way and upon any structure therein for the purpose of making new installations, changes or repairs. Conduct operations so as to provide the time needed for such work to be accomplished during the progress of the improvement, and at no additional cost to Owner.

The Contractor will protect from damage all existing improvements and utilities at or near the site of the work, the location of which is made known to him. The Contractor will repair or restore any damage to such facilities resulting from failure to comply with the requirements of this Contract or failure to exercise reasonable care in the performance of the work. If the Contractor fails to protect all existing improvements and utilities at or near the site of work or refuses to repair any such damage promptly, the Owner may, at its sole discretion, have the necessary work performed and charge the cost thereof to the Contractor.

105.07 SURVEY SERVICE

Give notice to Engineer not less than three (3) working days in advance of when survey services will be required in connection with the laying out of any portion of the work.

Engineer will furnish and set construction stakes establishing lines and grades as he/she determines necessary for all work under the Contract, including lines and grades for street excavation and fill, curbs and gutters, and structures.

Engineer will furnish appropriate offset lines and grades for all projects involving trenching operations. Engineer will not transfer the offset lines or grades into the ditch, to batterboards, or any other point within the work which is provided by Contractor.

105.08 PROTECTION OF SURVEY MARKERS

Permanent Survey Markers

Notify the engineer not less than three working days prior to starting work in order that the Engineer may take necessary measures to ensure the preservation of survey monuments, stakes, lot stakes, and bench marks. Do not disturb permanent survey monuments, stakes, lot stakes, or bench marks without the consent of Engineer, and notify Engineer and bear the

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expense of replacing any that may be disturbed without permission. Replacement shall be done by Engineer with all costs charged against, and shall be deducted from, payments for Contract work.

When a change is made in the finished elevation of the pavement of any roadway in which a permanent survey monument is located, adjust the monument cover to the new grade at no expense to the Owner.

Lines and Grades

Preserve construction survey stakes and marks for the duration of their usefulness during construction. If any construction survey stakes are lost or disturbed through negligence of Contractor, and in the judgment of the Engineer need to be replaced, such replacement shall be charged against, and shall be deducted from, payments for Contact work.

All work, upon completion, shall conform to the lines, elevations, and grades shown on the Plans.

105.09 PROTECTIONS OF PROPERTY

Protect all public and private property, insofar as it may be endangered by operations and take every reasonable precaution to avoid damage to such property.

Restore and bear the cost of any public or private improvement, facility, or structure within the right-of-way or easement which is damaged or injured directly or indirectly by or on account of any act, omission, or neglect in the execution of the work and which is not designated for removal but visibly evident or correctly shown on the Plans. Restore to a condition substantially equivalent to that existing before such damage or injury occurred, by repairing, rebuilding, or otherwise affecting restoration thereof, or if this is not feasible, make a suitable settlement with the Owner of the damaged property, all at no expense to Owner.

Give reasonable notice to occupants of buildings on property adjacent to the work to permit the occupants to remove vehicles, trailers, and other possessions as well as salvage or relocate plants, trees, fences, sprinkler systems, or other improvements in the right-of-way which are designated for removal or which might be destroyed or damaged by work operations.

Protect all designated trees and planted areas within the right-of-way or easements. Exercise care and conduct operations so as to minimize damages to other planted areas.

Review with Engineer the location, limits, and methods to be used prior to clearing work. Clearing and grubbing shall be performed in strict compliance with all local, State and Federal laws, and requirements pertaining to clearing and burning, and particularly in conformity with the provisions of ORS Chapter 477, and all subsequent amendments, which require, among other things, filing with the State Forester a general description of the right-of-way to be cleared before the start of clearing operations. Obtain the required permit from the State Forester and perform clearing work in conformance thereto.

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The Contractor shall be responsible for the protection of public and private property adjacent to the work and shall exercise due caution to avoid damage to such property.

The Contractor shall repair or replace all existing improvements within the right-of-way, easement, and permit of entry areas which are not designated for removal (examples are curbs, sidewalks, storm drains, water mains, sanitary sewers, driveways, fences, walls, signs, utility installations, pavements, structures, sprinkler lines) which are damaged or removed as a result of his/her operations. Repairs and replacements shall be equal to or better than existing improvements, and shall match them in finish and dimension.

Tree, lawns, and shrubbery that are not to be removed shall be protected from damage or injury. If damaged or removed because of the Contractor's operations, they shall be restored or replaced in as nearly the original condition and location as is reasonably possible. Lawns shall be reseeded after replacement of topsoil and covered with suitable mulch except as noted otherwise.

The costs to the Contractor for protecting, repairing, removing, replacing, or restoring existing improvements not required as a part of this work shall be incidental to other bid items.

105.10 PROTECTION OF WORK

Until acceptance of the project, at all times protect from damage and preserve all materials, supplies, equipment of any description, and all work already performed, from the nature of the work, the action of the elements, and damage by any person or persons, or from any other cause, whatsoever.

105.11 USE AND POSSESSION PRIOR TO FINAL COMPLETION

The Owner shall have the right to take possession of or use for its own benefit any completed or partially completed part of the work. Such possession or use shall not be deemed an acceptance of the occupied portion of the project or any work not completed in accordance with the Contract. While the Owner is in such possession, the Contractor shall be relieved of the responsibility for injury or damage to the said completed portion of the work other than that resulting from the Contractor's fault or negligence. Continued operation or use of facilities being rehabilitated shall not be construed as use or possession prior to final completion.

Prior to the Owner taking possession of or using any completed or partially completed part of the work, written notice shall be given by the Engineer to the Contractor at least 24 hours in advance of the Owner actually assuming responsibility for such possession or the use of any completed or partially completed part of the work.

If such prior possession or use by the Owner delays the progress of the work or, otherwise, causes additional expense to the Contractor, an equitable adjustment to the Contract price and/or time of completion will be made by Change Order. Use or possession by the Owner does not stop the time of the Contract from running. It does not relieve the Contractor from responsibility for completing the project in accordance with the Contract.

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Should Contract time expire and liquidated damages become assessable, the cost of that portion of the work which the Owner has taken possession of shall be deducted from the full Contract amount to determine the liquidated damage assessment rate.

105.12 USE OF LIGHT, POWER, AND WATER

Furnish temporary light, power, and water complete with connecting piping, wiring, lamps, and similar equipment necessary for the work as approved. Install, maintain, and remove temporary lines upon completion of work. Obtain all permits and bear all costs in connection with temporary services and facilities at no expense to Owner. Conform to applicable rules and codes in the use of these facilities.

Water used in the work will not be furnished by the Owner, except through a bulk water station or metered fire hydrant. Information regarding bulk water stations or hydrant meters is available from the engineering permit technician at the Permit Application Center (PAC, Room 325, City Hall) at 588-6256. The Contractor must have a hydrant meter permit in his/her possession 24 hours prior to the time he/she intends to use the hydrant.

There will be no separate payment for providing water for any portion of the work, it being understood that the cost thereof is included in the contracted prices for the various items of work, and is therefore a cost to be borne solely by the Contractor incidental to performance of the work.

105.13 SUBSURFACE DATA

All information obtained by Engineer regarding subsurface information and groundwater elevations will be available for inspection at the office of the Engineer upon request. Known utilities and structures expected to b adjacent to or encountered in the work are shown on the Plans. Such information is offered as supplementary information only. Neither the Engineer or Owner assumes any responsibility for the completeness or interpretation of such supplementary information.

Logs of test holes, test pits, soils reports, ground-water levels, and other supplementary subsurface information are offered as the best available information of underlying materials and conditions at the locations actually tested. Owner will not be liable for any loss sustained by the Contractor as a result of any variance between conditions contained in or interpretations of test reports and the actual conditions encountered during progress of the work.

Examine the site and available records, as set forth in Subsection 102.07. The submission of a Proposal shall be conclusive evidence that the bidder has investigated and is satisfied as to the subsurface conditions to be encountered, as to the character, quality, and quantities of work to be performed and materials to be furnished, and as to the requirements of the Contract Documents.

105.14 VERBAL AGREEMENTS

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

105.15 DUST CONTROL

During all phases of the construction work, and when directed, take precautions to abate dust nuisance by cleaning up, sweeping, sprinkling with water, or other means as necessary to accomplish the suppression of dust, at no expense to Owner.

105.16 TEMPORARY TRAFFIC CONTROL

Provide and be responsible at all times for such flaggers, signs, and other devices not otherwise specified to be furnished by the Owner in conformance with Section 202.

Upon failure to immediately provide the necessary flaggers, or to provide, erect, maintain, and remove barricades, lights and standard signs when so ordered, Engineer shall be at liberty, without further notice to Contractor or his/her Surety, to do so and deduct all of the costs thereof from any payments due or coming due to Contractor.

The Contractor shall submit a traffic control plan at the preconstruction conference unless the Special Provisions indicate no traffic control plan is necessary. Directional signing and protection barriers, as set forth in the City of Salem's Traffic Control Manual for Maintenance and Construction (revised February 1990) as approved by the City of Salem, Department of Public Works, Transportation and Development Division, Traffic Section, shall be required to maintain traffic for this project.

The Contractor shall notify affected residents and businesses in writing during business hours 48 hours in advance of parking removal, and/or street, driveway, and alley detour or closures.

All necessary traffic control required, including efforts necessary to comply with City and State permits, will be paid for under the lump sum Contract amount for the bid item Traffic Safety and Control, when shown on the Proposal. It shall include all costs associated therewith, including obtaining the Engineer's approval of any signing plans the Contractor proposes to use and obtaining "Street/Lane/Alley/Sidewalk Closure Permits". When not shown on the Proposal, all costs for traffic control shall be included in and incidental to pavement removal and replacement.

The Contractor shall be responsible to obtain a no-charge "Street/Lane/Alley/Sidewalk Closure Permit" from the City of Salem, Department of Public Works, Transportation and Development Division, Traffic Section, 48 hours prior to the closure of any street, alley, sidewalk, or lane

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involved with the construction of this project. The Contractor shall be responsible to notify those agencies as indicated on said permit.

Failure to provide proper, timely notification will be grounds to deny the commencement of construction.

105.17 REMOVAL OF DEFECTIVE OR UNAUTHORIZED WORK

All work which does not conform to the requirements of the Contract shall be considered as unacceptable.

Immediately remove unacceptable and defective work found to exist prior to acceptance of, or final payment for the work. Replace by work and materials which conform to the Contract Documents or remedy otherwise in an approved manner. This provision shall have full effect regardless of the fact that the unacceptable work may have been done or the defective materials used with the full knowledge of the Inspector.

Do not work without lines and grades having been given by the Engineer. Work done contrary to, or work done beyond the lines shown or as directed, except as herein provided, or any Extra Work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the Contract. Work so done may be ordered removed or replaced at no expense to Owner.

In the event any defect in work is of a minor nature and the Engineer determines that it is not of such consequence as to result in a dangerous and undesirable condition, or that the removal of such work would create a dangerous or undesirable condition, the Owner shall have the right to retain such work and make such deductions in the payment therefor as determined reasonable and in the public interest. Such determination by Owner shall be final.

105.18 RESTORATION AND CLEANUP

Periodically, or as directed by the Engineer, as the work progresses, and immediately after completion of the work, clean up and remove all refuse, debris, equipment, and unused materials of any kind resulting from the work. Upon failure to do so within 72 hours after directed, the work may be done by Owner or third party and the cost thereof be deducted from any payment due Contractor.

As a condition precedent to final acceptance of the project, remove all equipment and temporary structures, and all rubbish, waste and generally clean up the right-of-way and premises to conform substantially to conditions as they existed before the commencement of work, as approved.

Refer to ***Section 208 Restoration and Cleanup*** for additional requirements.

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105.19 FINAL INSPECTION

When all construction work on the project is complete and all Extra Work bills, forms and documents required under the Contract are submitted, notify the Engineer in writing. Engineer will make an inspection of the project and project records within 15 days of receiving said notice. If, at such inspection, all construction provided for and ordered under the Contract is found completed and satisfactory and all certificates, bills, forms, and documents have been properly submitted, such inspection shall constitute final inspection.

If work is found unsatisfactory, or if all certificates, bills, forms, and document have not been properly submitted, the Engineer will so notify the Contractor. After corrections are made, or all certificates, bills, forms, or documents are properly submitted, notify the Engineer in writing. Engineer will make another inspection within five days after such notice, and if all work is satisfactory, then this inspection shall constitute the final inspection.

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106 Control of Materials

106.01 PREFERENCE FOR USE OF OREGON PRODUCTS

Preference may be given to services, articles, or materials produced or manufactured in Oregon, if price, fitness, availability, and quality are otherwise equal. These provisions do not apply to Contracts on projects financed wholly or in part by Federal funds.

106.02 QUALITY OF MATERIALS

Use only new materials, parts, products and equipment in the work which conform to specified requirements, with certain salvage exceptions contained in Subsection 206.3.02. Materials and products which after approval have become unsuitable or unacceptable for use, regardless of cause, will be rejected by the Engineer and shall not be used.

106.03 SAMPLING AND TESTING

Test of materials will be made by Owner in accordance with methods described or designated in the applicable Specifications, and at any time during the production, fabrication, preparation, and use of the materials.

Owner reserves the right to require samples and to test products for compliance with pertinent requirements irrespective of prior certification of the products by the manufacturer thereof as set forth in Subsection 106.04.

When tests of materials are necessary, as determined by the Engineer, such tests will be made by and at the expense of Owner unless otherwise specified. Afford such facilities as required for collecting and forwarding samples where practical and withhold from use the materials represented by the samples until tests have approved samples. In all cases furnish the required samples without charge and in ample time to permit testing of materials prior to use. No claim will be allowed for any delay caused by awaiting test results. Provide safety measures and devices to protect those who take the samples.

In the absence of any reference Specification, it shall be understood that such materials shall meet the Specifications and requirements of the American Society for Testing and Materials (ASRM), or the American Association of State Highway and Transportation Officials (AASHTO), as directed by the Engineer. When there is no pertinent coverage under ASTM or AASHTO, the material concerned shall meet Specifications and requirements of Applicable Commercial Standards of the Commodity Standards Division of the U.S. Department of Commerce. Lacking such coverage, materials shall meet requirements established by reputable industry for a high-quality product of the kind involved.

All testing shall be performed by, or handled through, the testing laboratory of the Owner or as directed by the Engineer.

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When test which have been performed by the Owner, have found that the materials have failed and must be replaced, then the Contractor shall bear all costs for all subsequent testing necessary to prove the materials meet the specified requirements.

106.04 CERTIFICATION

For commercial products inclusive of industry standardized products, in lieu of normal sampling and testing procedures by the Contractor and Owner, the Engineer may accept from Contractor two copies of the manufacturer's certification with respect to the product involved, under conditions set forth as follows:

1. Certification shall state that the named product conforms to Owner's requirements and that representative samples thereof have been sampled and tested as specified.

2. Certification shall either be accompanied with a certified copy of test results, or certify that such test results are on file with the manufacturer and will be furnished to Engineer upon request.

3. Certification shall give the name and address of the manufacturer, the testing agency, and the date of test; and shall set forth the means of identification which will permit field determination of the product delivered to the project as being the product covered by the certification.

4. Owner will not be responsible for any costs of certification or for any costs of the sampling and testing of products in connection therewith.

106.05 INSPECTION REQUIREMENTS

Allow access to Engineer or his/her representatives to all parts of the work and to plants of manufacturers at all times. Furnish them with every reasonable facility for ascertaining if the work meets requirements and intent of the Contract Documents. Furnish all samples required for testing purposes at no expense to Owner.

106.06 INSPECTION BY OTHERS

Inspection of work by persons other than representatives of the Owner will not constitute inspection by Owner, except as set forth in Section 106.04.

Private laboratories and/or engineering testing firms which have been previously pre-qualified by the City of Salem may in some cases be employed by the City to provide testing and/or inspection duties.

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106.07 STORAGE AND PROTECTION OF MATERIALS

Store materials to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the right-of-way may be used for storage purposes, including Contractor's equipment, but any additional space required therefor shall be provided by Contractor at his/her expense. Do not use private property for storage purposes without written permission of the Property Owner or lessee. When requested, furnish copies of such written permission to the Engineer.

106.08 TRADE NAMES, APPROVED EQUALS, OR SUBSTITUTIONS

In order to establish a basis of quality, certain processes, types of machinery, or equipment of kinds of materials may be specified either by description of process or by designating a manufacturer by name and referring to his/her brand or product designation or by specifying a kind of material. It is not the intent of these Specifications to exclude other processes, equipment, or materials of equal value, utility, or merit.

Whenever a process is designated or a manufacturer's name, brand or item designation is given or whenever a process or material covered by patent is designated or described it shall be understood that the words ***or approved equal*** follow such name, designation, or description, whether in fact they do so or not.

If it is desirable to furnish items of equipment by manufacturers other than those specified, as a substitute after the Contract is executed, secure approval prior to placing a purchase order or furnishing same. The Engineer shall determine whether the material offered is equivalent to that specified.

If the Proposal includes a list of equipment, materials, or articles for which Contractor must name the manufacturer at time of submission of the bid, no substitutions therefor will be permitted after a Proposal has been accepted, without the express consent of Owner.

Assume full responsibility for all expenses involved in making any required changes in the Contract Documents to accommodate a substitution approved by the Engineer for the convenience of Contractor or to circumvent an unforeseen difficulty in obtaining a specified article.

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107 Legal Relations and Responsibilities

107.01 LAWS AND REGULATIONS

Keep fully informed of all Federal and State laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of work. Observe and comply with all such laws, ordinances, regulations, orders, and decrees. Protect and indemnify Owner and his/her representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by Contractor, his/her Subcontractors, suppliers of materials or services, or others engaged by the Contractor, or their employees.

Attention is directed to the statutes of the State of Oregon for public works Contracts. Chapter 279 of the Oregon Revised Statutes, as amended or superseded, including the latest additions and revisions, are incorporated by reference as parts of the Contract Documents.

General requirements for street and sewer improvements contained in Chapter 17 of the Owner's code shall apply to all applicable improvements.

107.01.01 SPECIFIC LAWS TO BE OBSERVED

Vehicles used to provide transportation services in furtherance of this project shall be operated in compliance with the operating authority, lease, safety, and other applicable motor carrier laws administered by the Public Utility Commissioner (PUC). Any questions regarding PUC motor carrier law should be directed to the Motor Investigations Division of the PUC office in Salem.

107.02 ASSIGNMENT OF CONTRACT AND SUBLETTING

No Contract or any portion thereof may be assigned or sublet without written consent of the Owner.

Under certain conditions, permitted by law, the Owner may give written consent for the Contractor to assign certain monies which are due under the Contract.

Any assignment of money shall be subject to all setoffs and withholding in favor of the Owner and to all deductions provided for in the Contract and particularly all monies withheld, whether assigned or not, shall be subject to use by the Owner for completion of the work in the event the Contractor should be in default therein.

No request for assignment of progress payments or retention monies shall be considered by the Owner unless accompanied by a written consent from the bonding company covering specific projects or a single project.

No assignment, or assignments, made unilaterally by the Contractor without prior written consent, as expressed above, will be honored by the Owner.

107.03 SUBCONTRACTORS

No part of the work shall be transferred or subcontracted without the prior written consent of the Owner, or approval at the time of award, and no such consent or approval shall release the Contractor from any obligation to the Owner or to persons employed by the Subcontractors or to those supplying materials to the Subcontractors. In all cases, Subcontractors will be considered by the Owner as an employee and liable to be replaced for incompetency, neglect of duty, or misconduct.

107.04 NO WAIVER OF LEGAL RIGHTS

Owner shall not be precluded or estopped by any measurement, estimate, or certificate made either before or after completion and acceptance of work or payment therefor, from showing the true amount and character of work performed and materials furnished by the Contractor, or from showing that any such measurement, estimate or certificate is untrue or incorrectly made, or that work or materials do not conform in fact to the Contract. Owner shall not be precluded or stopped, notwithstanding such measurement, estimate, or certificate, or payment in accordance therewith, from recovering from the Contractor and his/her Sureties such damages as it may sustain by reason of his/her failure to comply with terms of the Contract, or from enforcing compliance with the Contract. Neither acceptance by Owner, or by any representative or agent of the Owner, of the whole or any part of the work, nor any extension of time, nor any possession taken by Owner, nor any payment for all or any part of the project, shall operate as a waiver of any portion of the Contract or of any power herein reserved, or any right to damages herein provided. A waiver of any breach of the Contract shall not be held to be a waiver of any other subsequent breach.

107.05 OTHER CONTRACTS

Owner shall have the right to let other Contracts to be coordinated with this Contract. Cooperate with and afford such other Contractors reasonable opportunity for introduction and storage of materials and for execution of their work. Any matter of dispute between Contractors shall be decided by the Engineer, and his/her decision shall be binding. If any part of the work depends for its proper execution upon work of any such other Contractor, inspect and promptly report to the Engineer any defects that affect subsequent work. Failure to do so shall constitute an acceptance of such other Contractor's work as fit and proper for the reception and attachment of his/her own work and equipment.

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107.05A COOPERATION AND COLLATERAL WORK

The Contractor shall be responsible for ascertaining the nature and extent of any simultaneous, collateral, and essential work by others. The Owner, its workers and Contractors, and others, shall have the right to operate within or adjacent to the work site to perform such work.

The Owner, the Contractor, others, and the employees of each, shall coordinate their operations and cooperate to minimize interference.

The Contractor shall absorb in his/her bid all costs involved as a result of coordinating his/her work with others. The Contractor will not be entitled to additional compensation from the Owner for damages resulting from such simultaneous, collateral, and essential work. If necessary to avoid or minimize such damage, or delay, the Contractor shall redeploy his/her work force to other parts of the work.

Should the Contractor be delayed by the Owner, and such delay could not reasonably have been foreseen and prevented by the Contractor, the Engineer will determine the extent of the delay, the effect of the delay on the project as a whole, and any commensurate extension of time.

107.06 INSURANCE

Provide and maintain insurance as set forth in Subsection 103.07.

Casualty Insurance

Maintain such casualty insurance as will protect the Contractor and Owner from any and all claims which may arise from operations under this Contract or in connection therewith, including all operations of Subcontractors. Insurance shall provide limits **not less than $500,000 combined single limits comprehensive general or commercial general liability for bodily injury, personal injury, and property damage,** and automobile liability coverage in not less than the same limits for bodily injury and property damage.

Such insurance shall be without prejudice to coverage otherwise existing, **and shall name as addition insured the Owner** and those for whose conduct the Owner is subject to action or suit pursuant to ORS 30.265(1); and shall further provide that the policy shall not be terminated or be canceled prior to the completion of the Contract without 30 days' prior written notice to the Owner.

Notwithstanding the naming of additional insured, said policy shall protect each insured in the same manner as though a separate policy had been issued to each; but nothing herein shall operate to increase the insurer's liability as set forth elsewhere in the policy beyond the amount or amounts for which the insurer would have been liable if only one person or interest had been named as insured.

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The contractor shall not commence work under this Contract until he/she has furnished the Owner with evidence of insurance coverage specified herein, which evidence shall include a Certificate of Insurance and copy of the policy endorsement providing the additional insured coverage herein required, both acceptable as to form by the City Attorney. The City Attorney may approve the apparent adequacy of additional insured coverage prior to receipt of a copy of the endorsement upon sufficient assurance that such coverage is bound through a licensed insurance agent upon the condition that a copy of the endorsement as issued by the insurer and conforming to such agent's representations is delivered for approval within 30 days of such temporary approval.

Fire and/or Standard Extended Coverage Insurance

Insure the work for 100 percent of the replaceable value thereof for the life of the Contract against all loss or damage by fire and against all loss or damage covered by the Standard Extended Coverage Insurance endorsement, including theft, vandalism, and malicious mischief, with insurance company or companies acceptable to Owner. The amount of the insurance may vary with the extent of the work completed but shall at all times be at least equal to the replaceable value of the amount furnished or delivered, but not yet paid for by Owner. The insurance policy or policies shall be held jointly in the name of the Owner and Contractor as their respective interests may appear. The loss, if any, shall be made adjustable with, and payable to Owner as trustee from whom it may concern. Any payments made under such policy shall inure to the benefit of Owner to the extent of any loss suffered by Owner and to Contractor as to any remaining balance, for replacement of the loss suffered. The policy of insurance shall provide that it shall not be terminated or be canceled prior to completion of the Contract without 30 days written notice to the Owner. Be responsible for all damage to the work under construction, whether from fire, water, high winds, or other cause, during construction and until final completion and acceptance, even though partial payments or progress payments have been made under the Contract.

Worker's Compensation Insurance

Prior to issuance of a Notice to Proceed, and before performing any work on the project, the Contractor shall submit proof in form and substance acceptable to the Owner that:

1. The Contractor is not a ***subject employer*** as defined in ORS 656.005(25); or

2. The Contactor is a ***carrier-insured employer*** as defined in ORS 656.005 (5); or

3. The Contractor is a ***self-insured employer*** as defined in ORS 656.005 (23).

In the event the Contractor wishes to comply with this Section by furnishing proof that he/she is not a ***subject employer***, he/she shall also file with the Owner a declaration of independent Contractor status, and waiver of eligibility for Workers' Compensation coverage on a form furnished by the Owner for that purpose.

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Promptly notify the Owner, in no event less than ten calendar days, prior to any change or foreseeable change in Contractor's status as described in the preceding paragraph; and, in the event such status is changed whether or not notice has been given in advance, immediately suspend all work under this Contract until the Owner has acknowledged, in writing, the sufficiency of proof that the Contractor meets one of the three criteria specified above.

107.07 ROYALTIES AND PATENTS

Pay all royalties and license fees. Save the Owner free and defend Owner, from all loss or damage that may result from the wrongful or unauthorized use of any patented article or process.

107.08 PERMITS

The Contractor shall keep himself/herself fully informed of all local ordinances, State, and Federal laws in any manner affecting the work herein specified. He/she shall at all times comply with said ordinances, laws, and regulations, and protect and indemnify the Owner and its officers and agents against any claim or liability arising from or based on the violation of any such laws, ordinances, or regulations. Permanent easements and rights-of-way necessary to the project will be obtained by the Owner. Temporary working easements, licenses, and permits of entry must be obtained by the Contractor, except as specified elsewhere in the Contract Documents. Building permits and similar permits required by the City of Salem in its regulatory capacity will be furnished by the Owner at no cost to the Contractor. Other permits, licenses, and like fees related to the work and required by State, County, or other agencies must be borne by the Contractor.

107.09 WAGE RATES

Pursuant to Oregon Revised Statutes, Chapter 179, pay minimum prevailing wages for work performed hereunder equal to the minimum prevailing wages on file in the office of the State Labor Commissioner applicable to the City of Salem, Oregon, area as of the date of signing of the Contract by the parties, which schedule of prevailing wages shall be made a part of the Contract by reference as though fully set forth therein.

107.10 EMPLOYER'S CONTRACT FOR MEDICAL CARE OF EMPLOYEES

Make payment promptly, as due, to any person, co-partnership, association or corporation, furnishing medical, surgical and hospital care, or other needed care and attention, incident to sickness or injury, to employees, of all sums which have been agreed to be paid for such services and all monies and sums which: (1) may or shall be deducted from the wages of employees for such services pursuant to the terms of Oregon Revised Statutes Chapter 655, and any Contract entered into pursuant thereto; or, (2) are collected or deducted from the wages of employees pursuant to any law, Contract or agreement for the purpose of providing or paying for such service.

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107.11 PAYMENT OF OBLIGATIONS

Make payment promptly, as due, to all persons supplying labor or materials for the prosecution of work under the Contract. Do not permit any lien or claim to be filed or prosecuted against the Owner on account of any labor or material furnished. Pay to the State Tax Commission all sums withheld from employees pursuant to Oregon Revised Statutes Chapters 315 or 316.

Failure to make prompt payment of any claim, when due, for labor or services supplied for the prosecution of work under the Contract, including labor or material supplied to Subcontractors, may necessitate Owner paying such claim to the person furnishing the labor or services and charge the amount of payment against funds due or to become due Contractor by reason of his/her Contract. Such payment shall not relieve the Contractor or his/her Surety from his/her or its obligation with respect to any unpaid claims.

107.12 PROTECTION OF OTHER GOVERNMENTAL AUTHORITIES

Whenever work under the Contract affects or may affect public property owned by or under the jurisdiction of any governmental authority, agency, or district, including governmental subdivision other than the Owner, indemnify and save harmless such governmental authority, its, officers, agents, and employees from any loss, damage, or claim of loss or damage to such property or the use thereof, arising from work under the Contract. Supply any bond or insurance and make any special guaranty deposit required by such governmental authority, before beginning any portion of the work which affects or may affect the property of such governmental authority or the use thereof.

107.13 PUBLIC SAFETY AND CONVENIENCE

Conduct the project with proper regard for the safety and convenience of the public. When the project involves use of public ways provide flaggers when required and install and maintain means of free access to all fire hydrants, service stations, warehouses, stores, houses, garages, and other property. Private residential driveways shall be closed only with approval of the Engineer or specific permission of the Property Owner. Do not interfere with normal operation of public transit vehicles unless otherwise authorized. Do not obstruct or interfere with travel over any public street or sidewalk without approval. Provide open trenches and excavations with adequate barricades of an approved type which can be seen from a reasonable distance. At night mark all open work and obstructions by lights. Install and maintain all necessary signs, lights, flares, barricades, railings, runways, stairs, bridges, and facilities. Observe all safety instructions received from Engineer or governmental authorities, but following of such instructions shall not relieve Contractor from his/her responsibility or liability for accidents to workers or damage or injury to person or property. Provide temporary traffic control and signing as specified in paragraph 202.

Emergency traffic such as police, fire, and disaster units shall be provided reasonable access to the work area at all times.

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Be liable for any damages which may result from failure to provide such reasonable access or failure to notify the appropriate authority.

107.14 PERSONAL SAFETY

Be responsible for conditions of the jobsite, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. Safety provisions shall conform to the applicable Federal, State, County, and local laws, ordinances, and codes. Where any of these are in conflict, follow the more stringent requirement.

The duty of the Engineer to conduct construction review of Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site.

107.15 DETOURS

Construct and maintain detours caused by work operations, or for convenience of the Contractor, at no expense to Owner. Submit Plans for such detours to Engineer for approval.

Construct and maintain approved temporary detours to provide adequate passage of public traffic and protection of the work at all times.

Assume responsibility for detours within the limits of the project such as side street crossing, temporary bridges over freshly placed concrete, or utilization of one or more lanes of the construction area for maintenance of traffic.

If, in the judgment of the Engineer, one-way piloted traffic is necessary, it shall be provided for as set forth in Section 202. The Engineer may recommend if flagging and piloting can be dispensed with after working hours. In the event that flagging and piloting are required after working hours as a result of carelessness or negligence on the part of Contractor to properly condition work at the end of the day, such piloting, and flagging shall be provided by Contractor at no expense to Owner.

Upon failure to immediately provide, maintain, or remove suitable detours or detour bridges when ordered to do so by Engineer, Owner may without notice to Contractor or his/her Surety, provide, maintain, or remove the detour and deduct costs thereof from any payments due or coming due to Contractor.

107.16 LABOR

Upon notification is writhing from the Engineer, remove immediately from the job for its duration any laborer, worker, mechanic, foreman, superintendent, or other person employed who is found to be incompetent, intemperate, troublesome, disorderly, or otherwise objectionable, or who fails or refuses to perform his/her work properly and acceptably.

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Attention is directed to provision s of Chapter 97 of the Salem Revised Code, and to Chapter 659, Oregon Revised Statutes relative to unlawful employment practices and discrimination by employers against any employee or applicant for employment because of race, religion, color, sex, or national origin. Particular reference if made to Section 659.030 ORS, which states that it is an unlawful employment practice for an employer, because of the race, religion, color, sex, or national origin of any individual, to refuse to hire or employ or to bar or discharge from employment such individual or to discriminate against such individual in compensation or in terms, conditions or privileges of employment.

In the event the Contract is funded in whole or in part by Federal funds, comply with all provisions of Executive Order No. 11246 and of the rules, regulations, and relevant orders of the Secretary of Labor.

In the event of the Contractor's noncompliance with the nondiscrimination clauses of a Contract so funded, or with any such rules, regulations, or orders, the Contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government Contracts or Federally assisted construction Contracts, in accordance with procedures authorized in Executive Order No. 11246, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

If it is necessary to perform construction work on Saturdays, Sundays, legal holidays, or outside the eight hour regular working day, first notify Engineer of intent to do so one day prior to commencing such overtime work. In any event, all work shall be subject to approval. Prior to the start of such work, arrange with the Engineer for continuous or periodic inspection of the work, surveys, and tests of materials when necessary.

107.17 WORKING CONDITIONS

Agree, pursuant to ORS Chapter 279, that no person shall be employed for more than eight hours in any one day, or 40 hours in any one week, except in cases of necessity, emergency, or where the public policy absolutely requires it, and such cases the worker shall be paid at least time and a half for all overtime in excess of eight hours a day and for work performed on Saturday and on any legal holiday specified in ORS Chapter 187, except Veterans' Day. However, when specifically agreed to under a written labor-management negotiated labor agreement, a worker may be paid at least time and a half pay for work performed on Veterans' Day or on any legal holiday specified in ORS Chapter 187. This paragraph does not apply to labor performed in the manufacture or fabrication of any material ordered by the Contractor or manufactured or fabricated in any plant or place other than the place where the main Contract is to be performed.

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107.18 USE OF EXPLOSIVES

Obtain a permit from Owner for use of explosives on any of Owner's projects; such use of explosives is subject to all the provisions, laws, orders, and regulations of any other governmental authority in whose jurisdiction such work may be done.

107.19 RAILROAD CROSSINGS OR RIGHT-OF-WAY

Submit a program of proposed operations whenever the project or work thereunder involves the crossing of any railroad line or the encroachment on any railroad right-of-way. This program of proposed operations shall be approved by the appropriate railroad officials and the Engineer before the work is started within such area. Pay for services of flaggers and/or watchpersons furnished by the railroad company and provide and drive piling, set cribbing, build bridges or tunnels, install enclosing pipe, and do all other work required by the railroad company or necessary for safety or maintenance of railroad traffic. Furnish any bond or insurance required of the Owner by the railroad company as a result of such intended operations and indemnify Owner for any and all expenses incurred by Owner, and assume any and all liability or claims thereof imposed on Owner as a result of operations in railroad right-of-way area. Bear all costs resulting from interferences, obstructions, or liabilities set forth in this Specification, whether or not herein specifically mentioned.

107.20 RIGHTS-OF-WAY, EASEMENTS, AND PREMISES

Confine construction activities within property lines, limits of easements, and limits of construction permits as shown or specified in the Contract Documents, unless arrangements are made with Owner (s) of adjacent private property. Prior to the use of any private property outside these specified boundaries, file with the Engineer a written permission of the Property Owner (s), and upon terminating such usage, file with the Engineer a release from all damages, signed by the Property Owner (s).

Do not unreasonably encumber the specified work areas with materials and equipment, and obtain and bear the cost of permits for special occupancy and use of the specified work areas from the proper agencies. Comply with the Engineer's directions regarding signs, advertisements, fires, and smoking.

107.21 WASTE SITES

Excavated materials not suitable or not required for backfill or embankment shall be deposited on one or both of the following waste sites; (1) predesignated waste sites contained in the Contract Documents, and (2) waste sites provided by the Contractor. All costs for disposing of this excess material shall be incidental to other items of work contained in the Proposal.

Operate either type of waste site in such a manner as to meet all safety and health requirements of State and local agencies. Sites operations, or the result of such operations,

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which create a nuisance problem, or which result in damage to public or private properties will not be permitted.

Permits for dumping on sites designated in the Contract Documents will be provided by Owner; obtain permits for other sites which are located within Owner's boundaries from Owner's Building Division at no expense to Owner. Furnish copies of issued permits to Engineer prior to commencing filling operations.

Do not deposit material on an unimproved dedicated street are without permission of the Engineer. See Subsection 204.3.10 for further requirements.

(1) Where waste sites are designated in the Contract Documents, the operations shall be performed as directed and upon completion, uniformly clean and shape the area as directed.

(2) Where there is additional waste excavation in excess of that needed for the project or for predesignated sites, dispose of this material be securing and operating a waste site in conformance with the general requirements hereinbefore described. Contractor may accept any reimbursement that can be secured from the sale of such materials.

107.22 VERMIN CONTROL

At the time of occupancy by Owner, any structure or structures entirely constructed under the Contract shall be free of rodents, insects, vermin, or pests. Arrange and pay for extermination work as may be necessary as part of the Contract work within the Contract time. Work shall be performed by a licensed agency in accordance with the requirements of governing authorities. Assume responsibility for any injury to persons or property resulting from extermination work and for the elimination of any offensive odors resulting from extermination operations.

107.23 MAINTENANCE

Make all necessary repairs and replacements to remedy, in a manner satisfactory to the Engineer and at no cost to Owner, any and all defects, breaks, or failures of the work occurring within one year following the date of acceptance of the work due to: faulty or inadequate materials or workmanship, and for damage or disturbances to other improvements under, within, or adjacent to the work, whether or not caused by settling, washing, or slipping, when such damage or disturbance is caused, in whole or in part, from activities of the Contractor in performing his/her duties and obligations under this Contract. When such defect or damage occur, within the time period described hereinbefore, in any part of the surface or subsurface work done under the Contract, or in any adjacent surface or subsurface improvements not included in the work under the Contract, repair the same and the one-year maintenance period required shall, with relation to such required repair, be extended one year from the date of completions of such repair.

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107.24 SANITATION

The Contractor shall provide and maintain enclosed toilets for the use of employees engaged in the work. These accommodations shall be maintained in a neat and sanitary condition. They shall also comply with all applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

Sewage flows shall not be interrupted. Should the Contractor disrupt existing sewer facilities, sewage shall be conveyed in closed conduits and disposed of in a sanitary sewer system. Sewage shall not be permitted to flow in trenches, plugged sanitary sewers with no method of drainage, or to be covered by backfill.

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108 Prosecution and Progress of Work

108.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

Before starting work, submit for written approval a proposed construction schedule to the Engineer. If it is desirable to carry on operations in more than one location simultaneously, submit a schedule for each location two weeks in advance of beginning such operations. In the event that the Contractor's proposed construction schedule does not meet the necessary construction program schedule as determined by Owner, resubmit a schedule that conforms as approved.

The schedule shall show the proposed order of work and indicate the time required for completion of the major items of work. This working schedule shall take into account the passage or handling of traffic with the least practicable interference therewith and the orderly, timely, and efficient prosecution of work. It will also be used as an indication of the sequence of the major construction operations and as a check on the progress of work, but does not become a part of the Contract.

108.02 PRECONSTRUCTION CONFERENCE

Meet with the Engineer for a preconstruction conference at a time mutually agreed upon to discuss the construction scheduled set forth in Subsection 108.01 and items of work which require special coordination between the Contractor, Owner, and other third party interest involved in the project, i.e., franchise permittees.

108.03 NOTICE TO PROCEED

Written Notice to Proceed will 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. Do not commence work under the Contract until such written notice has been given.

Notice to Proceed for street projects may be delayed by Owner until required utility relocation, construction, or reconstruction has been completed or has progressed to a satisfactory degree of conformance which will allow initial Contract work to commence.

Commence work within ten days after the date of the Notice to Proceed, or such other date as may be fixed by the Notice to Proceed, which date shall establish the date for commencement of the Contract time. Notify Engineer 48 hours in advance of the time and place work will be started.

108.04 CONTRACT TIME

Time shall be considered the essence of the Contract. The Owner, however, may grant extensions of time to the extent it finds reasonable and justified when the delay is due solely to

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causes beyond the control of the Contractor and without any fault or negligence or participation by the Contractor, as provided in Section 108.06.

If, in the judgment of the Engineer, insufficient forces are being employed, or inadequate equipment and methods are used, or if progress is for any reason unduly delayed, he/she may instruct the Contractor in writing to increase his/her force or equipment, or adopt improved methods to expedite the work. Conformity to the Engineer's instructions shall not relieve the Contractor of any of his/her responsibilities under the Contract.

108.05 SUSPENSION OF WORK

The work may be suspended in whole or in part when determined by the Engineer that the suspension is necessary in the interest of the Owner. The Contractor shall comply immediately with any written order of the Engineer suspending work. Such Suspension shall be without liability to the Contractor on the part of the Owner except as otherwise specified below.

108.05.1 PAYMENT FOR DELAYS TO CONTRACTOR

The Contractor may be compensated for delays caused solely by the failure of the agency to furnish necessary rights-of-way, failure to deliver materials shown in the Contract Documents to be furnished by the agency, or for the suspension of the work by the agency for its own convenience or benefit. If the Contractor sustains a loss which could not have been avoided by the judicious handling of forces, equipment, or plant, there shall be paid to the Contractor such amount as the Engineer may find to be fair and reasonable compensation for such part of the Contractor's actual loss as was unavoidable.

108.05.2 WRITTEN NOTICE AND REPORT

If the Contractor desires payment for a delay as specified herein or an extension of time, it shall, within 30 days after the beginning of the delay, file with the Agency a written request and report as to the cause and extent of the delay. The request for payment or extension must be made at least 15 days before the specified completion date. Failure by the Contractor to file these items within the times specified will be considered grounds for refusal by the Agency to consider such request.

Resumption of Work

In all cases of suspension, work will be resumed only upon written order of the Engineer or Owner.

108.06 DELAYS AND EXTENSION

Contract completion time may be subject to adjustment during the progress of the work at the written request of the Contractor, for causes beyond the control of the Contractor and which the Engineer determines actually affected the time necessary for completion of work under the Contract.

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Owner or Engineer will not consider adjustment of Contract time based on shortage or inadequacy of labor and equipment, negligence or fault of Contractor, and other deficiencies or lacks which are within the province of Contractor's control or responsibility. Causes which will be given consideration in justifying adjustment of Contract time will include, but are not limited to, the following:

1. Errors, changes, or omissions in the Contract Documents.

2. Failure of Owner, its representatives, and its other Contractors to act promptly in carrying out obligations and duties.

3. Failure of Owner to submit the Contract and bond form to the Contractor for execution within the specified time contained in Subsection 103.01.

4. Performance of Extra Work under Subsection 104.06.

5. Court orders enjoining the prosecution of the project, strikes, acts of God which shall include unusual action of the elements not reasonably foreseeable by the Contractor, or at of Owner not authorized by the Contract or permitted by law.

A Contract time extension will be considered only if the Contractor has given written notice to Owner of the cause of delay within ten days after the beginning thereof and notice to Owner of the termination thereof within five days after such termination, and makes claim for such extension prior to the Contract completion date. The decision by Owner of the reasonable term of any extension or denial thereof shall be final.

An adjustment of Contract time as herein provided shall be Contractor's sole remedy for any delay in completion of the project arising from causes beyond the control of Contractor, and that in no event shall Contractor be entitled to collect or recover any damages, loss, or expense incurred by reason of such delay.

Contract time extensions shall be granted for those days when the SCS prohibits the particular work activity scheduled for that day (i.e., asphalt paving), and those days when in the opinion of the Engineer adverse weather conditions would preclude the Contractor from effectively working on scheduled work items, or when the scheduled construction activity would damage work already completed. When a time extension is granted as above, on the day before a weekend or holiday, the extension shall hold through the weekend or holiday.

The determination of the Engineer shall be final. Adjustment of Contract time as provided for in the SCS shall be the Contractor's sole remedy for any delay in completion of the project arising from weather or other causes beyond the control of the Contractor. In no event shall the Contractor be entitled to collect or recover damages, loss, or expense incurred by reason of such delay.

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108.065 DURATION OF CONTRACT

The Contractor shall begin work not later than ten days after the date the Notice to Proceed is issued and shall complete the entire work within the number of calendar days stated in the Proposal. Work will be considered complete and time count stopped when all forms, documents, and final pay estimate have been submitted and a written request for final inspection has been made as per ***Subsection 105.19 Final Inspection*** of the SCS.

If, after an inspection, the work is found to be unsatisfactory, including cleanup, the Contract time count will resume until corrective work has been completed.

If all forms, documents, and final pay estimate have not been submitted when final inspection is requested then the Contractor shall have 30 days to submit all forms, documents, and final pay estimate from the date final inspection was requested. The Contract time count will resume after the expiration of said 30 days and run until all forms, documents, and final pay estimate have been submitted.

108.07 LIQUIDATED DAMAGES

Time shall be considered the essence of the Contract. If Contractor fails to complete the work as specified within the time specified in this Contract or any extension thereof by the Owner, actual damage to Owner for the delay will be substantial but will be difficult or impractical to determine, and, therefore, in lieu thereof the Contractor and/or his/her Surety shall be liable to Owner as fixed, agreed, and liquidated damages for each and every calendar day of delay, the amount as set forth in the Bid Proposal.

108.08 CONTRACTOR'S REPRESENTATIVE

Designate in writing before starting work an authorized representative, who shall have complete authority to represent and to act for Contractor, in his/her absence from the work site, in all directions given to him/her by the Engineer. Contractor or his/her authorized representative, shall supervise the work, and shall be present on site continually during its progress. If called for in the Contract Documents, maintain an office on or adjacent to the project site. Keep a complete copy of the Plans and Specifications on or near the site at all times. If Contractor and his/her authorized representative are not present on any part of the work where it may be necessary to give instructions, directions may be given by Engineer to the superintendent, or foreman who may have charge of that particular part of the project, and such order shall be received and followed. Such directions shall not be deemed to change the status of Contractor or Subcontractor, nor to make Owner and employer, nor to give Owner direct responsibility for the methods and manner of the work. Such directions of major importance will be confirmed in writing. Any direction will be so confirmed in each case on written request from the Contractor.

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108.09 CONFLICTS, ERRORS, OMISSIONS, AND ADDITIONAL DRAWINGS

Check and compare all Plans prior to construction and notify Engineer of any discrepancies or omissions in order to permit correction by Engineer. Coordination of Plans and Specifications is intended. Furnish labor and materials required for the work if indicated on one and not the other as fully as if mentioned or indicated on both; and should any work or materials be reasonable required or intended for carrying the project to completion which are inadvertently omitted on the Plans or Specifications, furnish same as fully as if particularly delineated or described. The intent of the Plans and Specifications is to show and describe a complete project within the limits stated. Dimensions shown on Plans shall be followed, rather than scale measurements. Whenever it appears that the Contract Plans are not sufficiently detailed or explicit, the Engineer may furnish additional detail drawings or written instructions, and Contractor shall perform the work in accordance with the additional details or instructions. In case of conflict between requirements set forth in the Contract Documents the provisions for order of precedence in Subsection 104.02 shall apply.

108.10 OWNER'S RIGHT TO DO WORK

Neglecting to prosecute the project properly, or failing or refusing to perform any of the terms or conditions of the Contract, will permit Owner to supply or correct any deficiency or defect without prejudice to any other remedy. Such action by Owner shall be taken only after three days' notice by Engineer to Contractor and his/her Surety, unless in the judgment of the Engineer and emergency or danger to the work or to the public exists, in which event action of Owner as set forth above may be taken without any notice whatsoever. The cost of such action by Owner shall be deducted from the payment then or thereafter due Contractor. Pay Owner any costs in excess of such payment due.

108.11 TERMINATION OF CONTRACT

All terms and conditions of the Contract are considered material, and failure by Contractor to comply with any of said terms or conditions shall, at Owner's option, be deemed a breach of Contract. Upon such failure, Owner shall have the right, whether and alternative right is provided or not, to declare the Contract terminated. Issuance by Owner or by the Engineer of an order stating that the Contract is terminated, and service of a copy of said order upon Contractor and his/her Surety, shall be deemed a complete termination of the Contract. Upon the Contract being so terminated, Owner may retain all sums due under the Contract and both the Contractor and his/her Sureties shall be liable under his/her bond for all losses, expenses and damages caused to Owner by reason of his/her failure to complete the Contract, and Surety shall be required, at Owner's option, to complete the project. Notwithstanding such termination, Contractor and his/her Sureties shall remain liable under the terms of the Contract for work performed prior to such termination. The Engineer will determine the payment due Contractor for work performed prior to the date of Contract termination.

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108.12 DEFAULT BY CONTRACTOR

If Contractor fails to begin work as required by the Contract, or if he/she should be adjudged bankrupt, or make a general assignment for the benefit of his/her creditors, or a receiver is appointed on account of his/her insolvency, or if at any time when work has been resumed after a Suspension of Work (pursuant to Subsection 108.05) he/she refuses, neglects, or fails to correct the deficiency (s) or reason (s) for the suspension, or if he/she abandons the work, Engineer may give written Notice of Default to Contractor and his/her Surety, and he/she shall discontinue or not begin the work, and any or all payments due or that may become due to Contractor may be withheld by Owner until the completion by Owner, Surety, or another person of all work included in the Contract, and until expiration of any maintenance and/or warrantee period.

After service on Contractor of such order to desist from work or part thereof, or Notice of Termination as set forth in Subsection 108.11, Owner may take possession of the project or such designated part thereof, and may use all or any part of Contractor's plant, tools, equipment, materials, or other property on the project, none of which shall be removed by Contractor as long as they may be required for the work, and Owner may, by Contract or otherwise, provide supervision of workers, materials, appliances, and equipment necessary for the completion of, and may complete the project or such designated part thereof. The expense so incurred for completion of the project or part thereof, together with all damages liquidated or otherwise sustained or to be sustained by Owner shall be deducted from the fund or appropriation set aside for the purpose of the Contract and shall be charged to Contractor as if paid to him/her. In case the amount of such expenses and damages exceeds the sum which would have been payable under the Contract if completed entirely by Contractor, the amount of such excess shall be paid to Owner by Contractor and both he/she and his/her Sureties shall be liable to Owner therefor; in case the amount of such expenses and damages shall be less than the sum which would have been payable under the contract if completed entirely by Contractor, he/she shall be entitled only to payment in accordance with Contract terms for the work Contractor actually performed, subject however, to all terms of said Contract.

Complete all work unless an order to desist as provided above has been received, and cooperate with and in no way hinder or interfere with forces employed by Owner or others.

Upon completion of the project by others, be entitled to the return of all material which has not been used in the work or which has not been paid for, and for all plant, tools, equipment, and other property, provided, however, that no claim will be allowed because of usual and ordinary depreciation, loss, wear and tear.

None of the foregoing provisions, or the provisions in Subsection 108.11, shall be construed to require Owner to complete the work, nor to waive or in any way limit or modify the provisions of the Contract relating to the fixed and liquidated damages suffered by Owner on account of the failure of Contractor to complete the project within the time prescribed.

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108.13 COMPLETION AND ACCEPTANCE

After completion of all items of work in the Contract and completion of final inspection as set forth in Subsection 105.19, the Engineer will recommend to Owner that the work be accepted and payment be made as provided for in Subsection 109.09.

Final acceptance of work under the Contract will be made by adoption of Engineer's report by Owner.

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109 Measurement of Payment

109.01 MEASUREMENT OF QUANTITIES

Payments shall be based on measurements of completed work in accordance with the United States Standard Measures. Units of measurement for payment shall be as shown or specified. Engineer will make measurements at no cost to Contractor. In calculating quantities, all lengths and areas will be based on horizontal and vertical measurements unless otherwise specified.

Basis is defined as the particular standard unit of measurement which will be applied to a particular item of work as shown in the Proposal for a specific Contract. Each basis of measurement herein set forth is generally applicable and will be in effect; however, in case of conflict, the order of precedence will conform to Subsection 104.02.

Volume of materials measured in the vehicles by which they are transported will require computing of the volume of the vehicle to the nearest 0.1 cubic yard for its approved capacity, and identification of the vehicle and its capacity. Pay quantities will be determined by vehicle measurement at point of delivery with no allowance for settlement of material during transit. Loads shall be level and uniform. Payment will not be made for material in excess of the approved capacity of the vehicle and deductions will be made for loads below approved capacity.

Volumes of concrete and masonry in structures will be measured according to neat lines as shown on the Plans or as altered on order of the Engineer.

Volume—Volumes of earthwork, particularly excavation and embankment, will be computed by the average end area method or by other methods of equivalent accuracy.

Weight—When payment for materials other than bituminous cements is on a weight basis and unless otherwise set forth in the Specification under which material is to be furnished, pay quantities will be determined by weighting material on weigh scales provided by the Contractor as set forth hereinafter. Such weighing is to be of material in the hauling vehicle as loaded for delivery. Determination of tare weights and weight of loaded vehicles will be to the nearest 20 pounds. Tare weights will be determined by weighing empty vehicles at intervals of such frequency as the Engineer deems necessary to ensure accuracy of pay load weights.

Portland cement will be measured by the pound, hundredweight, ton, sack, bag, or barrel. The term Barrel of cement will mean 376 pounds, avoirdupois, of cement. The terms Sack and Bag of cement will each mean 94 pounds, avoirdupois, of cement.

Quantities of asphalt cements, liquid asphalt materials, and other bituminous cements normally shipped in tank cars or tank trucks, when they are to be paid for by the gallon (U.S. Standard) or by the ton, will be determined from volume computations of the materials when at a temperature of 60 degrees F, with standard recognized correction factors applied when the

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materials are measure at any temperature other than 60 degrees F. Net certified scale weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when bituminous material has been lost from the car or the distributor, wasted or otherwise not incorporated in the work. When bituminous materials are shipped by truck or transport, net certified weights or volume, subject to correction for loss or foaming, may be used for computing quantities.

Weights of metals and of metallic coating will be determined on the basis set forth in the Specification under which their use is required.

Scales—When the Contract calls for materials which are to be measured by weighing on scales, provide suitable scales and transport materials to scales at no expense to the Owner. Before use of scales is commenced, and as frequently thereafter as the Engineer may deem necessary to ensure accuracy, have the scales examined by an official of the States Sealer of Weights and Measures, and bear all costs resulting therefrom. Be responsible for maintaining the scales in accurate condition at all times.

Furnish and so locate scales that the amount of hauling involved in the delivering of materials is no greater than if no weighing were required; if not, bear expense of whatever extra hauling is required. If hauling of materials is to be paid for as a separate pay item, the pay distance shall be via the most direct practicable route and no allowance will be made for any extra hauling required to reach the scales.

If material is weighed on public scales, a representative of the Owner shall be present at all times to witness the weighing and to check and compile records of scale weights.

109.02 SCOPE OF PAYMENT

Quantities listed in the Proposal do not govern final payment. Payments to the Contractor will be made only for actual quantities of Contract items performed in accordance with terms of the Contract and for items of work actually performed as Extra Work or under supplemental agreement in accordance with the terms of the Contract.

Accept the compensation , as herein provide, in full payment for furnishing all materials, labor, tools, equipment and incidentals, excluding those specified in Subsection 104.08, necessary for performing all work under the contract, also for all loss, damage, or liability arising from the nature of the work, or from the action of the elements, subject to provisions of Subsection 106.07 or from any unforeseen difficulties which may be encountered during prosecution of the work, until final acceptance by Owner.

109.03 PAYMENT FOR CHANGES INITIATED BY THE OWNER

109.03.01 CONTRACT UNIT PRICES

If a change is ordered in an item of work covered by a Contract unit price, and such change does not involve a substantial change in the character of the work from that shown on the

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Plans or included in the Specifications, an adjustment in payment will be made based upon the increase or decrease in quantity and the Contract unit price. In the case of such and increase or decrease in a major bid item, the use of this basis for the adjustment of payment will be limited to that portion of the change which, together with all previous changes to that item, is not in excess of 25 percent of the total cost of such item based on the original quantity and Contract unit price.

If a change is ordered in an item of work covered by a Contract unit price, and such change does involve a substantial change in the character of the work from that shown on the Plans or included in the Specifications, an adjustment in payment will be made in accordance with Subsection 109.03.03.

Should any Contract item be deleted in its entirety, payment will be made only for actual costs incurred prior to notification of such deletion.

109.03.02 STIPULATED UNIT PRICES

Stipulated unit prices are those established by the Owner in the Contract Documents, as distinguished from Contract unit prices submitted by the Contractor. Stipulated unit prices may be used for the adjustment of Contract changes.

109.03.03 AGREED PRICES

Adjustments in payments for changes other than those set forth above will be determined by agreement between Contractor and Owner consisting of an acknowledged Engineer's Directive or a fully executed Change Order. If unable to reach agreement, the Owner may direct the Contractor to proceed on the basis of Extra Work in accordance with Subsection 104.06.

109.03.04 MAJOR BID ITEMS

A major bid item as described in Subsection 109.03.01 above is hereby defined as a single bid item covered by a Contract unit price whose value as determined by the extended item price in the Contractor's Bid or the most recent Engineer approved estimated quantity, whichever is later, is more than 10 percent of the total cost of the Contract.

109.04 ELIMINATED ITEMS

Engineer shall have the right to eliminate, omit, or cancel (herein collectively termed elimination) portions of the Contract Documents relating to construction of any item or part of any item therein by payment to the Contractor of a fair and equitable amount covering all items of actual cost incurred directly in connection with eliminated work and prior to the date of elimination of work by order of the Engineer. Where practicable, work completed before elimination shall be paid for at unit prices, otherwise Contractor will be allowed a profit percentage on materials used and construction work actually performed at rates as provided in Subsection 109.06 for Force Account work, but no allowance will be made for anticipated profits. Acceptable materials ordered by Contractor, delivered on the work, or properly stored at sites approved by the Engineer prior to date of elimination of work by order of Engineer may

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be purchased from Contractor by Owner at actual cost, and thereupon shall become the property of Owner.

109.05 PAYMENT FOR EXTRA AND FORCE ACCOUNT WORK

If it is agreed between the Contractor and Engineer that Extra Work is to be paid for at stipulated unit prices or stipulated lump sum prices, payment for the Extra Work will be so made; otherwise, payment for Extra Work will be made on the Force Account basis as hereinafter set forth. Payment for Extra Work will be made only when the Extra Work involved has been authorized by the Engineer, in writing, prior to performance of the work; and when the Extra Work is performed as specified.

When Extra Work is ordered by the Engineer to be done on a Force Account basis, work so done and accepted will be paid for in the following manner:

(a) Labor—For all labor, including equipment operations, and for foremen in direct charge of the specific operations, while engaged directly upon Force Account work, the Contractor will be paid:

(a-1) The actual wages paid to said laborers and foremen when such wages are paid at rates not exceeding those for comparable labor currently employed on the project, or recognized current prevailing rates in the locality of the project.

(a-2) The actual cost of industrial accident insurance, unemployment compensation contributions, and social security for old age assistance contributions incurred or required under statutory law and these Standard Specifications.

(a-3) The actual amount paid to, or in behalf of, workers by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits, or other benefits, when such amounts are required by collective bargaining agreement or other employment Contract generally applicable to the classes of labor employed on the work.

(b) Materials—For all materials actually used in the work, in accordance with the instructions of the Engineer, except such as are to be furnished and paid for under rental rates applicable in connection with the use of equipment as hereinafter provided, the Contractor will be paid the actual cost thereof to the purchaser, whether contractor, Subcontractor or other forces, from the supplier thereof, including transportation costs to the job site; subject to the following conditions:

(b-1) If a cash or trade discount is offered or is available to the purchaser, it shall be credited to the City notwithstanding the fact that such discount may not have been taken.

(b-2) If materials are procured other than by direct purchase from and direct billing by the supplier, the cost thereof shall be deemed to be the price paid to the actual

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supplier, less discounts, as determined by the Engineer. No markup other than actual handling costs will be permitted.

(b-3) If materials are obtained from a supply or source wholly or partly owned by the purchaser, the cost thereof shall not exceed the price paid by the purchaser for similar materials furnished from said source on Contract items, or the current wholesale price for such materials delivered to the job site, whichever is lower.

(b-4) If the cost of materials is determined by the Engineer to be excessive, then the cost of such materials shall be deemed to be the lowest current wholesale price at which such materials are available in the quantities concerned, delivered at the job site, less any discounts offered or available.

(c) Equipment—For use of Contractor-owned equipment, the Contractor will be paid in accordance with the general provisions and conditions and at the rental rates set forth in the Dataquest Incorporated Rental Rate Bluebook, Volumes 1 and 2, most current edition as of the last day of such equipment's actual use on the job site. For the use of equipment not listed in the Bluebook, the rental rate shall be as agreed by the Contractor and the Engineer, in writing, prior to the use of the unlisted equipment.

Since the Dataquest Bluebook has rates for hourly, weekly, and monthly rental periods, the rate will be determined on the basis of the amount of use of the equipment for any other purpose in connection with the project. If the extra work requires equipment that is already on the project, the compensation will be calculated per the monthly rate for that equipment. If the extra work requires a piece of equipment that is not planned for any other purpose in connection with the project, it will be paid at the daily rate for use less than four days, and at the weekly rate for use of five days to three weeks. Any use longer than three weeks will be at the monthly rate.

For equipment that is rented from an equipment rental company, the rate shall be paid as per the actual invoice from that company.

(d) Special Services—Under agreement by the Engineer and Contractor, it may be determined that a certain item or service under Force Account work cannot be satisfactorily performed by the forces of the contractor or his/her Subcontractors in which case such item or service may be performed by a specialist. Invoices for such item or service on the basis of the current market price thereof may be accepted without complete itemization of labor material, and equipment cost when such itemization is impracticable or not customary under the circumstances. Where the Force Account work necessitates fabrication or machining work by the Contractor away from the job site, charges for such work may, by agreement, be accepted as a specialist billing. The specialist invoices shall show credit for cash or trade discounts offered or available the same as applies to other Force Account work but shall not include percentage or other markup to cover the Contractor's overhead charge or profit.

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(e) Percentage Allowances—To the actual costs enumerated and limited above, amounts equal to a percentage of such actual costs will be allowed and paid to the Contractor. These percentages will be as follows:

Under (a) Labor	20 percent
Under (b) Materials	15 percent
Under (c) Equipment	15 percent
Under (d) Special Services	15 percent

The percentage allowances made to the Contractor in accordance with the terms outlined above will be understood to be reimbursement and compensation for all superintendence, use of tools and small equipment, overhead expense, bond cost, insurance premiums, profits, indirect costs and losses of all kinds, and all other items of cost not specifically designated herein as items for which payment is to be made, whether the services, costs, and other items involved are furnished or incurred by the Contractor, by the Subcontractor or by other forces. No other reimbursement, compensation, or payment will be made for any such services, costs, or other items.

Should any percentage allowance or other corresponding allowance be made by the Contractor to a Subcontractor or to others, in connection with Force Account work, such allowance shall be at the sole expense of the Contractor and The Contractor will not be reimbursed or otherwise compensated for the same by the City.

109.07 PROGRESS PAYMENTS AND RETAINAGE

Payments for all work under the Contract will be made at the price or prices bid therefor, and those prices shall include full compensation for all incidental work.

The Contractor shall submit certification of payrolls as required by ORS 279.354 as follows:

1. For projects 90 days or less from the date of award of the Contract to the date of completion of work under the Contract the statement shall be submitted as currently required by ORS279.354(2)(a).

2. For any project exceeding 90 days in length from the date of award of the Contract to the date of completion of the work under the Contract the statement shall be submitted as currently required by ORS279.354(2)(b).

The current requirements of Bureau of Labor and Industries, titled Prevailing Wage Rates for Public Works Contracts In Oregon, is contained in the Owner's Proposal portion of the Contract Document for bidding purposes. Each Subcontractor who performs work on the project during the period covered by the payment shall file a similar statement which covers its workers as required by ORS 279.354.

Final payment shall not be made to the Contractor until he/she has filed with the Owner all signed wage certification forms required above certifying that he/she has paid not less than the

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prevailing rate of wages as required by Chapter 279 ORS, as set forth in the Contract Documents.

When work under Contract is being performed in accordance with the Contract construction schedule and all provisions of the Contract, the Contractor shall submit an estimate of work performed in any calendar month (which added to the previous quantities performed will indicate the total gross dollar amount performed through that calendar month). This monthly progress payment request estimate of work completed through the 25th day of the month (which is the payment estimate cut-off date) shall be submitted on the City of Salem, Department of Public Works Authorization for Progress Payment form. The completed form must be received ant stamped in by the Engineer at the Public Works office not later than the 28th day of the month. All quantities for progress payments submitted for payment shall be subject to the approval of the Engineer and his/her determination shall be final.

These estimates shall include value of labor performed and materials incorporated in the work since commencing work under the Contract. Such estimates need not be made by strict measurement and may be approximate only, and shall be based upon the whole amount of money that will become due according to terms of the Contract when the project has been completed.

Provided that satisfactory construction progress is being made, the Engineer may include in the initial progress payment request estimate up to 100 percent of the invoiced cost to contractor of materials delivered to the Contract construction site, limited to invoices of $2,000. The materials shall be properly stored and protected from damage by the Contractor, who will remain liable for the materials until they are incorporated into the project and a final acceptance of the project is issued by the Engineer, subject to the warranty provisions of the Contract.

If the total Contract price is determined on a unit price basis, this progress payment will be made on the basis of these unit prices. If the total Contract price is determined on a lump sum basis, this payment will be made on the basis of the percentage of work in place and completed. Payment schedules for such work may be required by the Engineer before the start of the work.

The amount of all progress payment request estimates, as approved by the Engineer, after deducting 5 percent and all previous payments, shall be due and payable to the Contractor on the tenth day of the month following the month during which progress payment request was made; provided, the Contractor submits his/her progress payment request based upon the current Contract purchase order amount by the 28th of the month as stated above.

If any such progress payment request incorporates any request for an extension of Contract completion time, Change Order, or Extra Work/Force Account amounts which are not incorporated in the current Contract Purchase order amount for the month's pa period, it will take an additional 30 days for the City of Salem to verify, and modify the Contract purchase order amount, if warranted to comply with the requirements for the City of Salem to authorize such payment, completion time, Change Order, or extra bill. The 5 percent deduction, as set

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forth above shall be withheld by the Owner to ensure faithful completion of the work under the terms of the contract Documents and to provide a fund for the payment of any claims which may accrue against the Owner because of some act or omission on the part of the Contractor. Such amount of retainage shall be withheld and retained by Owner until it is included and paid to the Contractor as part of the final payment o the Contract amount. Securities in lieu of retainage may be accepted, or if the Contractor requests, retainage as accumulated will be deposited by the Owner in an interest bearing account pursuant to ORS Chapter 279 for progress payments. After 50 percent of the work under the Contract is completed, and the work is progressing satisfactorily, the Owner may elect to eliminate further retainage on any remaining monthly Contract Payment.

Nothing contained in this Subsection shall be construed to affect the right, here reserved, to reject the whole or any part of the aforesaid work should such work be later found not to comply with any of the provisions of the Contract Documents. All estimated quantities of work for which progress payments have been made are subject to review and correction on the final estimate. Payment by the Owner and acceptance by the Contractor of progress payments based on periodic estimates of quantities of work performed shall not, in any way constitute acceptance of the estimated quantities used as the basis for computing the months of the progress payments.

109.08 DEFERMENT OF PAYMENTS

No partial or final payment will be made until all orders made by Engineer to Contractor in accordance with the Specifications are complied with, nor until all claims or liens filed or prosecuted against Owner, its officer or employees contrary to provisions of the Contract are satisfied. Give special attention to ***Subsection 204.4.12 Withheld Progress Payments***, relative to sewer construction.

In the event a complaint or charge of unlawful employment practices pursuant to the provision of ORS Chapter 659 is filed against the Contractor by anyone, including the Owner, and the Commissioner of Labor and Commissioner of Labor issues a cease and desist order as defined in ORS Chapter 659, no further payments will be made on the Contract until such time as all of the provisions of the cease and desist order have been complied with by Contractor.

109.09 FINAL ESTIMATE AND PAYMENT

Pursuant to ORS Chapter 279, notify the Engineer when work is considered complete and Engineer shall, within 15 days after receiving notice, either accept the work or notify Contractor of work yet to be performed on the Contract. If accepted, Engineer shall so notify Contractor, and will make a final estimate and recommend acceptance of the work as of a certain date. Upon approval and acceptance by Owner, Contractor will be paid a total payment equal to the amount due under the Contract including all retainage.

Before final payment is made under the Contract, supply and file with the Auditor a statement in writing which complies with ORS Chapter 279 and under oath as heretofore set forth, certifying the hourly rate of wage paid each nonexempt classification of workers employed by

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him/her upon such project. Require each Subcontractor who performed work on the project to file with Auditor a similar statement which covers its workers.

If a Foreign Contractor, provide Owner with evidence that provisions of ORS Chapter 279 have been satisfied; this is a prerequisite to final payment. See Subsection 103.08.
As a further prerequisite to final payment, execute and deliver to Owner, in form approved by the Attorney, a receipt for all amounts paid or payable to Contractor under the Contract, and a release and waiver of all claim against Owner growing out of or connected with the Contract and furnish satisfactory evidence that all amounts due for labor, materials, and other obligations under the Contract have been fully and finally settled or are fully covered by insurance protecting Owner, its officers, agents, and employees as well as Contractor.

If Owner declares a default of the Contract, and Surety completes said Contract, all payments after declaration of default and retainages held by Owner shall be paid to Surety and not to Contractor in accordance with terms of the Contract.

109.10 ACCEPTANCE OF FINAL PAYMENT

Acceptance by Contractor of final payment shall release Owner and Engineer as agent of Owner from all claims and all liability to Contractor for all things done or furnished in connection with the work, and every act of Owner and others relating to or arising out of the work. No payment, however, final or otherwise, shall operate to release Contractor or his/her Sureties from obligations under the Contract and the performance, payment, and other bonds and warranties, as herein provided.

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Division 2—General Technical Requirements

201 Mobilization

201.1.00 DESCRIPTION

This section covers, but is not limited to, work necessary to move in personnel and equipment; set up all offices, buildings, and facilities; and prepare for construction, complete.

201.2.00 MATERIALS

Provide all materials required to accomplish the work as specified.

201.3.00 CONSTRUCTION

201.3.01 GENERAL

Set up construction facilities in a neat and orderly manner within designated or approved work area. Supply all labor and equipment necessary to accomplish the work as specified. Conform to applicable requirements of ***Section 105*** of ***GENERAL REQUIREMENTS***, including, but not limited to, (1) required notifications, (2) protection of surveying monuments and other markers, (3) temporary traffic control, (4) temporary utility connections, (5) protection of property, and (6) dust control.

201.4.00 MEASUREMENT AND PAYMENT

201.4.01 LUMP SUM BASIS

When Mobilization is listed as a separate pay item on the Proposal, it will be paid for on a lump sum amount basis. Normal retainage will be deducted from partial payments.

Partial payments for Mobilization under the Contract will be made under the following schedule:

1. After 5 percent of the total original Contract has been earned (from other bid items), then 50 percent of the amount bid for Mobilization will be paid, upon request.

2. After 15 percent of the total original Contract has been earned (from other bid items) then 85 percent of the amount bid for Mobilization will be paid, upon request.

3. Upon completion of 20 percent of the total original Contract (from other bid items) then 100 percent of the amount bid for Mobilization will be paid, upon request.

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No bid for Mobilization, when listed as a separate pay item in the Proposal, will be accepted which is more than 20 percent of the total original Contract price bid.

The above schedule of partial payments for Mobilization shall not be construed to limit or prelude partial payments otherwise provided by the Contract.

201.4.02 INCIDENTAL BASIS

When not listed in the Proposal, all Mobilization costs will be considered incidental work for which no separate payment will be made.

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202 Temporary Traffic Control

202.1.00 DESCRIPTION

This Section covers all work necessary to conduct construction operations so as to offer the least possible obstruction and inconvenience to the public and to protect pedestrian and vehicular traffic, complete.

Additional traffic control provisions are contained in ***subsections 105.16 and 107.13*** of the ***GENERAL REQUIREMENTS***.

This Section covers protection and restoration of pavement markings and repairs to traffic signal installations.

202.2.00 MATERIALS

202.2.01 UNIFORM TRAFFIC CONTROL DEVICES

Provide barricades, signs, and traffic control devices built in conformance with the Manual on Uniform Traffic Control Devices, published by the U.S. Department of Transportation as amended by the Oregon supplement thereto.

202.3.00 CONSTRUCTION

202.3.01 GENERAL

Provide flagger, barricades, lights, signs, pilot cars, and/or all traffic control devices necessary to comply with Sections 105, 107.13, and 202 of the SCS, and all provisions of the May 1982, version of the City of Salem Traffic Control Manual for Maintenance and Construction as they pertain to traffic control and safety (including pedestrian) within the project construction area. Adequately warn the public at all times of existing conditions on all streets affected by work operations.

Whenever the Contractor must close a street or lane(s) of traffic in any street, he/she shall obtain the necessary no-cost permit therefor from the Permit Application Center a minimum of 48 hours prior to the planned closure.

Patrol and traffic-control the area and reset all disturbed signs and traffic-control devices immediately. Remove or cover non-applicable signs during periods not needed, as approved. Prior to closing or partial closing of any street, conform to ***Subsection 105.05 NOTIFICATIONS RELATIVE TO CONTRACTOR'S ACTIVITIES.***

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202.3.02 TRAFFIC CONTROL WITHIN THE PROJECT

The Contractor shall present his/her proposed traffic control plan to the Engineer at the pre-construction meeting and obtain approval prior to commencing work. When necessary, allow traffic to pass through the work with as little inconvenience and delay as possible.

Provide approved access to private properties at all times, except during urgent stages of construction when it is impractical to perform construction and maintain access to private property simultaneously. When access is to be denied or impaired, give occupants of affected properties at least 24 hours prior notice.

When, in the judgment of the Engineer, vehicular parking is a hazard to through traffic or to the work, furnish and place NO PARKING signs on any street which is directly involved in the construction work.

202.3.03 CONSTRUCTION AND MAINTENANCE OF DETOURS

Construct and maintain temporary detours for protection of the work and the safe passage of traffic around work area, as approved.

Conform to requirements for Detours in ***Section 107*** of ***GENERAL REQUIREMENTS***.

202.3.04 ONE-WAY PILOTED TRAFFIC CONTROL

When detours are not available, confine operations to a width which provides for safe passage of traffic. If, in the judgment of the Engineer, one-way piloted traffic is necessary, provide at least two flaggers to control traffic, one flagger being stationed at each end of the roadway being limited to restricted use and furnish a pilot car and driver to lead traffic. At the end of each day leave work in such condition that it can be traveled without damage to the work and without danger to public traffic.

202.3.05 PROTECTION AND RESTORATION OF TRAFFIC FACILITIES

The Contractor shall make all repairs to traffic signal installations as a result of his/her work and shall limit his/her activities in the street to preclude extensive damage to pavement markings. Temporary pavement markings for parking lane lines shall be placed and maintained by the Contractor, if such are damaged, throughout the course of the project. Such temporary markings shall be placed at the end of each working day for the completed portions of the project.

The placement of final pavement markings shall be done by the Owner at no expense to the Contractor so long as the Engineer determines that the Contractor exercised all reasonable care in avoiding unnecessary damage to the pavement markings. If the Engineer determines reasonable care was not exercised by the Contractor in avoiding damage to pavement markings, the Owner's actual cost to restore the final markings will be subtracted from payments due to the Contractor.

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202.4.00 MEASUREMENT AND PAYMENT

202.4.01 LUMP SUM BASIS

When listed in the Proposal as a separate pay item, payment for traffic safety and control will be made on a lump sum basis.

202.4.02 INCIDENTAL BASIS

When not listed in the Proposal for separate payment, all temporary traffic control will be considered incidental work for which no separate payment will be made.

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203 Clearing and Grubbing

203.1.00 DESCRIPTION

This Section covers work necessary to clear, remove, and dispose of all debris and vegetation such as stumps, trees, logs, roots, shrubs, vines, grass, and weeds within the designated limits, to preserve from injury or defacement such objects and vegetation as are designated to remain in place, and to perform final clean-up of the designated area.

Clearing is defined as cutting of trees, bushes, vines, and other vegetative growth at or above ground surface and removal from the site of all such cut or down vegetation.

Grubbing is defined as removal of vegetative growth and natural wooden items remaining at or below ground surface following the clearing operation.

Review with the Engineer the location, limits, and methods to be used prior to commencing work under this Section.

Removal of man-made structures, including , but not limited to, concrete slabs, walls, vaults, footings, asphaltic surfaced areas, and graveled areas, shall be included in payment for excavation or excavation and backfill as provided in Subsection 204.3.03, and will not be included in clearing and grubbing.

203.2.00 MATERIALS

Explosives used for clearing and/or grubbing shall be fresh, stable material manufactured to the standards of the "Institute of Makers of Explosives", and shall conform to the applicable requirements of ORS Chapters 476 and 480.

No blasting may be done unless the Contractor or Subcontractor doing the blasting furnished evidence of insurance approved by the legal department of the Owner, prior to commencing work.

203.3.00 CONSTRUCTION

203.3.01 GENERAL

Obtain the required permit from the State Forester as specified in ***Subsection 105.09 Protection of Property***, and perform clearing work in conformance thereto.

Remove trees and plants as designated within the area of work, and remove all sod, topsoil, and organic earth within designated areas.

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Remove and stockpile as directed, all topsoil that is free of roots, rocks, and other objectionable material and is determined by the Engineer to be suitable for future use. Take reasonable care to prevent topsoil from becoming mixed with subsoil.

203.3.02 MERCHANTABLE TIMBER

Owner reserves the right to merchantable timber as designated in the Contract Documents and as marked at the project site by the Engineer. Assume ownership, remove, and dispose of all other timber. Cut, trim, and handle marked merchantable timber in such a manner as to ensure the best sale value to Owner and dispose of resulting waste materials as hereinafter specified.

203.3.03 PROTECTION OF EXISTING VEGETATION

Protect all trees, shrubbery, and other vegetation, not designated for removal, from damage caused by the work. Cut and remove tree branches only where approved. When directed, remove branches other than those required to provide a balanced appearance of any tree. Sears from removal of branches shall be treated with an approved tree sealant.

203.3.04 CLEARING

Clear the area above the natural ground surface of all vegetable growth and objectionable materials, and cut timber and timber growth so that no stump extends above ground surface more than 6 inches.

203.3.05 CLEARING BORROW AND WASTE DISPOSAL AREAS

Clear areas designated as borrow and waste disposal areas to designated limits and dispose of all waste as herein specified.

203.3.06 GRUBBING AND STRIPPING

Completely remove all stumps within the limits of required excavations, and within the limits of required embankments having heights of less than 4 feet. No stump or portion thereof shall come within 3 feet of embankment subgrades or slope surfaces. Use of explosives for stump removal shall conform to requirements of ***Subsections 204.3.09 and 107.18***.

On areas to be occupied by embankments, remove all roots and embedded wood to a depth not less than 1 foot below subgrade or slope surface on which the embankment is to be constructed.

On excavation areas, remove all roots and embedded wood to a depth not less than 6 inches below subgrade or slope surface through which excavation is required.

Areas on which grubbing and/or stripping is to be performed shall be indicated on the Plans or otherwise specified.

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203.3.07 DISPOSAL OF WASTE MATERIAL

Remove and dispose of all waste materials or debris. When burning is permitted by law, pile all trees, stumps, brush, roots, and similar combustible material within the cleared area and dispose of by burning, subject to air quality standards and permits. Remove all waste material from the site when burning is not permitted, when not combustible, or when not practicable to burn.

203.3.08 BACKFILLING AND CLEAN-UP

In areas not subject to future excavations of filling, fill all holes and depressions caused by clearing and grubbing with material acceptable to the Engineer and reshape area to conform to adjacent undisturbed topography.
Leave work area in a clean and slightly condition, free from litter and debris.

203.4.00 MEASUREMENT AND PAYMENT

203.4.01 ACREAGE BASIS

When shown in the Proposal, payment for clearing and grubbing will be made on an acreage basis for the area cleared and grubbed within limits staked by Engineer, measured to the nearest 0.1 acre. No payment will be made for area within the existing street or easement where clearing or grubbing is not required.

203.4.02 LUMP SUM BASIS

When shown in the Proposal, payment for clearing and grubbing will be made on a lump sum basis for all clearing and grubbing within the limits specified.

203.4.03 INCIDENTAL BASIS

When not listed in the Proposal for separate payment, all clearing and grubbing will be considered incidental work for which no separate payment will be made.

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204 Excavation, Embankment, Bedding, and Backfill

204.1.00 DESCRIPTION

204.1.01 GENERAL

This Section covers work necessary for excavation, construction of embankment, foundation stabilization, pipe bedding, trench backfill, and disposal of material required in construction of streets, sewers, water mains, storm drains, structures, and appurtenances thereto.

204.1.02 UNCLASSIFIED EXCAVATION

Unclassified excavation is defined as all excavation, regardless of type, nature, or condition of materials encountered unless separately designated. The Contractor shall assume full responsibility to estimate the kind and extent of various materials to be encountered in order to accomplish the work.

204.1.03 CLASSIFIED EXCAVATION

204.1.03A Rock Excavation

Rock Excavation is defined as the removal of all material which is, in fact, systematically drilled and blasted or broken by owner operated tools designed for rock excavation. The term “Rock Excavation” shall be understood to indicate a method of removal and not a geological formation.

In trenches, boulders or pieces of concrete below street subgrade larger than one-half cubic yard will be classified as rock if drilling and blasting or other approved methods are actually used for their removal.

204.1.03B Common Excavation

Common excavation is defined as removal of all material not classified as Rock Excavation.

204.1.04 TRENCH EXCAVATION

Trench Excavation is defined as removal of all material encountered in the trench to the depths and widths as shown or as directed, and is classified as either common or rock excavation.

204.1.05 BORROW EXCAVATION

Borrow material is defined as material obtained from borrow sources lying outside of, separated from, and independent of planned excavation occurring within the project limits.

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204.1.06 EMBANKMENT

Embankment is defined as furnishing, placing, and compacting embankment materials to the depth and configuration as shown.

204.1.07 FOUNDATION STABILIZATION

Foundation Stabilization is defined as the removal of unsuitable material in the bottom of an excavation and replacement with specified material for support of a roadbed, pipe, main, conduit, structure, or appurtenances thereto.

204.1.08 PIPE BEDDING

Pipe Bedding is defined as furnishing and placing of suitable material under and around the pipe in accordance with the appropriate Standard Plan.

204.1.09 PIPE ZONE

Pipe Zone is defined as the full width of trench from the bottom of bedding to a point 12 inches above top outside surface of the barrel of pipe as shown on the appropriate Standard Plan.

204.1.10 TRENCH BACKFILL

Trench Backfill is defined as furnishing, placing, and compacting backfill material in the trench between the top of pipe bedding and bottom of pavement base, ground surface, or as directed. Trench backfill shall be classified as either common, granular or controlled density.

204.2.00 MATERIAL

204.2.01 BORROW AND EMBANKMENT MATERIALS

Provide embankment and borrow materials of approved earth, sand, bank-run, or river-run, gravel or rock, or combinations thereof, as specified or directed, free of peat, humus, muck, frozen ground, organic matter, or other materials detrimental to construction of firm, dense, and sound embankments.
Use all approved materials originating from required excavations as far as practicable in the formation of embankments and subgrade, and for bedding, backfilling, and other work as shown or directed. Maximum particle size shall be as shown or approved.

204.2.02 FOUNDATION STABILIZATION

Use foundation stabilization consisting of gravel or crushed aggregate of approved clean, well-graded granular material.

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204.2.03 PIPE BEDDING

204.2.03A Rigid Pipes and Conduits

Use 1-inch-minus crushed aggregate or Portland Cement concrete as shown on the appropriate Standard Plan or construction plans. Use sand where specified.

Crushed aggregate shall be as required for Aggregate Base Material in ***Section 303 AGGREGATE BASES***.

204.2.03b Flexible Pipes and Conduits

Use pipe bedding material as specified in Special Provisions.

204.2.04 PIPE ZONE BACKFILL

Use pipe zone backfill material above the bedding consisting of imported or selected trench side material which is friable and free of vegetation, containing no frozen ground, rock, clay masses, clods, or other pieces of material larger than that allowed to be placed in the pipe zone of the particular pipe being installed. Pipe zone backfill for rigid pipes shall contain no material larger than 1-inch for all asbestos-cement pipe, and 1 ½ inches for all other pipe.

Pipe zone backfill for flexible pipe shall be as specified.

204.2.05 COMMON BACKFILL MATERIAL

For common backfill material, use approved native material excavated from within limits of the project, free from vegetation and other deleterious material, and containing no frozen ground. Maximum particle size shall be as shown or approved, except for trench backfill, wherein the particle size shall not exceed ½ cubic foot in volume.

204.2.06 GRANULAR BACKFILL MATERIAL

Use granular material for backfill consisting of sand, bank-run or river-run gravel from an approved source, or crushed aggregate.

204.2.06A Sand

Use sand consisting of fine granular material, naturally produced by the disintegration of rock, or produced from crushed gravel, and reasonably free of organic materials, mica, clay, and other deleterious substances as approved. Use a maximum particle size of ¼-inch, with a gradation which allows 90 percent to 100 percent by with to pass a No. 4 sieve and not more than 5 percent to pass a No. 200 sieve.

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204.2.06B Bank-run and River-run Gravel

Use bank-run or river-run gravel from an approved source, free from organic material, having a maximum particle size as shown or approved, and having a reasonable gradation from coarse to fine.

For trench backfill, the maximum particle size shall not exceed 3 inches.

204.2.06C Crushed Aggregate

Use crushed aggregate consisting of graded crushed gravel or crushed rock, free from organic material, with maximum particle size as shown or approved and conforming to requirements for Aggregate Base Material in ***Section 303 AGGREGATE BASES***.

For trench backfill, the maximum particle size shall not exceed 3 inches.

204.2.07 IMPERVIOUS BACKFILL

Utilize impervious backfill material composed of particles at least 50 percent of which pass a No. 200 sieve, and with a plasticity index not less than 209.

204.2.08 IMPORTED TOPSOIL

Conform to imported topsoil in ***Section 207 LANDSCAPING***.

204.2.09 NATIVE TOPSOIL

Use approved topsoil from the site, properly stored and protected and free from grass, overburden and roots, sticks, hard clay, and stones which will not pass a 1-inch-square opening.

204.2.10 WATER AND COMPACTION –Deleted.

204.2.11 CONTROLLED DENSITY BACKFILL

Controlled Density Backfill (CDB) is a cementitious material mixed, transported, and delivered using normal ready mixed concrete operations. CDB is a mixture of aggregate (sand or coarse rock), cement, and water that is flowable and requires no compaction. The mixture shall be proportioned such that the 28-day strength is between 50 and 100 psi. The material shall be capable of setting up within 24 hours to support paving operations.

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204.3.00 CONSTRUCTION

204.3.01 EXCAVATION

Excavate, remove, and dispose of all formations and materials, natural or man-made, irrespective of nature or conditions, encountered within limits hereinafter defined or as specified in the contract Documents, necessary for construction of the project.

Incidental to excavation shall be the furnishing, installing, and removal of all shoring, sheeting, and bracing as required to support adjacent earth banks and structures, and for the safety of the public and all personnel working in excavation.

204.3.02 PRESERVATION OF EXISTING IMPROVEMENTS

Conduct operations in such a manner that existing street facilities, utilities, railroad tracks, structures, and other facilities, which are to remain in place will not be damaged, as specified in Section 105. Furnish and install cribbing and shoring or whatever means necessary to support material carrying existing facilities, or to support the facilities themselves, and maintain such supports until no longer needed.

Protect temporary facilities, until they are no longer required, and when temporary supports and other protective means are no longer required, remove and dispose of as directed.

204.3.03 EXCAVATION OF EXISTING IMPROVEMENTS AND MISCELLANEOUS

Unless otherwise specifically provided for, excavation will include all existing improvements which lie within the limits of excavation and which is required to be removed for the construction of the project.

The volume of such improvements within the excavation limits will be included in the quantities for excavation.

When existing improvements have been or are to be abandoned and are found to interfere with construction, the interfering portions shall be removed and the remaining open portions securely sealed.

Payment for all work in this Section and repair of any damage will be considered incidental to the work and included under bid items for Excavation, Excavation and Backfill, or other specified earthwork items.

204.3.04—Deleted.

204.3.05 LIMITS OF EXCAVATION

Excavate to the depths and widths designated, allowing for forms, shoring working space, gravel or sand base, and finish topsoil where required. Do not excavate deeper than elevation

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shown without approval. Excavation carried below grade lines shown or established without approval shall be replaced with approved compacted material; overexcavation under footings shall be filled with concrete of strength equal to that of the footing; and cuts below grade shall be corrected by similarly cutting adjoining areas and creating a smooth transition, all at no additional expense to the Owner.

204.3.06 SLOPE GRADING

Make slopes free of all exposed roots, unstable rock, and loose stones exceeding 3 inches in diameter. Shape tops of banks to circular curves with, in general, not less than a 6-foot radius, unless rock makes such work impractical. All surfaces shall be neatly and smoothly trimmed. Overexcavating and backfilling to the proper grade will not be accepted.

204.3.07 FOUNDATION STABILIZATION

It is the Contractor's responsibility to alert the Engineer of possible unstable foundation material. If the Contractor encounters material that he/she suspects is unsuitable for supporting the foundations, piers, retaining walls, cribbing, sewers, pipes, or other facilities he/she shall immediately notify the Engineer so that the conditions can be evaluated and a decision made as to how to overcome the difficulty. No additional compensation shall be due the Contractor for these delays beyond an adjustment to the Contract completion date.

If the Engineer determines that unstable ground can be overcome by foundation stabilization, overexcavate to stable ground as approved and backfill to required grade with material conforming to Subsection 204.2.02. Compact in layers, not exceeding 6 inches deep, to required density and grade as approved.

If the Engineer determines that unstable ground can be overcome by foundation stabilization, such other method of stabilization determined by the Engineer may be the basis of additional compensation to the Contractor.

204.3.08 COMMON EXCAVATION

Perform all excavation regardless of type, nature, or conditions of the material encountered. Method of excavation used is optional. Use hand methods for excavation that cannot be accomplished without endangering existing or new structures or other facilities.

When the precise location of subsurface structures is unknown, locate such structures by hand excavation prior to utilizing mechanical excavation equipment.

204.3.09 ROCK EXCAVATION AND EXPLOSIVES

204.3.09A Depth of Excavation

Excavate to the depths designated or as shown on the appropriate Standard Plan. Correct overexcavation with compacted material or concrete as directed at no

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additional expense to Owner. In trenches for sewers, water mains, or conduits, remove all material necessary to provide a minimum clearance of 6 inches under the pipe and replace with bedding material in conformance with Subsection 204.2.03.

204.3.09B Methods and Records Required

Before rock removal by systematic drilling and blasting or other methods will be permitted, expose the material by removing common material above it. Notify Engineer who, with Contractor or his/her representative, will measure the amount of material to be removed and will record the information. Then drill, blast, or break with power-operated tools specially designed for rock excavation, and excavate the material.

204.3.09C Use of Explosives

Use explosives which are fresh, stable materials manufactured to the standards of the "Institute of Makers of Explosives," and conforming to applicable requirements of ORS Chapters 476 and 480.

Conform to applicable provisions of ***Section 107*** in the ***GENERAL REQUIREMENTS***.

Use of explosives shall be avoided as far as practicable. Such blasting as must be done shall be controlled in a manner which will avoid possible shattering or loosening of materials back of lines to which the excavations are to be made. All blasting shall be supervised and/or done by a State certified powderman. Be responsible for any and all damages to property or injury to persons resulting from blasting, or accidental or premature explosions that may occur in connection with the use of explosives. Give adequate warning to all affected persons and adjacent property owners prior to blasting.

204.3.09D Trench Blasting

When blasting rock in trenches, cover area to be shot with blasting mats or other approved type of protective material that will prevent scattering of rock fragments outside of the excavation.

The Contractor shall comply with all requirements of OSHA for blasting rocks in trenches.

204.3.10 DISPOSAL OF EXCESS MATERIALS

Excavated materials not suitable or not required for backfill or embankment as directed by Engineer shall be deposited on one or both of the following sites: (A) at pre-designated sites contained in the Contract Documents, and (B) sites supplied by Contractor. All costs for disposing of this excess material shall be included in the bid item for Excavation or Excavation and Backfill as contained in the project Proposal.

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204.3.10A Disposal on Pre-designated Sites

When Sites for excess material are contained on the Plans, disposal operations shall be performed as Engineer may direct. Owner will secure all necessary disposal permits for required work done under the Subsection.

204.3.10B Sites Provided by Contractor

All excess material not required for preceding Subsection will be disposed of by Contractor at his/her option and he/she shall be entitled to receive any reimbursement that he/she can secure from sale of such material. Within the City of Salem, no excess material shall be deposited on an unimproved, dedicated street area without a permit from Engineer, and no excess material shall be deposited on any private property without a fill permit from the City of Salem. Prior to filling, furnish copy of fill permit to Engineer.

Sites provided by the Contractor shall be in accordance with the City of Salem's cut and fill ordinance.

204.3.11 TEMPORARY LOCATION OF EXCAVATED MATERIALS

Place excavated material, suitable for embankment or backfills and not excess material, only within the construction easement, right-of-way, or approved working area. Pile in such a manner that it will cause a minimum of inconvenience to the public. Furnish the Engineer a copy of written approval from each Property Owner prior to stockpiling material on private property.

Provide free access to all fire hydrants, water valves, and meters, and leave clearance to enable free flow of stormwater in all gutters, conduits, and natural water courses.

204.3.12 OVEREXCAVATION FOR ROADWAYS

Remove unsuitable sub grade material to such depths as directed. Excavation below sub grade shall be of the same classification as that above subgrade provided it is removed in the same operation.

When roadway excavation has been completed and it is required to move equipment back in to excavate unsuitable material, or where additional excavation depth requires special equipment because of the presence of shallow utilities or other unforeseen conditions, perform the work as directed and payment for excavation below grade will be made on the basis of Extra Work as provided in the GENERAL REQUIREMENTS. See Section 301 for other sub grade work.

Excavate below grade and backfill to restore surface as directed, when required by negligence in work operations, at no expense to Owner.

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Overbreak is defined as that portion of any material which is excavated, displaced, or loosened outside and beyond slopes, lines, or grades as staked or re-established with exception of slides as defined hereinafter, regardless of whether overbreak is due to blasting, to inherent character of any formation encountered, or to any other cause. Remove and dispose of all overbreak at no expense to Owner.

204.3.13 SURFACE REMOVAL AND REPLACEMENT FOR TRENCHES

204.3.13A Removal and Replacement of Topsoil

Where trenches within easements cross lawns, garden areas, pasturelands, cultivated fields, or other areas on which reasonable topsoil conditions exist, remove all topsoil to a depth of at least 12 inches for full width of the trench to be excavated. Stockpile and protect from the elements all native topsoil in a location satisfactory to the Property Owner and do not mix with remaining excavated material. Replace removed topsoil in the top of backfilled trench to the depth removed.

Maintain finished grade of topsoil level with area adjacent to the trench until final acceptance by Engineer. Repair damage to adjacent topsoil caused work operations. Remove all rock, gravel, clay, and any other foreign materials from surface; regrade, and add topsoil as required.

Use native topsoil as defined by SCS 204.2.09 except that the moisture content of the material shall be preserved at all times while stockpiled by suitable coverings or by minimizing the time of removal. All topsoil and sod adjacent to the trench shall be suitably protected from rutting or other damage with sheeting, by use of lightweight equipment or other approved means.

Payment for removing, stockpiling, and replacing topsoil in the trench is included in the bid item, Trench Excavation and Backfill, and no further compensation will be made unless directed by Engineer to place imported topsoil material.

204.3.13B Removal and Replacement of Pavement, Curb, Driveways, and Sidewalk

Saw cut all asphalt pavement by a method approved by the Engineer prior to excavation of trenches.

Saw Portland Cement concrete pavement, curbs, and sidewalks to a minimum depth of 4 inches or half the concrete thickness, whichever is greater. Subsequent removal may be accomplished by using a jackhammer or **drophammer**, the type of **drophammer** to be approved by Engineer. Full depth cut by pavement saw can be done at option of Contractor, but ant no additional cost to Owner. Use of any machine utilizing a falling or swinging weight in the form of a **headache ball** will not be permitted.

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Width of cut shall be a minimum of 12 inches wider than the width of the trench, and shall follow lines parallel to pipe or conduit centerline or as directed in the field by the Engineer.

Replacement of pavement, curb, and sidewalk shall conform to the requirements for RESURFACING contained in ***DIVISION 4 – SANITARY SEWERS AND STORM DRAINS***, or as specified on the Construction Plans.

204.3.13C Removal and Replacement of Sod

Where directed by the Engineer, the Contractor shall soak, dislodge, roll, and stockpile healthy sod for replacement after construction. Sod shall be removed in a minimum of 2 ½ -inch-thick by 5-foot-long sections for rolling. All sod shall be re-laid on a damp soil surface a maximum of six hours after removal. Care should be taken to assure the uniform appearance of the area due to the bent of the grass and the successful rooting of the sod when complete.

204.3.14 TRENCH EXCAVATION AND SHORING

204.3.14A Maximum Length of Open Trench

Except by permission of the Engineer, the maximum length of open trench where prefabricated pipe is used shall be 500 feet (152m) or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is the greater. The distance is the collective length at any locations, including open excavation, pipe laying and appurtenant construction and backfill which has not been temporarily resurfaced.

Except by permission of the Engineer, the maximum length of open trench in any one location where concrete structures are cast in place will be that which is necessary to permit uninterrupted progress. Construction shall be pursued as follows: excavation, setting of reinforcing steel, placing of floor slab, walls, and cover slab or arch. Each shall follow the other without any one operation preceding the next nearest operation by more than 200 feet (60m),

Failure by the Contractor to comply with the limitations specified herein may result in an order to halt the work until such time as compliance has been achieved.

A section of trench shall be considered as unfinished until excavation, construction, backfilling, compaction, gravel road restoration, Portland Cement concrete pavement, minimum of first lift of asphaltic concrete pavement, and cleanup operations have been completed. Cleanup of backfilled and construction area shall include resurfacing and cleaning of area so as to allow use of trench and adjacent construction area for normal use as required in ***Section 208 RESTORATION AND CLEANUP***.

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204.3.14B Trench Width

It is the intent of these Specifications that trench width at the ground surface be kept to a minimum necessary to install the pipe in a safe manner. In all cases, trenches must be of sufficient width to allow for shoring and permit proper joining of pipe and compaction of the backfill material along sides of the pipe. Minimum trench width, in the pipe zone, must provide a clear working space on each side of the bell pipe barrel.

Maximum pay width of trench at top of pipe is specified under ***204.4.00 MEASUREMENT AND PAYMENT***. When required by design, it will be shown on the Plans. If maximum width shown is exceeded by Contractor without written authorization, Contractor will be required, at no expense to Owner, to provide pipe of a higher strength designation, a higher class of bedding, or both as approved. All trenches shall be excavated with vertical walls unless otherwise specified.

Make the excavation for manholes and other structures wide enough to provide a minimum of 12 inches between sides of structure and sides of excavation.

Confine top width of trench to dedicated rights-of-way or construction easements. Special written agreements to extend width may be made by the Contractor with affected Property Owner, provided such agreement is first approved by Engineer.

204.3.14C Grade

Excavate trench to lines and grades shown or as established by Engineer, with proper allowance for pipe thickness, pipe bedding and foundation stabilization. The subgrade upon which bedding is to be placed shall be firm undisturbed and true to grade. If the trench is overexcavated, restore to grade with material of type specified for pipe bedding at no expense to Owner. Place material over full width of the trench in compacted layers not exceeding 6 inches deep to established grade with allowance for pipe bedding.

204.3.14D Shoring, Sheeting, and Bracing of Trenches

All trenches and excavations shall be adequately shored to prevent caving of the vertical sidewalls of the trench and to protect adjacent structures, utilities, property, workers, and the public. Maintain sheeting until pipe has been placed and backfilled at the pipe zone. Remove shoring and sheeting as backfilling is done in a manner that will not damage the pipe or permit voids in the backfill. All sheeting, shoring, and bracing of trenches shall conform to safety requirements of the Federal, State, or local public agency having jurisdiction. The mops stringent of these requirements shall apply.

Before beginning work, submit to Owner for approval, all details of shoring intended to be used. This approval shall in no way relieve Contractor of responsibility for its safety and sufficiency.

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When omitted from the Proposal, there will be no separate payment for shoring, sheeting, and bracing of trenches, it being understood that the cost thereof is included and incidental to the Contract unit prices for the various ***Trench Excavation and Backfill*** items of work.

When listed separately in the Proposal, payment for these items shall include all labor, equipment, and material required to place ***close sheeting*** or ***sheet piling*** when and whichever is required and approved by the Engineer in order to prevent caving of vertical sidewalls, to protect existing utilities, traffic, and personnel.

Sheet piling will not be used except under abnormal construction situations where the trench walls won't stand long enough to place shoring after excavation. Payment for driven sheet piling shall be on the linear foot of trench basis at the price quoted in the Proposal or at the price stipulated elsewhere in these Contract Documents.

Close sheeting and ***sheet piling*** are defined as specific shoring methods as defined in Sections 437-83-3416 through 437-83-3593 of the Oregon Occupational Safety and Health Code—Oregon Administrative Rules. There will be no separate payment of shoring which does not equal or exceed these methods, it being understood that the cost for such substandard methods (including trench box or bracing) is included in, and incidental to, the contracted prices for the various trench excavation and backfill items of work.

204.3.15 DEWATERING

Furnish, install, and operate all necessary machinery, appliances, and equipment to keep excavations free from water during construction. Remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the pipe laying and until the backfill at the pipe zone has been completed. Dewater and dispose of water so as to prevent injury to public or private property, or nuisance or menace to the public. Drainage of trench water through the pipeline under construction is prohibited unless specifically approved by the Engineer. At all times have on hand sufficient pumping equipment and machinery in good working condition for all ordinary emergencies, including power outage. Have available at all time competent workers for operation of the pumping equipment. Control surface runoff to prevent entry or collection of water in excavations. All excavation shall be kept free of water when concrete is being deposited or during placement of backfill.

Control ground water such that softening of the bottom of excavations or formation of ***quick*** conditions or ***boils*** during excavating shall be prevented. Design and operate dewater systems so as to prevent removal of natural soils and so that 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, submit to Engineer a statement of the method, installation, and details of dewatering system proposed to be used. Open and cased sumps shall not be used as primary dewatering for excavations deeper than 3 feet below static water table unless authorized.

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Release ground water to its static level in such a manner as to maintain the undisturbed state of natural foundation soils. Prevent disturbance of compacted backfill and flotation or movement of structures, water mains, sewers, and other utilities.

Dewatering shall be considered as incidental to, and all costs included in, the various Contract pay items in the Proposal.

204.3.16 EMBANKMENT

204.3.16A Roadway Embankment

Preparation of Embankment Foundations. Prior to construction of embankments, excavate unstable material or unsuitable foundation material and dispose of as directed. Limit excavation to lines, grades, and cross sections shown or approved. Backfill basements, trenches, and holes which occur within embankment limits with approved material, which may include small pieces of broken concrete and masonry. Break concrete floors of basements as approved. Compact natural ground underlying embankments to the depth of grubbing or a minimum of 8 inches, to density specified for the embankment material to be placed.

Embankment Construction. Place 12 inches of earth between any structure and large rock as directed by the Engineer.

In the immediate vicinity of curbs, walks, driveways, inlets, manholes, and similar structures, in holes, and where embankment and fill materials cannot be reached by normal compacting equipment, compact to specified density by approved methods.

Where embankments are constructed predominantly of rock fragments, place material in layers of the thickness as directed, but not greater than 3 feet. Placing of indivual rock fragments having dimensions greater than 3 feet will be permitted provided that they have no more than two dimensions greater than 6 feet, that clearances between adjacent fragments provide adequate space for placing and compacting of material in horizontal layers as specified, and that no part comes within 4 feet of subgrade. Distribute and manipulate rock so that interstices between larger pieces are filled with smaller pieces, forming a dense and compact mass.

Exercise precaution to ensure that embankment construction and fill does not move, endanger, or overstress any structure. Place and compact embankments at the end of bridges and extend a distance three times fill height from each bridge end prior to the time that work begins on the bridge ends. Do not construct embankments when embankment material, foundation, or embankment on which it would be placed is frozen.

Compacting and Density Requirements. Density of compacted materials in place will be determined by AASHTO T 191, T 205, T 238, and minimum density by ASTM 698.

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Compact all embankments, fills, and backfills to a minimum density in place of 95 percent of maximum dry density according to ASTMD-698.

Roadbed cuts to a depth of 8 inches below established subgrade shall be compacted to a minimum density in place of 95 percent of maximum density.

Perform watering of materials to enhance compaction of embankments and backfills and to alleviate dust nuisance as specified in ***DIVISION 3—STREETS***, or as directed.

Slide Removal and Repair. Side slopes shall be constructed as staked or re-established. In case a slope, finished to the lines as staked or re-established, slides back of established slope into the roadway prism, or out of an embankment before final acceptance of the work, remove slide material and reconstruct the slope as directed. Reconstruction will be paid for as extra work, unless due to negligence by Contractor.

Obtain materials to replace embankment slides from approved source. Repair slopes undercut at the base or destroyed in any manner due to negligence during the work by resloping parallel to the damaged slope or as approved, at no expense to Owner.

204.3.16B Pipeline Embankment

Where embankments are to contain water mains, conduits, or sewers, construct embankment to support pipe in accordance with details shown on the Plans. Use excess excavated trench material suitable for embankment, or approved imported material when directed; when imported material is directed to be used it will be paid for as Granular Material.

Embankment shall be made in 8-inch lifts, with minimum compaction of 95 percent of maximum density for full depth of fill. Density in place and maximum density will be determined as specified in paragraph 204.3.16A.

Additional Pipe Cover. In locations where insufficient pipe cover exists, place excess excavated trench material suitable for embankment over the pipe as shown or directed to provide a minimum cover of 3 feet. Compact as required for underlying trench backfill.

204.3.16C Embankment for Structural Foundations

Deposit approved materials free form roots, organic material, trash, and stones larger than 3-inch diameter in uniform lifts across the full width of embankment. Compact each lift to 95 percent of maximum density as determined by ASTM D 698.

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204.3.17 BEDDING

204.3.17A Bedding for Rigid Conduits

Construct bedding in conformance with the appropriate Standard Plan. Approximate limits for various classes of bedding will be shown on the Plans. Engineer shall have the authority to change bedding classifications and limits thereof as necessary during construction.

Class bedding consists of a pipe cradle of Portland Cement concrete as specified on the appropriate Standard Plan. Bottom of trench shall be fully compacted before placement of pipe or cradle. Place concrete in such a manner that no dirt or foreign material becomes mixed with the concrete. Allow concrete sufficient time to reach initial set before any additional backfill material is placed in the trench. Conform to applicable provisions for Concrete Encasement in ***DIVISION 4 – SANITARY SEWERS AND STORM DRAINS***.

Class B bedding consists of leveling the bottom of trench or top of foundation material and placing bedding material to the horizontal centerline (springline) of pipe. Bedding material shall be as specified hereinbefore and as shown on the appropriate Standard Plan. Bedding shall be placed in at least two lifts. Place first lift to provided minimum depth of bedding material shown on the appropriate Standard Plan before pipe is installed. Spread smoothly to proper grade so that pipe is uniformly supported along the barrel. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Bedding under pipe shall provide a firm, unyielding support along entire pipe length. Place subsequent lifts or not more than 6 inches thickness up to the horizontal centerline of the pipe. Bring lifts up together on both sides of pipe and carefully work under pipe haunches by slicing with a shovel, vibration, or other approved procedure.

Class C Bedding shall conform to requirements for Class B bedding except that bedding material shall be placed only to approximately the lower quadrant of pipe as shown on the appropriate Standard Plan.

Class A, B, and C bedding shall be considered to include full width of excavated trench from the bottom of trench or top of foundation stabilization material to the top of bedding.

Particular attention must be given to the area from the flow line to horizontal centerline of pipe or top of bedding to ensure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of pipe zone.

204.3.17B Bedding for Flexible Conduits

Material for bedding for Flexible Conduits shall be as specified. Place in more than one lift. First lift shall provide a minimum of 4-inch thickness under any portion of the pipe

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and be placed before pipe is installed. Spread smoothly so that the pipe is uniformly supported along the barrel. Install subsequent lifts of not more than 6-inch thickness to the top of pipe zone and individually compact to either 95 percent density as determined by ASTM D698.

204.3.18 PIPE ZONE PLACEMENT

Place specified pipe zone material carefully around the pipe I 6-inch layers and compact to 95 percent maximum density as determined by ASTM S 698. Prevent pipe from movement either horizontally or vertically during placement and compaction of pipe zone material.

When, in the Engineer's judgment, insufficient or unsuitable material exists at trench side for placement in the pipe zone, import and place approve material. There will be no separate payment for providing and placing approved imported backfill in the pipe zone above the bedding, it being understood that the cost thereof is included in and incidental to the Contract unit prices for the various Trench Excavation and Backfill items of work.

204.3.19 SEWER TRENCH BACKFILL AND COMPACTION

Place and compact backfill in conformance with the appropriate Standard Plan. Resurfacing shall be as specified in ***DIVISION 4—SANITARY SEWERS AND STORM DRAINS***, and as shown.

Engineer will sample excavated material to determine suitability of common material for backfill use. If common material is found to be compactable and within tolerance range of moisture content, use of the common material for backfilling may be directed by the Engineer. Take reasonable precautions to prevent approved excavated material from becoming wet and exceeding the critical moisture limits; if approved common material does become wet and exceeds the critical moisture limits through negligence, replace with granular material at no expense to Owner. When common material is not approved or available for backfill, import and place granular material backfill or CDB as specified.

Backfill trench above the pipe zone to the specified grade, or as shown on the Plans. Compact to a minimum of 90 percent of maximum density as determined by ASTM D 1557 (AASHTO T-180) proctor. Then place and compact crushed aggregate base material to a minimum of 95 percent maximum density in the upper 3 feet. Compaction with Hydrahammer equipment will not be approved.

Excavate test pits in the backfill as directed by 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 before 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 backfill and shall be included in unit prices bid for the various items involved.

If required density has not been obtained, remove the backfill from trench, replace with approved backfill, and recompact as many times as it is necessary to obtain the required specified densities. Should routine field density tests indicate that specified compaction

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densities are not being obtained because of soil types or any other reason, the Engineer may indicate such causes and recommend changes.

Where CDB is used, backfill the trench above the pipe zone with CDB material. No compaction of the CDB is required. Allow the CDB material to set up for 24 hours prior to final pavement replacement. Whenever temporary steel plates are installed over the street cut, they shall be capable of carrying a minimum of H-20 loading. The steel plates shall have a minimum of 12 inches bearing on all sides of a cut. The steel plates shall be anchored to minimize shifting. All steel plates shall have their edges shimmed with cold mix asphalt.

Any subsequent settlement of trench during the maintenance period shall be considered to be the result of improper compaction and shall be promptly corrected as required under ***Subsection 107.22 MAINTENANCE***, in the ***GENERAL REQUIREMENTS***.

Where topsoil existed prior to excavation, replace the native topsoil in the top 12 inches of trench. Compact and rake to match the ground surface adjacent to trench. Maintain surface of backfilled trench level with existing grade until the end of the Contract maintenance period.

In paved and graveled areas maintain surface of the backfilled trench level with the adjacent and existing grade with 1-inch-minus crushed aggregate material, or cold mix asphalt pavement if directed, until the final pavement replacement is completed or the entire project is accepted by Owner. Place cold mix asphalt in conformance with ***RESURFACING*** in ***DIVISION 4—SANITARY SEWERS AND STORM DRAINS***.

Maintain backfilled trench surface between any two successive manholes until the following operations have been completed and approved by the Engineer:

1. Service connections installed, backfilled, and compacted.
2. Construction of manholes and appurtenances.
3. Hydrostatic or air testing.
4. Cleanup and restoration of all physical features.
5. Utilities restored to their original condition or better.
6. All work required between the two manholes accomplished.

Do not undertake final pavement replacement until all items outlined above have been completed and approved.

Maintenance of backfilled trenches is considered as incidental to this item of work, and payment for such maintenance will be considered as included in payment of Excavation and Backfill.

Compaction of backfilled trenches is included as part of the backfilling procedure and payment will be considered to be incidental to the item for Excavation and Backfill.

Where indicated on the plans, impervious backfill (clay dams) shall be placed in the trench 10 feet from each manhole and at midway between manholes, if manholes are farther than 400

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feet apart. Each such clay dam shall measure a minimum of 5 feet along the trench and extend from bottom of excavation to bottom of pavement base and be compacted to 95 percent relative maximum density as determined by ASTM D 698.

204.3.20 WATER COURSE UNDERCROSSINGS

Backfill undercrossing of water courses with approved impervious material in the top 2 feet of stream bed and 2 feet into stream banks. Compact to a minimum of 95 percent of maximum density as determined by ASTM D 698. Payment for water course undercrossing will be considered as incidental to other pay items of work, or may be paid for as a lump sum amount bid for construction between stations as shown on the design drawings.

204.3.21 RIPRAP

When specified and shown, construct filter blanket and/or riprap as required in ***Section 610 SLOPE PROTECTION***.

204.3.22 WATERLINE TRENCH BACKFILL AND COMPACTION

Conform to applicable requirements contained in ***Subsection204.3.19 SEWER TRENCH BACKFILL AND COMPACTION***, with the following exceptions:

Maintenance of Backfilled Trench

Maintain backfilled trench surface between any two successive valves until the following operations have been completed and approved by Engineer:

1. Service connections installed and backfilled.

2. Valves, valve boxes, and hydrants installed.

3. Hydrostatic testing.

4. Flushing and sterilization.

5. Cleanup and restoration of all physical features.

6. Utilities restored to their original condition or better.

7. All work required between the two valves accomplished including restoration of surface to specified condition.

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204.3.23 STRUCTURAL BACKFILL AND COMPACTION

204.3.23A Moisture Control

Insofar as practicable, maintain optimum moisture content required for compaction, as determined by ASTM D 698, throughout each lift of the fill. Add any required moisture to material which is not predominantly granular by nature, preferably at the site of excavation. Add moisture to granular backfill by sprinkling or spraying during compaction operation. Do not compact nongranular material if it is significantly above optimum moisture content. Aerate by such processes as scarifying, blading, or discing.

204.3.23B Common Backfill Around Structures

Place backfill around concrete structures only after the concrete has attained two-thirds of its specified compressive strength. Remove all form materials and trash from the excavation before placing and backfill.

Place common backfill in all areas, unless otherwise shown or directed. Place backfill around piers and columns on all sides to approximately the same elevation at the same time. backfill in front of abutments and walls shall be placed first to prevent the possibility of forward movement. Take special precautions to prevent any wedging action against the concrete. Deposit material from the excavation is lifts. Compact each lift to at least 95 percent of its maximum density at optimum moisture content, as determined by the applicable method of ASTM D 698, before placing the next lift. Jetting or puddling will not be permitted. Make adequate provision for thorough drainage of all backfill.

Earth-moving equipment shall not be operated within 5 feet of walls of concrete structures unless approved. Compact backfill adjacent to concrete walls with pneumatic tampers or other approved equipment that will not damage the structure.

204.3.23C Common Backfill Not Around Structures

Place common backfill to lines and grades shown to produce a rough grade in areas containing no structures, paving, utilities, or similar appurtenances. Material shall be deposited in lifts. Each lift shall be compacted to at least 95 percent of its maximum density at optimum moisture content, as determined by the applicable method of ASTM D 698, before placing next lift.

204.3.23D Granular Backfill Around Structures

Place imported granular backfill in lifts. Compact each lift to 95 percent of its maximum density, as determined by ASTM D 698 Method D, before placing next lift.

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204.3.23E Granular Backfill Under Footings and Slabs

When shown, natural ground shall be graded and prepared as approved, and crushed granular backfill placed under footings, slabs, and other structures. Deposit material in lifts and compact to 95 percent of its maximum density as determined by ASTM D 698, Method D.

204.3.23F Granular Backfill Under Facilities

When shown, place Imported Granular Backfill I previously excavated areas under piping, sidewalks, curbs, and similar structures and facilities. Place material in lifts and compact each lift to 95 percent of its maximum density as determined by ASTM D 698, Method A.

204.3.23G Sand Backfill

Use sand backfill wherever shown or directed, and for drainage blanket under vapor barriers, where such barriers are used beneath concrete slabs. Place material in lifts and compact each lift to 95 percent of its maximum density as determined by ASTM D 698, Method D.

204.4.00 MEASUREMENT AND PAYMENT

204.4.01 COMMON AND UNCLASSIFIED EXCAVATION

All common excavation and unclassified excavation will be measured on a cubic yard basis, or on a linear foot basis for trench excavation and backfill when so shown in the Proposal, all in original position prior to excavation. The quantity measured for payment will include only material excavated from within the limits defined herein. Any additional excavation outside of these limits, unless ordered in writing by Engineer, shall be considered as having been made for Contractor's benefit and will be considered as incidental to the work.

204.4.01A Structural Excavation

Horizontal limits for measuring excavation shall be the sides of the trench or pit, except that no measurement or payment for excavation will be made for material removed outside vertical planes 1 foot outside and parallel to the neat lines of footing or bases for structures, or as shown.

Bottom limit for measurement shall be the elevation designated for the bottom of footing or base for the structure.

Upper limit for measurement shall be the ground surface at the site of work immediately prior to beginning work or the bed of the stream as it exists at the time excavation is started, with the following exceptions; (1) where excavation for the structure comes within the limits or roadway excavation areas, the upper limit shall be

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the planes of the bottoms and side slopes of those areas; or (2) where excavation for the structure comes within the limits of embankment to be constructed as a part of the Contract, such embankment shall be constructed prior to construction or installation of the structure and upper limit shall be the planes of the new embankment at elevation designated for embankment construction.

If ordered by Engineer, in writing, additional excavation below elevations shown will be measured the same as set forth herein, except that the upper pay limit will be the elevation shown for bottoms of footings or gases of the structure, and lower pay limit will be the elevation established by Engineer for bottoms of footings or based of the structure.

No measurement of payment will be made for excavations made below elevations established by the Engineer for bottoms of footings or bases of structures nor for any other unauthorized excavation.

204.4.01B Roadbed and Slope Excavation

Pay quantities shall be computed to the neat lines of cross sections as staked or as otherwise directed.

204.4.01C Trench Excavation and Backfill

Measurement by the Cubic Yard:

Volume for trench excavation and backfill will be computed upon the following basis for length, width, and depth of trench:

Length. Length will be the entire horizontal distance on a linear foot basis measured along centerline of trench, including measurement through valves, fittings, couplings, manholes, or structure locations, except that the measurement through such structures will be deducted if the Proposal contains a separate provision for payment of this item that is applicable to those structures.

Measurement will be from center-to-center of valves, fittings, couplings, manholes, structures, or end of pipe, whichever is applicable.

Width. Width upon which sewer excavation will be calculated will be based on the outside diameter of the pipe barrel as follows:

Size of Pipe	Pay Width of Trench
6” thru 8”	2.5 feet
10” thru 24”	Outside diameter plus 18”
27” thru 36”	Outside diameter plus 24”
42” and larger	Outside diameter plus 30”

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Width for calculating excavation payment for water mains and conduits shall be the same as for sewer.

Depth. Depth will be the vertical measurement from the invert of sewer pipe, or from bottom of trench for water mains and conduits, to the original ground or paved surface. Bottom of trench for water mains and conduits shall include all extra excavations required for placement of pipe bedding. Depth of trench will be measured at intervals of 25 feet along the centerline of trench between linear pay limits as specified herein, unless physical conditions necessitate a change that is mutually acceptable to both Engineer and Contractor. Average depth between measuring points will be the depth used for computing depth of trench between measuring points. Pay depth shall not exceed depth shown on the Plans, unless authorized by Engineer.

Measurement by the Linear foot:

When contained in the Proposal, quantities for trench excavation and backfill will be measured on a linear foot basis for type and depth of backfill used, with depth being measured from original ground or paved surface to invert of pipe.

For sanitary sewers and storm drains, depth figures shown in the Proposal are inclusive to the nearest 0.1 foot, that is, a trench depth measured as 11.9 feet will be paid for at the unit price for excavation 10 to 12 feet deep. A trench depth measured as 12.0 feet will be paid for at the unit price for excavation 12 to 14 feet deep. Depths measured at less than 6 feet will be included in the base depth of range of zero to 6 feet. Depth of trench will be measured at intervals of 25 feet along centerline of the trench, beginning at the center of the downstream manhole, or end of pipe and the average depth between measuring points will be the depth used for computing the depth of trench between measuring points. The unit price bid per linear foot for mainline and service line trench excavation and backfill for the type and depth shown shall be full payment for all work including excavation, bedding, and pipe zone material, imported backfill, or native backfill as required, compaction, importing of common material needed to make up for trench settlement, topsoil, seeding, and placing sod as required, aggregate surfacing as required, disposal of excess material, dewatering, sheeting and shoring, utility protection, restoration, and clean-up. Measurement for payment will be along the horizontal centerline of the pipe for the type and depth of backfill used, with depth being vertically measured from original ground or paved surface to invert of pipe. Removal and disposal of the existing pipe and/or liner pipe shall be included in and incidental to the various Contract unit prices for trench excavation and backfill.

There will be no additional compensation for potholing existing utilities, it being understood the cost is included in and incidental to the various Contract unit prices for trench excavation and backfill.

For water mains and conduits, measurement and payment shall include all excavation from original ground or paved surface to bottom of pipe and all extra excavation

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required to provide space for pipe bedding and shall also include any incidental excavation and backfill necessary to widen trench for installation of branch-line fittings and appurtenances. The unit price bid per linear foot for trench excavation and backfill for the type and depth shown shall be full payment for all work, including excavation, bedding, and pipe zone material, imported backfill in the street, and common backfill off the pavement, compaction, importing of common material needed to make up for trench settlement, topsoil seeding, and placing sod as required, aggregate surfacing as required, disposal of excess material, dewatering, sheeting and shoring, utility protection, restoration, and cleanup.

There will be no additional compensation for potholing existing utilities or for extra depth involved in deflecting pipe to avoid conflicts with other utilities, it being understood that the cost therein is included in and incidental to the various Contract unit prices for trench excavation and backfill.

Length of all trenches will be measured horizontally along center of pipe or conduit from center-to-center of valves, fittings, couplings, manholes, structures, or end of pipe or conduit, whichever is applicable. Measurement through structures will be deducted if the Proposal carries a separate item of structure excavation applicable to the structures.

The width of trenches for payment purposes only, shall be considered to be 18 inches greater than the inside diameter of pipe which is less than 24 inches in diameter, and 24 inches greater than the inside diameter of pipe more than 24 inches in diameter. No additional compensation will be allowed for over-width trenches.

Measurement and payment for trench excavation and backfill shall include all work specified herein, or not specifically paid for in other pay items.

The pay length of short trenches for the purpose of working pits used for work described in Section 407 shall be the horizontal distance as measured on the ground surface, but shall not exceed dimensions shown on the plans.

The length of trench for service line excavations shall be the horizontal distance measured from the centerline of the sewer main to the point of sewer service terminus or point of connection to the existing service, less one-half the pay width of the mainline trench as specified in this Subsection, except where otherwise specified in Subsection 407.5.03.

The depth of excavation shall be the vertical measurement from the invert of sewer pipe, or from bottom of trench for water mains and conduits, to the original ground or paved surface.

There will be no separate payment for constructing the clay dams shown on the plans, it being understood that the cost thereof is included in and incidental to the various excavation and backfill items of work.

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Alternate Basis of Payment for Open Trench Installations:

Pipe and conduit shall be measured along the longitudinal axis between the ends as laid and shall include the actual pipe in place and shall be measured from the center of the main sewer to the upper end of the house service sewer. Catch basin connections shall be measured from the inside face of the catch basin to the inside face of conduit or structure to which connection is being made. Chimney pipe shall be measured vertically from the upper end of the chimney to the invert of the sewer.

The price per linear foot for pipe and conduit in place shall be considered full compensation for all wyes, tees, bends, monolithic catch basin connections, and specials shown on the plans; the removal of interfering portions of existing sewers, storm drains, and improvements; the closing or removing of abandoned conduit and structures; the excavations of the trench; the control of ground and surface waters; the preparation of subgrade; placing and joining pipe; backfilling the trench; permanent resurfacing; and all other work (excluding temporary resurfacing) necessary to install the pipe or conduit, complete in place.

Payment for structures such as manhole, junction structures, lamp holes, and catch basins shall be made at the price bid for each structure and shall be full payment for each structure complete in place, including excavation, backfill, constructing inverts, furnishing and installing castings, restoration of the street surface and all other work, excluding temporary resurfacing, necessary to complete the work.

There will be no separate payment for constructing the clay dams shown on the Plans, it being understood that the cost thereof is included in and incidental to the various excavation and backfill items of work.

204.4.02 HARD SURFACE REMOVAL AND REPLACEMENT FOR TRENCHES

Measurement and payment for the removal and replacement of Portland Cement concrete pavement, asphaltic concrete pavement and surfacing, curbs, driveways, and sidewalks shall conform to the provisions of ***RESURFACING*** in ***DIVISION 4—SANITARY SEWERS AND STORM DRAINS***.

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204.4.03 ROCK EXCAVATION

204.4.03A Structural Rock Excavation

Rock excavation will be measured on a cubic yard basis for the actual quantity removed within the limits of excavation as defined for common and unclassified excavation. Quantity for payment shall be the amount approved by Engineer.

204.4.03B Roadbed and Slope Rock Excavation

Rock excavation will be measured on a cubic yard basis for the actual quantity removed within the limits of excavation as defined for common and unclassified excavation. Quantity for payment shall be the amount approved by Engineer.

204.4.03C Trench Rock Excavation

Length. Length will be the entire horizontal distance where rock is encountered, measured on a linear foot basis along centerline of trench.
In sewer trenches, manholes, and other structures will be excluded and will be measured separately. Measurement will commence at the first location where rock is encountered and continue to the point where rock terminates.

In trenches for conduits and water mains, valves, fittings, couplings, or structure locations will be included in the linear measurement, unless the Proposal carries a separate item that is applicable to the structures.

Width. For sewers, water mains, and conduits, the width for payment of trench rock excavation shall conform to applicable provisions of ***Subsection 204.4.01C—TRENCH EXCAVATION AND BACKFILL***.

Depth. Measurement for depth will be the vertical distance from top of rock to a depth that is 6 inches below the sewer pipe, water main, or conduit. Depth will be measured at intervals of 25 feet along centerline of trench, beginning at the first location that rock is encountered, and the average depth between measuring points will be the depth used for computing depth of rock.

Payment for rock excavation will be based on the unit price per cubic yard stated in the Proposal and will be paid in addition to the payment for trench excavation and backfill. Payment for rock excavation shall include full compensation for all work necessary to excavate the rock material. No payment will be made for rock excavated below required grade or outside the widths mentioned above. Rock exaction quantities for sewer manholes and other sewer structures shall be computed from the actual profile depth as above, multiplied by the area within a line parallel to and 1 foot outside of the actual dimensions of the manhole or structure base.

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204.4.04 EMBANKMENT

Measurement for embankment compacted I place will be made on a cubic yard basis. Computation of volume for payment will be based on field measurement of the actual number of cubic yards constructed and accepted, complete within limits shown or directed; where applicable, this shall be within neat lines of the staked cross section.

No measurement or payment will be made for quantities required due to subsidence or settlement of ground or foundation, for settlement of materials within the embankment or for shrinkage, settlement, washout, slippage, or loss regardless of cause, subject however to the provisions of ***RESPONSIBILITY OF CONTRACTOR*** in ***Section 105*** of the ***GENERAL REQUIREMENTS***.

No deduction will be made for piers, columns, pipes, or miscellaneous construction features constructed within embankment limits.

Payment shall constitute full compensation for all work and all materials used, whether obtained from the site of work or imported, complete as specified.

Trench excavation, bedding, and backfill placed in the completed embankment will be paid for separately for the particular item and class of construction.

204.4.05 FOUNDATION STABILIZATION

204.4.05A Structural and Roadway

Measurement for this item will be made on a cubic yard basis. Measurement will be based upon individual trip tickets of actual truck measure in cubic yards furnished to and validated by Engineer for material actually used.

204.4.05B Trench

Measurement for this item will be made on a cubic yard in place basis. Volume will be computed upon the following basis for length, width, and depth of trench.

Length and Width: Length and width shall conform to pay limits for common and unclassified trench excavation and backfill as contained in Subsection 204.4.01C. Length shall include only the actual linear footage of foundation stabilization used in the trench.

Depth: Depth measured will be the actual depth placed as directed below the level of bottom of bedding. Depth will be measured at intervals of 25 feet along centerline of trench, and the average depth between measuring points will be the depth used for computing the depth of foundation stabilization between measuring points.

Payment for this item shall constitute full compensation for all work necessary to furnish materials at trench side; for placing and compacting it in the trench; and in

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sewer trench, it shall include the extra depth of trench excavation required below pipe bedding grade to provide for a stable foundation for the pipe. Extra depth required for this item in water main or conduit trenches is included in payment for common trench excavation.

204.4.05C Trench-stipulated

A stipulated price may be contained in the Proposal for Contract pay item Foundation Stabilization along with an estimated quantity. The Owner has not made any subsurface investigation is the area of this project to determine the soil characteristics. In the event soil conditions are encountered which require this pay item, the unit price for it is pre-established, and by submittal of a Proposal on this project, Bidders acknowledge the sufficiency of this unit price. Bidders shall not change the typewritten figure shown for this item and shall include the amount shown for this item in their total project bid.

Payment for any quantity of Foundation Stabilization in the Proposal, which is actually needed in the field and authorized by the Engineer will be paid in addition to the payment for Common Trench Excavation and Common Backfill or Common Trench Excavation and Granular Backfill. When payment is authorized for this stipulated price pay item, such payment shall include full compensation for all labor, equipment, materials, and incidentals necessary for safe adequate completion of pipeline construction and/or reconstruction in full conformance with these specifications.

204.4.06 BEDDING FOR SEWERS, WATER MAINS, AND CONDUITS

There will be no separate payment for bedding sewers, including all excavation required below the pipe invert for the purpose of placing bedding, in accordance with the Plans, Standard Plan 605, and other Subsections of the SCS, it being understood that the cost thereof is included in and incidental to the contracted prices for the various items of work (by size and bedding type) under the headings of ***Sanitary Sewer Pipe*** or ***Storm Drain Pipe***. (See Subsection 402.4.01)

204.4.07 BACKFILL

204.4.07A Structural

Unless shown in the Proposal, all backfill of the type specified shall be considered as incidental to and included in the pay item for the appurtenant structure or facility.

If structural backfill is specified as a pay item and shown in the Proposal, measurement will be on a cubic yard basis. Horizontal and upper limits shall be measured the same as set forth in Subsection 204.4.01A, for material actually placed between outside surface of the structure or facility and horizontal limits as defined. Lower limit shall be a plane at the bottom of the completed footings or structure, or lower outside surface of other facilities. Any backfill outside of these limits will be considered as incidental, and all costs in connection with such backfill shall be included in the pay items shown in the Proposal.

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204.4.07B Pipe Zone Backfill

There will be no separate payment for pipe zone backfill, it being understood that the cost thereof is included in and incidental to the contracted prices for the various trench excavation and backfill items of work.

204.4.07C Granular Trench Backfill Material

Payment for this item will be made when imported granular material is specified or when directed by the Engineer to be placed in the trench or pipe line embankment.

Work under this item for granular backfill material will be measured on a cubic yard basis. Volume will be computed upon the following basis for length, width, and depth of granular backfill.

Length and Width. Length and width shall conform to pay limits for common and unclassified trench excavation and backfill as contained in Subsection 204.4.01C.

Depth. Depth of granular backfill will be the actual vertical depth placed as directed.

Measurement of the volume in cubic yards will be determined by subtracting the volume of the pipe based on the outside pipe barrel diameter from the volume of granular backfill calculated by using the pay limits contained hereinabove.

204.4.07D Controlled Density Backfill Material

Payment for this item will be made with CDB is specified or when directed by the Engineer to be placed in the trench or pipeline embankment.

Work under this item for CDB material will be measured on a linear foot or cubic yard basis. For the cubic yard basis, the volume will be computed upon the following basis for length, width, and depth of CDB:

Length and Width. Length and width shall conform to pay limits for common and unclassified trench excavation and backfill as contained in Subsection 204.4.01C.

Depth. Depth of CDB will be the actual vertical depth placed as directed. Depth will be measured above the pipe zone.

Measurement of the volume in cubic yards will be determined by using the pay limits contained hereinabove.

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204.4.08 RIPRAP AND FILTER BLANKET

Approved material for riprap and filter blanket will be measured on a cubic yard or ton basis only when listed in the Proposal as a separate bid item, or when directed by Engineer.

Measurement of the material in the hauling vehicle will be made by the Engineer at the point of delivery. Payment will be made for the actual volume or tonnage measured. No payment will be made on loads not checked and approved by Engineer.

Payment for riprap and filter blanket shall include all work necessary to furnish and place the material complete. When not listed in the Proposal, payment for riprap and filter blanket shall be incidental to other items of work.

204.4.09 IMPORTED TOPSOIL

Measurement and payment for imported topsoil will be made on a cubic yard basis and only when listed in the Proposal as a separate bid item or when directed by Engineer to be imported and placed as directed.

Measurement of the material in the hauling vehicle will be made by the Engineer at the point of delivery. Payment will be made for the actual volume measured. No payment will be made on loads not checked and approved by Engineer.

Payment for imported topsoil shall constitute full compensation for all work necessary to furnish materials on site, placing material, and for full compaction in place.

204.4.10 SHORING AND CRIBBING INCIDENTAL

Shoring and cribbing, including all work and materials expended in furnishing, placing, and removing such shoring and cribbing necessary to complete the excavation shall be considered incidental to the pay item for excavation.

204.4.11 DEWATERING INCIDENTAL

Dewatering shall be considered as incidental to and included in the pay item for excavation.

204.4.12 WITHHELD PROGRESS PAYMENTS

If the work limits specified in ***Subsection 204.3.14A WORK LIMITS***, are all progress payments will be withheld until resumption of main line sewer construction is authorized by the Engineer.

Contractor will not be entitled to anticipated profits, interest, or any other additional payment as a result of the withheld progress payment, nor will the necessary changes in the work schedule, due to the violation of Subsection 204.3.14A be cause for extension of Contract completion time.

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204.4.13 PAYMENT

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract.

Pay Item	**Unit of Measure**
Asphalt and Concrete Removal and Replacement	C.Y. or S. Y. or L. F.
Unclassified Excavation	C.Y
Common Excavation	C.Y
Rock Excavation	C.Y.
Common Trench Excavation and Common Backfill	C.Y. or L. F
Common Trench Excavation and Granular Backfill	C.Y. or L.F.
Borrow Excavation	C.Y.
Embankment	C.Y.
Foundation Stabilization	C.Y.
Pipe Bedding Class A for (size) Pipe	C.Y. or L.F.
Pipe Bedding Class B for (size) Pipe	C.Y. or L.F.
Pipe Bedding Class C for (size) Pipe	C.Y. or L.F.
Structural Backfill	C.Y.
Granular Backfill Material	C.Y.
Riprap	C.Y. or Ton
Filter Blanket	C.Y.
Imported Topsoil	C.Y.
Close Sheeting	L.F. (of trench) or Lump Sum
Sheet Piling	L.F. (of trench) or Lump Sum
Common Trench Excavation and Controlled Density Backfill	C.Y. or L.F.

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205 Materials – Types and Use

205.1.00 DESCRIPTION

This Section covers certain types of materials and their use that are common to appropriate forms of construction contained throughout Divisions 3 through 6.

205.2.00 MATERIALS

205.2.01 GENERAL

Unless specified otherwise in the Contract Documents or Standard Plans, materials contained herein will be used in required work.

205.2.02 PORTLAND CEMENT CONCRETE

Use concrete having a design strength of 3,000 psi in 28 days per AASHTO T22 and T23, with 1½ inch maximum size aggregate and a slump of between 2 inch and 4 inch unless otherwise specified.

High early strength concrete (Type III cement) will be used when patching trenches in Portland Cement concrete pavement.

For precast curbs and traffic barriers, use Class 4000 – 1 ½ concrete.

Use Type II cement concrete for all sewer and water main construction and appurtenances thereto.

Portland Cement concrete shall be sampled and tested in accordance with the following ASTM test methods:

(1) Sampling Fresh Concrete C172
(2) Obtaining Drilled Cores C42
(3) Molding and Curing Specimens C31
(4) Compressive Strength C39
(5) Flexural Strength C78
(6) Slump C143
(7) Air Content ..... C173 or C231
(8) Unit Weight Yield C138
(9) Setting of Mortar ..... C191 or C266

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205.2.03 CEMENT MORTAR

Use either standard premixed mortar conforming to ASTM C 387, or mortar proportioned with one part Portland Cement to two parts clean, well-graded sand which passes a 1/8 inch screen and which conforms to AASHTO M 45. Admixtures may be used, but do not exceed the following percentages of cement by weight; hydrated lime, 10 percent, and diatomaceous earth or other inert materials, 5 percent. Testing shall conform to the OSHD test for mortar strength.

205.2.04 CEMENT GROUT

205.2.04A Type "A" Grout

Utilize grout which consists of one part Portland Cement and three parts clean and well-graded sand. Use minimum amount of water to produce a thick, creamy consistency.

205.2.04B Type "B" Grout

Where "B: type grout is specified, use a mixture consisting of one part Portland Cement, five parts of clean and well-graded sand, and seven parts pea gravel, by volume.

205.2.05 STEEL REINFORCEMENT

Use steel deformed bars conforming to ASTM A 615, Grade 40, except that longitudinal bars in continuously reinforced concrete pavement shall be Grade 60. See ***Section 603 REINFORCEMENT***.

205.2.06 DOWELS

Utilize steel dowels which conform to ASTM A 306, Grade 70. Where specified, dowels shall be coated with plastic or other approved material for bond prevention. See ***Section 603 REINFORCEMENT***.

205.2.07 STRUCTURAL JOINT MATERIAL

Use preformed and poured joint fillers conforming to requirements of ***Subsection602.2.06 JOINT MATERIALS***. For joints in Portland Cement concrete pavement, curbs, gutters, driveways, sidewalks, and pathways, refer to ***DIVISION 3 – STREETS***.

205.2.08 CURING MATERIALS FOR PORTLAND CEMENT CONCRETE

Conform to one or more of the following requirements for curing materials; choice of method to be used is dependent on weather and existing conditions:

1. White Burlap – Polyethylene Sheets .....AASHTO M 171
2. Waterproof Paper .....AASHTO M 171

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[1]3. White – Pigmented Liquid Membrane-Forming Compound .....AASHTO M 148
4. White Polyethylene Film.....AASHTO M 171
5. Burlap Cloth (Jute or Kenaf).....AASHTO M 182

205.2.09 EPOXY CEMENT

Epoxy cement shall be a two compound epoxy resin adhesive conforming to requirements of AASHTO M 235.

205.2.10 PORTLAND CEMENT

Furnish one or more of the following types as specified:

Type I – For general use when special properties of other type cements are not required.

Type IA – Air-entraining cement for same uses as Type I, where air-entrainment is desired.

Type II – For use when moderate sulfate resistance or moderate hear of hydration is desired.

Type IIA – Air-entraining cement for same uses as Type II, where air-entrainment is desired.

Type III – For use when high early strength is desired.

Type IIIA – Air-entraining cement for same use as Type III, where air-entrainment is desired.

Portland Cement shall conform to AASHTO M 85 for low alkali cement except as follows:

1. Total alkali content (sodium and potassium oxide calculated as $Na_20+0.658k_20$) shall not exceed 0.6 percent.

2. Types I, IA, III, or IIIA must contain a maximum of 10 percent tricalcium aluminate.

3. Time-of-setting tests shall be by either the Gillmore Test of the Vicat Test or both, as Engineer may elect.

When not otherwise specified, use Type I. Contractor, at his/her option, may use Type III Portland Cement (high early strength) in lieu of Type I in the identical quantity specified for the latter.

Differing brands or types of cement, or the same brand or type of cement from different plants must not be mixed during use not be used alternately without prior written approval. Cement may be sampled either at the plant or site of work at option of Engineer.

[1] Required for PCC curbs, but do not use on bridges or box culverts. Test in accordance with the OSHD modified procedure.

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The Contractor is referred to Subsection 602.2.04 for use of admixtures.

205.2.11 WATER

Water used in all work must be reasonably clean and fee of oil, salt, acid, alkali, sugar, vegetable matter, or other substances injurious to the finished product. Use water conforming to AASHTO T 26 for mixing and curing Portland Cement concrete, mortar, or grout. Water of approved potable quality may be used without test.

205.2.12 AGGREGATES

205.2.12A General

Aggregates shall be subject to approval at the source or at the actual stockpile from which the aggregate is taken for incorporation in the work. During production of the aggregate, provide samples of each size for testing if requested by Engineer. On the basis of testing, modify, or adjust crushing and screening operations to bring each separate size of aggregate within gradings, proportions, and quantities as specified.

In all stages of production, transporting, and stockpiling, handle aggregates in such a manner as will prevent the segregation of materials and the intermingling of separate gradings or kinds of aggregates, as far as practicable.

Grading of designated aggregate sizes shall conform to the requirements of appropriate forms of work contained within applicable Sections throughout these specifications. The determination of sizes and grading of aggregate shall conform to AASHTO T 27 and AASHTO T11.

205.2.12B Coarse Aggregates

Coarse aggregate shall be natural or crushed rock or gravel which is retained on a No. 4 sieve and reasonably free from flat, elongated, sort or disintegrated pieces, vegetable material, or other deleterious matter occurring in a free state or as a coating on the stone.

Use crushed rock or crushed gravel for coarse aggregate in aggregate bases and all asphalt construction requiring coarse aggregate. Total deleterious matter shall not exceed 2 percent by weight.

Use crushed rock, natural gravel, or other approved inert materials of similar characteristics, or combinations thereof, for coarse aggregate in Portland Cement concrete. Do not allow amount of deleterious substances in Portland Cement concrete to exceed the following amounts:

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Light weight pieces .....0.25 percent (by weight)
Friable particles.....0.25 percent (by weight)
Material passing No. 200 sieve.....1.00 percent (by weight)
Wood waste .....0.05 percent (by weight)

Use coarse aggregates having weighted percentages of loss which do not exceed 12 percent by weight when subjected to five alternations of the sodium sulfate soundness test (AASHTO T 104).

Fracture of Gravel. When crushed gravel is furnished, it shall have at least one mechanically fractured face on not less than the following percentages (by weight) of the material retained on a No. 4 sieve.

Type of Use	Percentages
Asphalt Concrete Pavement (Division 3)	60
Asphalt Surface Treatment (Division 3)	90
Asphalt Treated Bases (Division 3)	65
Portland Cement Concrete (Division 6)	60
Aggregate Bases (Division 3)	50*
Aggregate Bases (Division 3)	70**
*1½"- 0 and larger; **smaller than 1¼" - 0	

Durability. The source material from which coarse aggregate is produced shall meet the following qualifying test requirements:

Test	Test Method	Requirements
Degradation: Passing No. 20 sieve	OSHD Standard	30% Maximum
Sediment Height	OSHD Standard	3" Maximum
Abrasion	AASHTO T 96	35% Maximum

Also, other sampling and testing of coarse aggregate shall be in accordance with the following methods:

Sampling	AASHTO T 2
Materials Passing No. 200 sieve	AASHTO T 11
Sieve Analysis	AASHTO T 27
Soundness	AASHTO T 104
Friable Particles	AASHTO T 112
Lightweight Pieces	AASHTO T113
Fracture	OSHD Standard

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205.2.12C Fine Aggregate

Use fine aggregate consisting of finely crushed rock or gravel, fine sand, and other finely divided natural and inert mineral matter, thoroughly washed, and reasonable free of clay, loam, shale, alkali, vegetable matter, and other deleterious matter occurring either free of as coating on the particles. Do not mix fine aggregate from different geological sources, and do not store in the same pile nor use alternately in the same class of construction or mix.

Portland Cement concrete shall contain fine aggregate which as a deleterious material content not exceeding the following limits:

Friable particles.....1 percent (by weight)
Lightweight particles.....1 percent (by weight)
Material passing No. 200 sieve.....4 percent (by weight)

When this fine aggregate for Portland Cement concrete is subject to five alternations of the sodium sulfate soundness test (AASHTO T104), weighted percentage of loss must not exceed 10 percent by weight.

Asphalt cement concrete and surface treatments shall contain fine aggregate having a weighted loss of not more than 15 mass percent when sodium sulfate is used or 20 mass percent when magnesium sulfate is used in five cycles of the soundness test. Total deleterious matter shall not exceed 2 percent by weight.

Use fine aggregates which meet the durability requirements for coarse aggregates contained hereinbefore, and which meet the following liquid limit and plasticity index requirements:

Quality	Test Method	Requirement
Liquid Limit	AASHTO T 89	NP or 33 Maximum *
Plasticity Index	AASHTO T 90	NP or 6 Maximum *

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*When tested as specified, both the liquid limit and plasticity index test results shall conform to the following:

Percent of Material Passing No. 40 Sieve	Liquid Limit (Maximum)	Plasticity Index (Maximum)
	AASHTO T 89	AASHTO T 90
0.0 to 5.0, inclusive	33	6
5.1 to 10.0, inclusive	30	5
10.1 to 15.0, inclusive	27	4
15.1 to 20.0, inclusive	24	3
20.1 to 25.0, inclusive	21	2
Over 25.0	21	0 or N.P.

Sampling and testing fine aggregate shall conform to the following methods:

1. Sampling..... AASHTO T 2
2. Material passing No. 200 sieve..... AASHTO T 11
3. Organic impurities..... AASHTO T 21
4. Sieve analysis..... AASHTO T 27
5. Mortar strength..... ASTM C109
6. Soundness..... AASHTO T 104
7. Friable particles..... AASHTO T 112
8. Lightweight pieces..... AASHTO T 113
9. Sand equivalent..... AASHTO T 176

205.2.13 ASPHALT MATERIALS

205.2.13A General

Unless otherwise specified herein or in applicable Subsections, types and grades of material shall conform to the current Oregon State Highway Division's ***Specifications for Asphalt Materials*** obtainable from the Engineer of Materials, ODOT, Salem, Oregon 97310.

205.2.13B Asphaltic Concrete

Hot Mix – Use AR 4000 or PBA-2 asphaltic cement as recommended for the Pacific Coast states.

Cold Mix – Use MC 250 liquid asphalt or CRS-2 cationic emulsified asphalt.

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205.2.13C Prime Coat

Use MC 250 liquid asphalt off CRS-2 cationic emulsified asphalt.

205.2.13D Seal Coat

Use CRS-2 cationic emulsified asphalt.

205.2.13E Tack Coat

Use AR4000 or PBA-2 asphaltic cement.

205.2.13F Slurry Seal

Use CQS 1-h cationic emulsified asphalt.

205.3.00 CONSTRUCTION

205.3.01 GENERAL

Conform to construction requirements contained in the specific Section within these specifications which is applicable to the type of work specified.

205.4.00 MEASUREMENT AND PAYMENT

Measurement and payment of materials will conform to the specific Section within these specifications which is applicable to the type of work specified.

NEWER VERSION PUBLISHED

206 Adjustment of Incidental Structures to Grade

206.1.00 DESCRIPTION

This section covers the work necessary for adjusting tops of manholes, sumps, catch basins, inlets, valve boxed, meter boxes, monument boxes, and similar structures to required elevation and/or horizontal alignment, complete.

206.2.00 MATERIALS

206.2.01 GENERAL

Materials used in adjustment of incidental structures may be materials salvaged from the existing installation and brought to a condition approved for reuse, or materials conforming to the requirements of related work referred to herein or elsewhere in the applicable Divisions.

206.3.00 CONSTRUCTION

206.3.01 EXCAVATION AND BACKFILL

Excavation shall be unclassified and shall include whatever materials are encountered to the depths as shown or as directed.

Saw cut around structure to be adjusted when new concrete pavement has been completed. Do not jack hammer for concrete pavement cutting. Replace pavement to previous density and grade.

Backfill shall be done in accordance with the applicable requirements of Section 204.

206.3.02 SALVAGE OF FRAMES, COVERS, AND GRATES

Metal frames, covers, grates, and fittings may be salvaged from structures to be adjusted or abandoned, and if of suitable size and condition, may be reused in the work, and such as are damaged or which are unfit for reuse, as determined by Engineer, shall be replaced with similar items which are comparable in all respects with those with which they are to replace and which are adequate for the intended purpose.
Salvaged components to be reused shall be gleaned of foreign material by solvents, sand-blasting, or other approved methods that will not harm the component but will restore it to a nearly new condition as approved.

Any metal components, castings, etc., not to be reused on the project shall revert to the Owner and the Contractor shall deliver them to the Owner's Field Office at 20th and Howard Streets Southeast immediately upon removal from the site at which said component was installed.

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206.3.03 RAISING TOPS OF MASONRY STRUCTURES

After existing frames, cover, and grates have been removed, exposed top surface on which new mortar or concrete is to be placed shall be chipped away to a depth of at least ¼ inch to expose firm concrete and the new surface shall be cleaned by brushing and shall be moistened with water at the time of placing new concrete thereon. New concrete shall then be placed to required grade and cured at least three days, after which the frame shall be seated in fresh mortar and brought to proper grade. Masonry of bricks or concrete blocks shall be raised with new bricks, blocks, mortar, or combinations thereof or with Portland Cement concrete, as conditions may require or permit. Concrete boxes may be lifted and placed on precast concrete box extensions, on new brick or on cast-in-place concrete as may be suitable.

Mortar for building up existing masonry shall not be placed to a depth of more than 2 inches. Concrete shall not be placed to a depth of less than 3 ½ inches. to conform to these requirements, existing shells, or walls of structures to be raised shall be cut down as necessary to provide space for the new construction.

Fabricated metal rings or plates may be furnished and used in adjustment work, provided the metal and is fabrication design is at least equal to pertinent characteristics of strength and support required of the covers or grates to be placed, that uniform bearing of bearing surfaces is assured, and positive provision is afforded against displacement when in service.

206.3.04 LOWERING TOPS OF MASONRY STRUCTURES

Where the top of an existing masonry structure is to be lowered, the masonry portion of the structure shall be exposed to required depth, cut off or removed to an elevation below that established for the bottom of metal frame or cover which is to be reset on masonry and shall then be built up with mortar, concrete, brick, or concrete blocks, or with metal rings or plates to required elevation and top design. Joining of new material to old, minimum thicknesses of new mortar and concrete, limitations, curing, and other details shall be as set forth hereinbefore.

206.3.05 ADJUSTING METAL STRUCTURES

Metal inlets, valve boxes, meter boxes, monument boxes, and other like structures shall be raised or lowered to grade normally by resetting the entire structure on firm foundation. In the case of raising these structure to a point where it would not enclose or protect its contents, add metal extensions of like design below the original structure. Contractor may replace the structure with a new structure of adequate design as approved. Salvaged structures not reused on the project shall become the property of Owner.

206.3.06 ADJUSTING MANHOLES, CATCH BASINS, AND SIMILAR STRUCTURES

Conform to applicable Sections of ***DIVISION 4 – SANITARY SEWERS AND STORM DRAINS***.

NEWER VERSION PUBLISHED

206.4.00 MEASUREMENT AND PAYMENT

206.4.01 MEASUREMENT AND PAYMENT INCIDENTAL

When no pay item is listed in the Proposal, all work will be considered as incidental to the other pay items and no separate payment will be made.

206.4.02 MEASUREMENT AS UNITS IN PLACE

When listed in the Proposal, measurement will be the actual number of manholes, sumps, catch basins, inlets, valve boxes, meter boxes, monument boxes, and other like structures adjusted under this Section, measured as units in place, completed and accepted. Separate measurement will be made of each specific type or of each separate grouping of types of structures for which separate items are shown in the Proposal. Required earthwork, backfill, replacement of base drains, stone bases, pavements, and other miscellaneous work will be considered as incidental to the adjusting work and no separate measurement thereof will be made.

206.4.03 PAYMENT AS UNITS IN PLACE

When listed in the Proposal, the accepted units in place will be paid for at the applicable Contract unit price per each for the particular pay items listed below and shown in the Proposal.

Pay Item	Unit of Measurement
1. Adjusting Manholes	Each
2. Reconstructing Concrete Manholes	Each
3. Adjusting Inlets	Each
4. Adjusting Boxes	Each

Items 1 and 2 above refer to manholes, sumps, and like structures designed to permit human entry and working space therein and to confine and control flow of pipe-conveyed liquids; which structures are herein collectively referred to as manholes.

Item 1 above applies to manholes, regardless of the kind of materials of which they are composed and regardless of design, type, or depth, which have had the tops thereof adjusted as specified; except as Item 2 is applicable as hereinafter provided.

Item 2 above refers to monolithic concrete manholes which, in having their tops adjusted as specified, have necessarily had their entire existing domes destroyed and new domes constructed, or had their entire existing top slabs destroyed and new slabs constructed, or precast manholes which have necessarily had adjustments made below the cone.

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Item 3 above refers to inlets and catch basins, defined as structures designed to receive surface water through grates and orifices and to discharge said waters under control through pipes and is applicable to such structures regardless of their designs, types, or sizes.

Item 4 refers to valve boxes, meter boxes, monument boxes, and other like structures, which are comprised of a box-like body and removable cover provided for the protection of and access to meters, valves, markers, monuments, shut-offs, and similar items. If a protective coating is required on the new metal used in the work, the coating shall be provided as an incidental item without separate or additional compensation.

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207 Landscaping

207.1.00 DESCRIPTION

This Section covers the work necessary for: (A) finish grading, addition of topsoil, fertilizer and weed control, establishment of lawns or grass areas by sod or seeding, and maintenance of lawn or grass areas, complete; (B) mulching, fertilization, and planting of ground cover, establishment of nursery stock, such as trees, shrubs, and small plants and maintenance of ground cover and nursery stock, complete; (C) irrigation system and subsurface drainage, complete.

207.2.00 MATERIALS

207.2.01 PLANTS

Names of plants conform to standardized names of the American Joint Committee on Horticultural Nomenclature. Names of varieties not included therein conform to names generally accepted in the nursery trade. Provide plants which are nursery-grown with habit of growth that is normal for the species, sound, healthy, vigorous, and free from insects, diseases, and injuries and equal to or exceeding measurements specified, measured before pruning with branches in normal position. Provide sizes and methods of handling according to the code of standards recommended by the AAN.

207.2.02 SEED

Provide tested grass or legume seed from blue tag stock and from the latest crop available. Deliver each variety in standard containers labeled in accordance with Oregon State laws and U.S. Department of Agriculture rules and regulations under the Federal Seed Act. Provide with label showing seed variety, percentage of purity, germination, maximum weed content, date of test within nine months of date o delivery, and as set forth in the General Seed Certification Standard by the Oregon State University Certification Board. Mold or evidence of container having been wet or otherwise damaged will be cause for rejection of each lot of seed.

Grass seed may be delivered to the project as a mixture provided each variety of grass seed in the mixture is identified and labeled as specified.

207.2.03 SOD

Provide grass sod from certified or approved source, strongly rooted and free of pernicious weeds.

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207.2.04 IMPORTED TOPSOIL

Where imported topsoil is specified in the Contract Documents, provide natural, fertile, friable topsoil, representative of local productive soil, and 90 percent free of clay lumps or other foreign matter larger than 2-inch diameter, not frozen or muddy, with pH 5.0 to 7.0, and not less than 3 percent humus as determined by loss on ignition of moisture-free samples dried at 100 degrees C. Gravel portion (particles larger than 2mm) shall not exceed 15 percent of total volume. Imported topsoil shall be free of quack grass, horsetail, and other noxious vegetation and seed. Should such regenerative material be present in the soil all resultant growth, both surface and root, shall be removed by Contractor within one year of acceptance of the work at no expense to Owner.

207.2.05 SAND

Conform to requirements of Subsection 205.2.12C for fine aggregate.

207.2.06 PEAT

Use a peat consisting of natural residue formed by decomposition of reeds, sedges, or mosses from freshwater site, free from lumps, roots, and stones, absorbing at least four times its dry weight of water, organic matter not less than 90 percent on a dry weight basis, and maximum moisture content at time of delivery of 65 percent by weight.

207.2.07 LIME

Provide a lime composed of ground dolomitic limestone not less than 85 percent total carbonates and magnesium, ground so that 50 percent passes 100 mesh sieve and 90 percent 20 mess sieve. Coarser material will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing 100 mesh sieve.

207.2.08 SUBDRAINS

Conform to requirements for Underdrains in ***DIVISION 4 – SANITARY SEWERS AND STORM DRAINS***. Clay drain tile, 4-inch diameter, conforming to ASTM C 4, may also be used. Use separator of approved 1-pound density superfine fiberglass.

207.2.09 IRRIGATION AND WATERING SYSTEMS

207.2.09A Pipe

Use copper pipe, Type K soft copper, conforming to ASTM B 88, with commercially pure wrought copper solder joint fittings. Make joints with 95-5 wire solder, ASTM B 32, grade 95 TA. The use of cored solder will not be permitted.

When using PVC pipe (SDR-PR), conform to ASTM D 224I, and use fittings of PVC with deep socket dimensions conforming to ASTM D 2466.

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207.2.90B Gate Valves

Install the following gate valves: to and including 3-inch with bronze bodies, 4-inch and larger with either bronze or iron bodies, all with bronze stems, bronze set rings, and bronze disc faces, conforming to ASTM B 62.

207.2.09C Pressure Reducing Valves

Use adjustable, heavy duty bronze, with approved stainless steel or monel strainer to permit quick cleaning or replacement without dismantling or removing the valve from the line and with integral or independent union.

207.2.09D Control Valves

Provide manual control valves of brass or bronze for underground installation, with cross or slot type handle for operation with a standard key, removable bonnet and stem assembly, adjustable packing gland, rising stem to assure full opening of valve, renewable disc-type washer seat, and integral or independent union.

Use electrically operated control valves of bronze, brass, or stainless steel, normally closed type, open or close time greater than four seconds, capable of manual control during power failure, approved flow control device. Provide with a motor assembly or operating parts removable without disturbing the valve body, all waterproof for underground burial, and with integral or independent union for supply line connection.

207.2.09E Quick-coupling Valves

Supply one-piece or two-piece body type, locking cap, body of approved heavy duty brass or bronze, watertight before and after the coupler is inserted, ad designed so that the valve seat is closed before the coupler is removed. Provide valve coupler, keys, and hose swivels of compatible design to quick-coupling valves.

207.2.09F Risers

Connect sprinkler heads and quick-coupling valves to galvanized steel pipe water supply lines with galvanized steel pipe risers. Heads and valves connected to plastic pipe water supply lines shall, in addition, be provided with and approved swing joint.

207.2.09G Vacuum Breakers

Install bronze-bodied machined valve seat, with working pressure rating to 150 psi. Provide pressure type vacuum breaker as an assembly consisting of vacuum breaker, two gate valves, check valve union, and nipples, as approved.

NEWER VERSION PUBLISHED

207.2.09H Backflow Preventers

Use either reduced pressure or double check valve assemblies, as shown, of a type and size approved by the Owner's Plumbing Division.

207.2.10 FERTILIZER

Fertilizer shall conform to the recommended content as provided for in SOIL TEST hereinafter. Furnish fertilizer in moisture-proof bags marked with weight and the manufacturer's certified analysis of the contents showing the percentage for each ingredient. Furnish fertilizer in a dry condition free from lumps and caking, in granular or pelletized form, of standard commercial grade conforming to all State and Federal regulations and to the standards of the Association of Official Agricultural Chemists. Fertilizer may be furnished in bulk form if an approved transfer hopper is provided.

207.2.11 MULCH AND GROUND COVERS

Use one or more of the following types of mulch:

1. Organic mulch of clean ground pine bark graded so that 50 percent consists of particles larger than ¼ inch but not exceeding 1 inch and 20 percent will pass a No. 10 sieve.

2. Stone mulch of screened washed bank gravel with rounded pebbles. Submit sample for approval of color and size.

3. Fiberglass mulch of approved commercial grade fiberglass yarn mat.

4. Straw mulch of threshed straw of oats, wheat, or rye, free from seed of obnoxious weeds or clean salt hay.

5. Fiber mulch of heavy, twisted jute mesh, weighing 1 pound per square yard, with openings between strands approximately 1 inch square.

6. Spray mulch of a verdyol complex, with nontoxic, 100 percent organic water soluble powder binding agent with silva fiber used in hydraulic seeding operations.

207.2.12 TIE DOWNS

Use one or more of the following materials as the need arises:

1. Eye-bolt masonry anchors of galvanized steel, with approved lead shield or flush shell for setting into masonry joint or concrete.

2. Wood stakes, 2 inch by 2 inch by 96 inch, clear straight cedar, or approved.

3. Wire for guys, or for fastening trees to stakes, of 12 gauge, pliable galvanized steel.

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4. Hose for guy wire encasement, of 2-ply reinforced rubber garden hose, minimum ½ inch diameter new or used.

5. Turnbuckles, zinc-coated, with a 6 ½ inch lengthwise opening, 3/8 inch diameter threaded openings fitted with screw eyes.

6. Wrapping material of first quality, burlap, minimum 8 ounce weight, 6 inches to 10 inches in width.

207.2.13 SOIL STERILANT

Use granular calcium cyanamide, manufactured for use as a herbicide, or other approved sterilant.

207.3.00 CONSTRUCTION

207.3.01 GENERAL

Conform to manufacturer's and supplier's recommendations and instructions and to accepted practices in the industry.

207.3.02 SOIL TEST

If directed by Engineer, have a soil test performed before the project schedule is submitted. The test may be performed by any Oregon State University County Extension Agent or by any other approved soils testing laboratory. The soils analysis shall provide a chemical analysis of the soil and recommendations for soil improvement for the crop to be grown. The recommendations shall be used to select the particular fertilizer and soil improvement chemicals to be used prior to planting.

207.3.03 LAWNS AND GRASS

207.3.03A Project Schedule

Within 20 calendar days of the date specified for commencement of work, submit for approval a time schedule indicating dates for beginning and completion of the following operations:

1. Delivery of materials
2. Preparation of seedbed
3. Planting grass
4. Maintenance

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207.3.03B Delivery, Handling, and Storage

Deliver sod immediately on lifting and after lawn bed is prepared for planting. Protect sod from drying by covering during delivery to protect from sun and wind. Store materials only in areas of site designated.

If sod is not laid within two days of delivery, spread flat with grass side up in cool place and keep moist. Rolled or stacked sod that becomes yellow will not be accepted.

207.3.03C Preparation of Subgrade

After rough grading is completed and before topsoil is spread, apply lime and/or superphosphate as determined by soil analysis. Conform to manufacturer's recommendations for applying lime and superphosphate simultaneously, and schedule application or applications accordingly.

207.3.03D Subsurface Drainage

Lay tiles on firm bed of gravel with minimum fall of 0.5 percent and located as detailed on drawings. Minimum depth of 24 inches and no deeper than required to produce minimum fall. Tiles butted so that space between does not exceed more than ¼ inch. Cover joints of tiles with fiberglass mat to prevent infiltrations of soil, and backfill trenches with gravel to within 4 inches of subgrade.

Place other drain materials in conformance with the applicable requirements for Underdrains in ***DIVISION 4 – SANITARY SEWERS AND STORM DRAINS***. Complete backfilling of trenches with a 4 inch layer of coarse sand and tamp for compaction, as approved.

207.3.03E Topsoil and Finish Grading

Spread topsoil and soil conditioner over the prepared rough grade using a rubber-tired tractor with grader blade or equivalent, weighing maximum of 3 1/5 tons; thoroughly mix the applied materials to a depth of 8 inches with a disc or cultivator over the entire area in two directions at right angles. Rake topsoiled area to a uniform grade so that all areas drain, as shown or as approved. Remove all trash and stones exceeding 2 inches in diameter from area to a depth of 2 inches prior to preparation and planting grass.

207.3.03F Soil Sterilant

Thoroughly water area to be treated one day prior to application of soil sterilant. Apply specified soil sterilant at rate recommended by Manufacturer or as specified. Water thoroughly after application and keep soil moist to a depth of one inch for three weeks. Three weeks after soil sterilant application, rake lightly immediately before seeding or sodding.

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When required by the Soil Test, apply lime uniformly at rate required with a mechanical spreader. Lime application shall be included in the schedule for approval.

207.3.03G Seeding

Plant grass seed only at times when local weather and other conditions are favorable to the preparation of the soil and to the germination and growth of grass seed. Sow grassed areas evenly with a mechanical spreader at a rate of one pound per 300 square feet, roll with cultipacker to cover seed, and water with fine spray. Method of seeding may be varied, as approved, however, responsibility to establish a smooth, uniformly grassed area will not be waived.

207.3.03H Sodding

Before sod is laid, correct soft spots and irregularities in grade of prepared bed, as approved. Lay so that no voids occur and tamp or roll, brush, or rake screened topsoil with no limps or stones larger than ¾ inch over sodded area. Water sod thoroughly. Complete sod surface true to finished grade even and firm. On slopes steeper than 1 to 2, fasten sod with wooden pins 6 inches long driven through sod into soil flush with top of sod at approved intervals.

207.3.03I Mulching and Protection

Mulch all areas with a slope greater than 5 percent by spreading a uniform light cover of straw mulch over the seeded area at a rate of 1 ½ tons per acre.

Mulch all areas with a slope steeper than 20 percent by placing fiber mulch in strips paralleling the slope to completely cover newly seeded area. Pin mulch to ground with 4 inch long wire staples at 5 foot intervals immediately after seeding.

Mulch all areas with a slope steeper than 25 percent with spray mulch applied at a rate of 15 gallons per 1,000 square feet after wetting the ground with water penetrating at least 1 inch deep.
Protect new seeded area from pedestrian traffic. Unless otherwise approved, erect a fence of 2 inch by 2 inch posts 4 feet high spaced 10 feet on center and strung with jute, hemp, or a single strand of No. 12 gauge wire marked with cloth strips at 3 foot intervals between posts.

207.3.03J Maintenance

Begin maintenance immediately after each portion of lawn is planted and continue for eight weeks after all lawn planting is completed.

Water to keep surface soil moist. Repair washed out areas by filling with topsoil, fertilizing, and seeding. Replace mulch on banks when washed or blown away. Repair fence, mow to 2 inches after grass reaches 3 inches in height, and mow frequently

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enough to keep grass from exceeding 2 ½ inches. Weed by local spot application of selective herbicide only after first planting season when grass is established.

207.3.03K Lawn Guarantee

If, at the end of the 8 week lawn maintenance period, a satisfactory stand of grass has not been produced, immediately renovate and reseed the unsatisfactory portions of lawn, or when approved, reseed at the beginning of the next planting season. If a satisfactory stand of grass develops by June 1 of the following year, the lawn will be accepted. If the lawn is not accepted, a complete replanting will be required during the ensuing planting season following the requirements specified hereinbefore.

A satisfactory stand is defined as a lawn or section of lawn that has:

1. No bare spots larger than 3 square feet.

2. Not more than 10 percent of total area with bare spots larger than 1 square foot.

3. Not more than 15 percent of total are with bare spots larger than 6 inches square.

207.3.03L Inspection for Acceptance

Submit a written notice eight weeks after the start of maintenance on the last section of completed lawn, and within 15 days of such written notice the Engineer will make an inspection of the lawn to determine if a satisfactory stand of grass has been produced. If a satisfactory lawn has not been established, another inspection will be made after written notice from the Contractor that the lawn is ready for inspection following the next growing season.

207.3.04 TREES, SHRUBS, AND GROUND COVER

207.3.04A Delivery, Preparation, and Storage

Dig plants designated as balled and burlapped in the Contract Documents with firm, natural balls of earth of diameter and depth sufficient to encompass the fibrous and feeding root system required for full recovery of plant. Firmly wrap balls with burlap and bind with twine, cord, or wire mesh. Where necessary to prevent breaking or cracking of ball during process of planting, or where the tree exceeds 4 inches in diameter, secure ball to a platform.

Dig bare root plants to remove earth with the least possible injury to fibrous root system. Cover roots with thick coating of mud by puddling or wrapping in wet straw, moss, or other suitable packing material immediately after digging for protection until delivery.

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Furnish container grown plants with self-established root systems sufficient to hold earth together after removal from container but not root-bound, grown for at least three months in container with inside diameter shown.

If plants are not in dormant state, spray with anti-desiccant to cover foliage as recommended by manufacturer, prior to digging plants. During shipment, protect plants with tarpaulin or other approved covering to prevent excessive drying from sun and wind.

Cover balls of balled and burlapped plants, and containers of container grown plants which cannot be planted immediately upon delivery with moist mulch to protect from drying. Plant or heel-in bare root plants immediately upon deliver. Water plants as necessary to prevent drying until planted. Do pruning only at time of planting.

Open and separate all bundles of heeled-in bare root plants before the roots are covered. Avoid leaving air pockets among roots.

207.3.04B Soil Conditioning

After the specified chemical analysis report for topsoil is received, prepare topsoil mixture for plant pits and beds by thoroughly mixing approved topsoil with soil conditioner materials, fertilizer, and lime. Thoroughly mix with rotary mixer or other approved method in following proportions:

Topsoil Classification by Clay Content	Required Mixture			Parts By Volume	
	Topsoil	Sand	Peat	Fertilizer*	Lime*
Clay 5-10 percent	4	0	1	(1/2) LB/CY	(1) LB/CY
Clay 10-15 percent	2	2	1	(1/2) LB/CY	(1) LB/CY
Clay 15-25 percent	2	4	1 ½	(1/2) LB/CY	(1) LB/CY

*Adjust in accordance with soil test chemical analysis report.

Store and protect topsoil mixture and other materials at designated area of the site. Protect topsoil mixture from excessive leaching by covering with tarpaulin if stored for more than six weeks.

207.3.04C Planting Procedures

Within 20 calendar days after the date specified for the commencement of work, submit time schedule for approval indicating dates for commencement and completion of the following operations:

1. Tagging of plants in the nurseries
2. Survey and staking of plant locations
3. Delivery of topsoil and other materials

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4. Digging and preparation of plant pits and beds
5. Delivery of trees to the site
6. Delivery of other plants to the site
7. Planting of trees
8. Planting of other plants
9. Guying, staking, and mulching
10. Completion of work for start of guarantee period

At least 20 days before start of the guarantee period, submit a schedule of proposed maintenance operations indicating the number of man-hours contemplated for each operation by season during autumn, winter, spring, and summer.

Within three weeks of the award of Contract, begin to prepare topsoil for plant pits. Thereafter conduct planting operations under favorable weather conditions during next season or seasons which are locally normal for such work.

Locate new planting where shown, except make approved adjustments where obstructions below ground are encountered or where changes have been made in the construction. Place no planting, except ground cover, closer that 18 inches to pavements and structures. Dig plant pits and have soil mixture for planting ready before plants are delivered. Excavate circular pits with vertical sides a minimum of 1 foot greater than the diameter of the ball. For trees, shrubs, and vines excavate pits to depth sufficient to accommodate ball or roots when plant is set to finished grade. Place 3 inches of compacted soil mixture in the bottom of pit. Set plants upright and face as approved to give the best appearance or relationship to adjacent structures. Do not pull burlap from under balls. Remove wire and surplus binding from top and sides of balls. Spread roots in normal position. But all broken or frayed roots off cleanly. Place prepared soil mixture and compact carefully to avoid injury to roots and to fill voids. When hole is nearly filled, add water as necessary and allow to soak away. Fill hole to finished grade and form shallow saucer around plant by placing ridge of topsoil around edge of pit 2 feet greater than diameter of ball. After ground settles, fill with additional soil to level of finished grade.

Plant trees before surrounding smaller plants and covers are placed. Position trees as shown or, where spacing dimensions or locations are not clear, as approved.

Plant shrubs on centers as shown, with spacing adjusted if required to evenly fill bed using specified quantity of plants.

Plant hedges on centers as shown. Excavate trenches a minimum of 4 inches deeper and 12 inches wider than spread of roots or diameter of balls. Make adjustments to spacing if necessary to fill trench evenly with the quantity of plants shown.

Plant ground covers in beds having minimum 8 inch of prepared soil mixture. Treat ground cover beds after preparation for planting, but before any plants are installed within bed area, with soil sterilant to destroy weed seeds. Apply according to

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manufacturer's directions delaying planting for the recommended minimum period to allow dissipation of herbicide. Space plants as shown. Mulch and water immediately after planting.

Plant bulbs in ground cover beds to recommended depths for each bulb type as shown.

Provide trees and planting beds with 2 inch layer of organic mulch within two days after planting and keep at this depth throughout maintenance period. Cover beds with stone mulch where shown to a depth of 4 inches. Mulch to entirely cover area of saucer around each tree.

Use four guys equally spaced as shown for all trees greater than 4 inches in diameter.

Use three guys equally spaced as shown for all trees 4 inch in diameter or less.

Where shown, wrap trunks of trees spirally from ground line to height of second branches. Make all wrappings neat and snug and hold material in place by raffia cord at top and bottom.

207.3.04D Drainage of Pits and Beds

Furnish subsoil drainage where shown. Dig trenches with vertical sides and smooth bottoms a minimum of 12 inches wide and 6 inches below tree balls, or 18 inches below finished grade at highest end of drain. Bed drain tile firmly, lay true to grade with minimum slope of 0.008 feet per foot and connect to approved outlet or discharge at grade. Make joint gaps maximum on 1/8 inch and cover with fiberglass separator to prevent ingress of soil. Cover entire tile line with 4 inch layer of crushed stone. Cover crushed stone with fiberglass separator and backfill with well compacted soil.

207.3.04E Pruning and Repair

At completion of planting work, prune and repair injuries to all plants. Limit amount of pruning to minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots as a result of planting operations. Do not change natural habit or shape of plant. Make cuts flush, leaving no stubs. On all cuts over ¾ inch in diameter and bruises or scars on bark, trace the injured cambium back to living tissue and remove. Smooth and shape wounds so as not to retain water. Coat with approved tree wound paint.

207.3.04F Paving Tree Pits

Set paving material on 2 inch sand bed as shown. Fill joints with sand by sweeping sand over surface and watering to settle. Sand in finished joints shall be flush with surface of brick.

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207.3.04G Plant Guarantee

Guarantee all plants for a minimum of one year to be alive and in vigorous growing condition at the end of guarantee period. Guarantee period shall extend one year from date of Acceptance of Work as defined in Subsection 101.01. Remove unsatisfactory plants and replace with plants of the same kind, quality, and size as originally provided as specified. Guarantee all plant replacements to be alive and in vigorous growing condition one year after replacement. Bear all costs of replacement except for replacements resulting from removal, loss, or damage due to occupancy of project in any part, vandalism, or acts of neglect on part of others. Replace plants that die during a season unfavorable for planting, during the first month of the next favorable planting season.

207.3.04H Maintenance

Begin maintenance immediately after each plant is installed and continue to maintain until the end of the guarantee period defined hereinbefore.

Perform the following operations: Watering as often as required to maintain capillary water within 2 inches of the soil surface around plants, weeding of plant beds, planting saucers and plant pockets to keep free of weeds using approved selective herbicide according to the manufacturer's directions for use, and/or weeding by hand methods, mulching monthly to replenish mulch and keep at required 2 inch minimum depth, tightening and repairing guys to keep trees erect and supported without damage to bark, resetting plants to proper grades or upright position, restoration of planting saucers, seasonal spraying to control disease or insect pests that may impair plant vigor.

Replace plants required by the plant guarantee on a regular monthly basis, except during the months of December, January, and February.

207.3.04I Final Acceptance

Submit notice in writing within 20 days of the date for final inspection at the end of the maintenance period and an inspection will be arranged within 15 days of this date. Final acceptance will be made provided the terms of the plant guarantee have been met and the project site is in the condition specified in MAINTENANCE, herein.

207.3.05 IRRIGATION SYSTEMS

207.3.05A General

Install components of the irrigation system as shown and as recommended by the equipment manufacturers. All sprinkler runouts shall be evenly graded to the drain points shown. Piping beneath paved areas shall have a minimum cover of 30 inches. Construct irrigation system in areas to receive topsoil after topsoil is spread, compacted, and rough graded. Steel pipe or copper tubing may be bedded using excavated

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material. Bed PVC pipe in sand, as shown and backfill to a minimum of 2 inches above the pipe with sand. Determine the final number and location of sprinkler heads after grading is complete, to provide complete coverage of all sprinkled areas. Flush out system thoroughly before installing sprinkler heads. Adjust flow on each head for proper coverage.

207.3.05C Copper Tubing

Cut tubing square and remove burrs. Clean both inside of fittings and outside of tubing with steel wool and muriatic acid before sweating. Take care to prevent annealing of fittings and hard-drawn tubing when making connections. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted.

207.3.05D PVC Pipe

Cut, make up, and install PVC pipe in accordance with the manufacturer's recommendations, as approved. Lay PVC pipe using the practice of snaking from one side of the trench to the other, one cycle per 40 feet or less. Use strap wrenches for tightening threaded plastic joints. Take care not to over tighten fittings. Do not lay PVC pipe when the temperature is below zero degrees F. Take precautions recommended by the manufacturer when the temperature is below 40 degrees F. Sprinklers and valves shall be installed in accordance with the manufacturer's recommendations, as approved.

207.4.00 MEASUREMENT AND PAYMENT

207.4.01 UNIT PRICE BASIS

When so listed in the Proposal, payment for the landscaping items listed will be made on a unit price basis for the number of items actually placed and accepted.

207.4.02 LUMP SUM BASIS

When so listed in the Proposal, measurement and payment will be made at the Contract lump sum pay item for landscaping, complete.

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208 Restoration and Cleanup

208.1.00 DESCRIPTION

This Section covers the work necessary to restore and clean up the site, and remove all construction equipment, refuse and unused materials of any kind resulting from project activities.

Additional requirements pertaining to site restoration and cleanup are contained in the ***GENERAL REQUIREMENTS***, Subsection 105.18.

Lawns, planting, mulching and topsoil shall conform to the requirements of ***Section 207 LANDSCAPING***.

208.2.00 MATERIALS

Provide all materials required to accomplish the work as specified.

208.3.00 CONSTRUCTION

208.3.01 SURFACE DRESSING

Slopes, sidewalk areas, planting areas, and roadway shall be smoothed and dressed to the required cross section and grade by means of a grading machine insofar as it is possible to do without damaging the work or existing improvements, trees, and shrubs. Supplement machine dressing by hand work as directed.

Upon completion of the cleaning and dressing, the project shall appear uniform in all respects. Grade all areas true to line and grade as shown and as approved. Where the existing planting is below sidewalk and curb, fill and dress the area to the walk regardless of limits shown. Wherever fill material is required in the planting area, make finish surface high enough to allow for final settlement.

208.3.02 REMOVAL OF MATERIALS

Remove and dispose of all excavated or construction materials, equipment, and trash of all kinds resulting from the work. Where brush and trees beyond the limits of the project have been disturbed, remove and dispose of or restore same as directed, at no expense to the Owner.

208.3.03 CLEANING DRAINS

Clean all drainage facilities such as inlets, catch basins, culverts, and open ditches of all excess material or debris which is the result of the work, as approved.

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208.3.04 CLEANING PAVED SURFACES AND APPURTENANCES

Clean all pavement surfaces, whether new or existing within the limits of the project. Clean existing improvements such as curbs, gutters, walls, sidewalks, castings for manholes, monuments, water gates, lamp poles, vaults, signs, and other similar installations as approved. Flush the street with a pressure type flusher as approved. Hand broom or flush all sidewalks as directed.

208.3.05 RESTORING PLANTED AREA

Hand rake and drag all former grassed and/or planted areas leaving disturbed areas free from rocks, gravel, clay, or any other foreign material and ready, in all respect, for seeding. The finished surface shall conform to the original surface, be free-draining and free from holes, rough spots, or other surface features detrimental to a seeded area.

208.3.06 RESTORING MOBILIZATION, BORROW, AND DISPOSAL AREAS

Clean all properties which were disturbed during construction of the project. Dispose of all uprooted stumps, felled trees, brush, excess excavation, rock, discarded materials, rubbish, and debris. Remove all plant, equipment, tools, and supplies and put the property occupied in a neat, clean, and orderly condition, in equal or better condition to that existing before move in.

208.3.07 REMOVAL OF SIGNS

Do not remove warning, regulatory, guide, or project signs prior to formal acceptance, except as directed.

208.3.08 RESTORING CURBS, SIDEWALKS, AND DRIVEWAYS

Repair or replace all curbs, sidewalks, driveways, and other structures damaged during construction of the work.

208.4.00 MEASUREMENT AND PAYMENT

208.4.01 LUMP SUM BASIS

When listed in the Proposal as a separate pay item, payment for restoration and cleanup will be made on a lump sum basis.

208.4.02 INCIDENTAL BASIS

When neither specified nor shown in the Proposal for separate payment, all restoration and cleanup will be considered incidental work for which no separate payment will be made.

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209 Mailbox Relocation

209.1.00 DESCRIPTION

This work shall consist of removing, maintaining in temporary locations during construction, and reinstalling in permanent locations, all mailboxes affected by construction work in accordance with these specifications and in conformity with the plans.

209.2.00 MATERIALS

209.2.01 CONCRETE

Concrete in collars shall be either a commercially mixed or field mixed concrete consisting of clean rock or gravel, sand, water, and 470 pounds (5 sacks) of Portland Cement per cubic yard.

209.2.02 REINFORCEMENT

Reinforcement in collars shall conform to the requirements of Section 603.

209.2.03 TUBE FRAME

The tube support frame shall conform to:

1. The requirements of ASTM A 500 Grade B and shall be galvanized in conformance to ASTM A 386, Class B-1 or;

2. The tensile requirements of ASTM A 53 Grade B and shall be galvanized with a minimum 0.9 ounce per square foot coating as measured by ASTM A 90 on the exterior surface followed by a chromate conversion coating and a cross link polyurethane acrylic coating. A zinc base corrosive resistant interior coating shall also be applied, or;

3. The equivalent.

209.2.04 MOUNTING BRACKET

The mounting bracket shall be of the design shown on the plans or an approved equal.

209.2.05 GALVANIZING

The mounting brackets, angles, adapter plates, and hardware shall be galvanized in conformance to AASHTO M 323.

Any damage to galvanized surfaces such as the cut end of the tube support frame, drill holes, and elsewhere shall be repaired by painting with one coat of a Zinc dust-Zinc Oxide Primer.

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209.2.06 MOUNTING SOCKET

The post mounting socket shall be the Flush V-Wing Socket manufactured by Foresight Industries of Cheyenne, Wyoming, or approved equal.

209.2.07 MAILBOX

Mailboxes will be furnished by others.

209.3.00 CONSTRUCTION

Beginning at the start of construction, all mailboxes affected by the work shall be protected and maintained at locations accessible to the delivery agent and as handy as possible to the person or persons being served. This may require removing and relocating the mailboxes more than once to maintain service throughout construction. When construction is completed the mailboxes shall be reinstalled on new supports in their permanent locations in conformance to the details shown on Oregon State Department of Transportation Standard Drawing No. 2136. The mounting brackets furnished shall be of the proper size to fit each existing mailbox.

When multiple supports are furnished for fewer than five mailboxes, Contractor shall furnish and mount on the support additional Size 1 mounting brackets for the empty spaces.

If the original (prior to construction) support for the mailbox is something that the Property Owner desires to retain, it shall be placed by the Contractor on the Owner's property adjacent to the work. Otherwise, the original mailbox support shall be disposed of by the Contractor.

209.4.00 MEASUREMENT AND PAYMENT

The quantities to be paid for will be the actual number of each kind of mailbox supports and the number of concrete collars, regardless of size, installed in permanent locations as specified. The accepted quantities will be paid for at the Contract unit price per each for the following pay items:

1. Single mailbox supports
2. Multiple mailbox support
3. Mailbox concrete collars

Payment when made as above set forth, will be complete compensation for all labor, materials, equipment, tools, and incidentals involved in removing existing mailbox supports, providing temporary installations as necessary, installing new supports, with either 2 foot, 0 inch or 2 foot 6 inch angle legs as required, in permanent locations and concrete collars where required and installing Owner-furnished mailboxes as specified.

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Division 3—Streets

301 Subgrade

301.1.00 DESCRIPTION

This Section covers work necessary for preparation of the subgrade, complete. See also ***Section 203*** for ***Clearing and Grubbing*** and ***Section 204*** for ***Excavation, Embankment, Bedding, and Backfill***.

Subgrade is defined as the area of new or existing roads, streets, alleys, driveways, sidewalks, or other public places upon which additional materials are to be placed as a part of work covered in other Sections or by future Work. Where applicable, subgrade may be considered to extend over the full width of the specified base course. Subgrade is classified as untreated or treated.

301.1.01 UNTREATED SUBGRADE

The uppermost material placed in embankments or unmoved from cuts in the normal grading of the roadbed and which is brought to true line and grade, shaped and compacted as necessary to provide a foundation for the pavement structure.

301.1.02 TREATED SUBGRADE

Subgrade which is improved by the addition of stabilizers and prepared as in Untreated Subgrade.

301.2.00 MATERIALS

301.2.01 SOIL STABILIZING MATERIALS

Soil stabilizing materials shall conform to the following requirements:

Material	Type	Grade
Granular Quicklime (CaO)	AASHTO T 27 and T 219 for grading and hydroxide content, with minimum 85 percent Calcium Hydroxide	100 percent passing 3/8 inch sieve, maximum 25 percent passing 100 sieve
Calcium Chloride	AASHTO M 144, sample and testing in accordance with AASHTO T 143	-
Sodium Chloride	AASHTO M 143	-
Portland Cement	AASHTO M 85	Conform to Portland Cement in Section 205

Storage of materials shall conform to ***Storage and Protection of Materials*** in ***GENERAL REQUIREMENTS***.

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301.2.02 WATER

Conform to the requirements in ***Subsection 205.2.11 Water***.

301.3.00 CONSTRUCTION

301.3.01 PREPARATION

In advance of setting line and grade, clear and dispose of brush, weeds, vegetation, grass, and debris off the subgrade. Drain all depressions or ruts which contain water. Blade and drag subgrade to remove irregularities and secure a uniform surface.

Complete all underground work contemplated in the area of the subgrade including backfill before subgrade work is started. This requirement includes work on the Contract, work to be performed by the Owner, or by others.

301.3.02 UNTREATED SUBGRADE

When excavating; shape the subgrade to line, grade, and cross section. When filling and/or grubbing; compact the fill material to the existing depth of grubbing or to a minimum of 8 inches and to not less than 95 percent of maximum density as specified in Subsection 303.3.04. Compact the subgrade to the full width of the cut or of the subgrade level on embankment.

Subgrade areas which cannot be compacted to specified density, but which in the judgment of the Engineer otherwise meets the requirements herein, may at the option of the Contractor, be removed and aerated or stabilized with an approved soil stabilizing materials.

When in the opinion of the Engineer, unsuitable material or other conditions are discovered which render the subgrade, unable to be compacted to the specified density, then the Engineer may order the Contractor to use treated subgrade as noted in Subsection 301.3.03. All such work ordered by the Engineer will be paid for as Extra Work as provided in Subsection 109.05 unless the unsuitable area was caused by the negligence of the Contractor in his/her operations. In such case all such costs shall be borne by the Contractor, at no additional expense to the Owner.

301.3.03 TREATED SUBGRADE

301.3.03A General

At Contractor's option, the subgrade material may be moistened and/or loosened by scarifying to the depth to be treated prior to application of the stabilizing materials, as approved.

Dry and reduce cemented soil clods to moisture content and size specified. Shape and size the subgrade material blanket to the size that can pass through the mixing machine. Apply stabilizing materials only when temperature is above freezing, or when wind and

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other weather conditions are not detrimental to the work or to the public, as approved. Take all precautions necessary to prevent injury to person, livestock, or property. Any material which is spilled or deposited at places other than on areas designated to be treated must be immediately picked up, buried, or made harmless.

301.3.03B Addition of Stabilizing Material

Apply stabilizer at a uniform rate as specified. Use equipment and methods that will ensure the uniformity of stabilizer distribution. Immediately discontinue use of any equipment or method which results in excessive loss or displacement of the stabilizer, as directed. Replace stabilizer lost, displaced by blowing, washing, or misplaced by other causes before it is mixed with or incorporated in the soil, at no expense to Owner. The use of blade graders to distribute lime and cement will not be permitted. No equipment except that used for watering and for applying and mixing the stabilizer will be permitted to pass over spread stabilizer until after it is mixed into the soil. If necessary, add water during mixing operations to provide an optimum moisture content.

Apply at a uniform rate, as specified, calcium chloride or sodium chloride or Portland Cement to the scarified subgrade in the same manner as for lime.

301.3.03C Mixing

Spread soil stabilizing material on a treated subgrade with approved equipment which uniformly distributes the required amount of material for the full width of the prepared subgrade. Continue mixing or remixing operations until the mixture is uniform, free of streaks or pockets of soil stabilizing material, and all material other than stones will pass a 2 inch sieve and at least 60 percent of which will pass a No. 4 sieve.

The stabilizing material content of samples taken periodically from the spread mixtures shall be within 1 percentage point of the content specified or approved.

301.3.03D Compaction

Immediately after mixing of a treated subgrade, spread the mixture to specified line, grade, and cross section and compact entire depth of the mixture to not less than 95 percent of maximum density as determined by ASTM D 698. Testing methods for density requirements shall be determined by AASHTO T 191, T 205, or T 238.

Compact and finish the cement treated surface within five hours after cement is applied and compact and finish other treated surfaces within 12 hours after compaction begins. If not compacted and finished within this time period, loosen the mixture and add stabilizing material and water as directed, remix, relay, and compact, all at no additional expense to Owner. During compaction, maintain surface of the mixture at proper grade and cross section and lightly water to retain optimum moisture content.

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Accomplish final finishing by rolling, accompanied by light watering, and reshaping to provide a surface free of hairline cracking.

301.3.04 TOLERANCES

Rework areas found to be deficient in thickness by more than 0.04 foot or excessive in thickness by more than 0.08 foot, except that fresh stabilizing material shall be added in an amount equal to one-half of the original amount; as specified. Accomplish all reworking at no expense to Owner.

The finished surface of treated and untreated subgrade shall not vary more than 0.04 foot from established grade and cross section at any point. The finished surface, when tested with a 10-foot straightedge, shall not vary from the testing edge by more than 0.08 foot at any point.

301.3.05 CURING TREATED SUBGRADE

Limit traffic over treated subgrade to wheel loads which do not cause any damage to the subgrade and which do not visibly deflect, ravel, or wear the surface. Keep the finished surface moist and protected from rutting, spalling, displacement, and disfiguration for a period of seven days or until a subsequent course of planned construction which will prevent drying of the mixture by evaporation or absorption is placed thereon.

301.4.00 MEASUREMENT AND PAYMENT

301.4.01 MEASUREMENT

301.4.01A Incidental Work

No measurement will be made for work involved in clearing the subgrade of vegetation and other debris, draining water from the subgrade, smoothing the subgrade in preparation for staking, or blading, shaping, and compacting the subgrade including roadbed materials to a depth of 8 inches below the subgrade, to final line, grade, and cross section. All work involved in these processes will be considered incidental to and included in the various other items of work in the Proposal.

301.4.01B Work Paid in Other Sections

Excess materials which cannot be disposed of by drifting into low spots during blading and shaping operations will be measured and paid for as provided in ***Section 204 Excavation, Embankment, Bedding, and Backfill***.

Additional materials required for completing the subgrade will be measured and paid for at the unit price for the type of material furnished as provided in ***Section 204 Excavation, Embankment, Bedding, and Backfill***.
Excavation of soft, spongy, or yielding spots, when directed, will be measured and paid for as provide in ***Section 204 Excavation, Embankment, Bedding, and Backfill***.

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Suitable backfill material, when furnished and placed as directed, will be measured and pad at the nit price for the type of material involved as provided in ***Section 204 Excavation, Embankment, Bedding, and Backfill***.

Water used in the work will be measured and paid for as provided in ***Section 302 Watering***.

301.4.01C Untreated Subgrade

No measurement and payment will be made for preparation of untreated subgrade unless otherwise provided.

301.4.01D Soil Stabilizing Materials

Quantities for soil stabilizing materials will be measured by the ton, dry weight, to the nearest 0.01 ton, for the materials incorporated in the work at the rate and in the quantity specified or directed. Measurement and payment of stabilizing materials will not include any which are lost, displaced, used in reworking, used in restoration work, or used contrary to direction. Packaged materials will be accepted at the net weight shown by the manufacturer, subject to periodic verification and approval. Provide a certificate with each shipment together with a certified copy of the weight of each delivery.

301.4.01E Treated Subgrade

Quantities for treated subgrade will be measured by the square yard, to the nearest square yard, of the finished surface of the treatment within the neat lines shown or established.

301.4.02 PAYMENT

301.4.02A Soil Stabilizing Materials

Payment for soil stabilizing materials will be made on a ton basis for the type or types specified and used in the work.

301.4.02B Treated Subgrade

Payment for treated subgrade will be made on a square yard basis for the type or types specified and used in the work.

NEWER VERSION PUBLISHED

302 Watering

302.1.00 DESCRIPTION

This Section covers work necessary to furnish and apply water or combinations of water and compatible binders or additives for roadway excavations, embankments, subgrades, road beds, backfills, sub bases, bases and surfacings, and water for the alleviation or prevention of dust within the project limits, as directed.

Excluded from this Section is watering used in connection with Portland Cement concrete construction, wetting foundations preparatory to placing concrete thereon, curing concrete, and watering which is specified as incidental.

302.2.00 MATERIALS

302.2.01WATER

Water shall be free of silts and other deleterious matter. Make all necessary arrangements and pay all costs for obtaining water. Maintain an adequate supply of water at all times, as approved.

302.2.02 BINDERS AND ADDITIVES

When shown, specified, or directed, use a mixture of water and an approved compatible binder or additive material.

302.3.00 CONSTRUCTION

Watering shall at all times be under the direction and subject to control of the Engineer, as approved.

Water by means of tank trucks equipped with spray bars, by hose and nozzle, or by other approved equal means which ensure uniform and controlled application. The use of splash boards will not be permitted without prior approval.

Perform watering at any hour of the day and on any day of the week necessary. Sprinkle directly on the road only when loss by evaporation is at a minimum, unless otherwise directed.

When compatible binder material or additive is combined with water in the work, mix in conformance with the manufacturer's directions, as specified or as directed.

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302.4.00 MEASUREMENT AND PAYMENT

302.4.01 MEASUREMENT

302.4.01A Water by Volume

Quantities of water determined by volume will be measured in units of 1,000 gallons (M-gals) to the nearest 0.1 unit, exclusive of binders and additives mixed therewith. Measurement will be made in tanks or tank trucks of predetermined and approved capacities or by approved meters provided by the Contractor. Measurement and payment will be made only for quantities as are approved for use in the work.

302.4.01B Water by Weight

Quantities of water determined by weight will be measured in tons to the nearest 0.1 ton. Measurement will be the actual tons used based on weight tickets from State certified scales presented for approval on the day the water is delivered. No measurement or payment will be allowed on tickets not so delivered and approved.

302.4.01C Binders and Additives

Quantities of compatible binders or additives combined with water for watering purposes will be determined separately from the water and will be measured as specified and shown on the Proposal.

302.4.02 PAYMENT

302.4.02A Water on Incidental Basis

When neither specified nor shown in the Proposal for separate payment, all water will be considered incidental to the other items of work and separate payment will be made.

302.4.02B Water by Volume

Payment for water will be made on a 1,000 gallon (M-gal) basis.

302.4.02C Water by Weight

Payment for water will be made on a ton basis.

302.4.02D Binders and Additives

Payment for compatible binders or additives combined with water for watering purposes will be paid for at the applicable Contract unit price as set forth in the Proposal. Payment shall constitute full compensation for the binder material or additive, for the combining of it with the water and for all extra costs involved in the use of the binder material or additive in the watering work.

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303 Aggregate Bases

303.1.00 DESCRIPTION

This Section covers work necessary to furnish and place one or more courses of aggregates and water, as sub base or base, on a prepared surface.

303.2.00 MATERIALS

Aggregates for aggregate base shall be crushed gravel or crushed rock, including sand.

303.2.01 AGGREGATE

Coarse and fine aggregates shall conform to requirements of ***Section 205 Materials*** and to additional requirements contained herein.

303.2.02 SAND EQUIVALENT

Base aggregates to be incorporated in the work shall have a sand equivalent of not less than 30 when tested in conformance with AASHTO T 176.

303.2.03 LIQUID LIMIT AND PLASTICITY

Base aggregate shall meet the requirement for Liquid Limit and Plasticity Index of ***Subsection 205.2.12C Fine Aggregate***.

303.2.04 GRADING REQUIREMENTS

The base aggregates shall be uniformly graded from coarse to fine and shall conform to one or another of the following grading requirements:

Separated Sizes					
Sieve Size Passing	**2 ½ " – 0**	**2" - 0**	**1 1/2" – 0**	**1" – 0**	**3/4" -0**
	Percentages (by weight)				
3"	100				
2 1/2"	95 – 100	100			
2"		95 – 100	100		
1 1/2"			95 – 100	100	
1 1/4"	55 – 75				
1"		55 – 75		90 – 100	100
3/4"			55 – 75		90 – 100
1/2"				55 – 75	
3/8"					55 – 75
*1/4"	30 – 45	30 – 45	35 – 50	40 – 55	40 – 60

*Of the fraction passing the ¼-inch sieve 40 percent to 60 percent shall pass the No. 10 sieve.

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For determination of sizes and grading conform to AASHTO T 27. For coarse aggregate base material used in the construction of the bottom course, use aggregate base of the designated size 1 ½ inch minus 0. For material used in construction of the top course base, wearing course, leveling course, shoulders, or stone foundation course, use the designated size ¾ inch minus 0.

303.2.05 ACCEPTANCE

Materials will be subject to acceptance as follows:

Construction Method	Time of Acceptance
Stationary plant mixed	Immediately following mixing
Travel plant mixed	After mixing and before laying
Road mixed	After mixing and before compacting

Acceptance will be based on periodic samples taken following mixing.

303.3.00 CONSTRUCTION

303.3.01 PREPARATION OF SUBGRADE

Ensure that all surfaces and materials on which subbase or base is to be constructed are firm and have been prepared as specified in the applicable portions of ***Section 301 Subgrade***.

303.3.02 MIXING

Mix to provide a homogeneous mixture of unsegregated and uniformly dispersed materials which will compact to not less than 95 percent maximum density as specified in Subsection 303.3.04. Add water during mixing in amount sufficient to provide optimum moisture content plus or minus two percentage points.

303.3.03 PLACING

303.3.03A Weather Limitations

When, in the judgment of the Engineer, the weather is such that satisfactory results cannot be secured, suspend operations. Place no surfacing materials in snow or on a soft, muddy, or frozen subgrade. Owner will not be liable for damages or claims of any kind or description by reason of operations suspended by Engineer.

303.3.03B Equipment

Furnish equipment that will provide for efficient and continuous operations insofar as practicable.
Aggregate bases shall be deposited on the roadbed at a uniform quantity per linear foot so that the contractor will not resort to spotting, picking up, or otherwise shifting of

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aggregate base material. Segregation of aggregates shall be avoided and the material as spread shall be free of pockets of coarse or fine material.

Spreading equipment—Spreading equipment shall have an adjustable screed or strike-off assembly and it may have a receiving, mixing, and distribution system. It may be a complete and integral unit, self-propelled and powered; a crawler-track or wheeled type tractor intimately combined with a receiving, mixing, spreading, and screeding unit attached thereto; or a heavy-duty self-propelled grader, oaf an approved type, equipped with at least an 8 foot blade. Equipment shall be capable of spreading and striking off material to the designated line, grade, and transverse slope with surface texture of uniform appearance without excessive segregation or fracture of material.

Spreading equipment may be provided with an automatic control system if Contractor so elects.

303.3.03C Thickness of Lifts

If the required compacted depth of the subbase or base course exceeds 8 inches, construct in two or more layers of approximately equal thickness. Maximum compacted thickness of any one layer shall not exceed 8 inches. Place each layer in spreads as wide as practicable and to full width of the course before a succeeding layer is placed.

303.3.04 COMPACTION

Each layer of base material shall be compacted to not less than 100 percent of maximum density as determined by ASTM D 698. Testing methods for density requirements shall be determined by AASHTO T191, T205, or T238.

303.3.05 SURFACE FINISH

Surface of the subbase shall parallel the established cross section and grade for the finished surface within 0.05 foot. The finished surface of base, when tested with a 10 foot straight edge shall not vary from the testing edge by more than 0.04 foot at any point.

303.4.00 MEASUREMENT AND PAYMENT

303.4.01 MEASUREMENT

303.4.01A Square Yard Basis

Measurement of aggregate base will be made on a square yard basis. Measurement will be made of width and length of each separately constructed strip of aggregate base incorporated in the work and accepted, wherein width is the design width or edge-to-edge width of aggregate base, whichever is the lesser, and length is from end to end along the center of the strip. Measurement shall be on the surface of the aggregate

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base to the nearest 0.1 foot and the square yardage shall be to the nearest full square yard

Extra thickness of aggregate base, when directed by the Engineer, will be measured by conversion on a proportionate volume basis to an equivalent number of square yards of specified standard thickness base.

303.4.01B Cubic Yard in Place Basis

Measurement of aggregate base will be made on a cubic yard in place basis by taking depth tests or cores, as directed, at the rate of one depth test for each 300 square yards of base course, or by means of average end areas on the complete work computed from elevations to the nearest 0.01 foot. On individual depth measurements, thicknesses more than ½ inch in excess of that shown shall be considered as specified thickness, plus ½ inch in computing the yardage for payment.

303.4.01C Ton Basis

Measurement will be made on a ton basis for the number of tons of aggregate base, as weighed on approved and tested scales. Give trip tickets to the Engineer for his/her signature as the material is delivered. Each trip ticket shall show the date and time of delivery, truck number or driver's name, net weight of material, and will be considered valid delivery receipts only when signed by the Engineer.

303.4.02 PAYMENT

Payment will be made on Square Yard, Cubic Yard, or Ton basis as shown on the Proposal.

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304 Asphalt Treated Bases

304.1.00 DESCRIPTION

This Section covers work necessary for the construction of all types of bituminous bases upon prepared foundations and subgrades.

304.1.01 COLD MIX

Cold mix asphalt treated base (ATB) is defined as a mixture of liquid asphalt or asphalt emulsion, well graded, high quality aggregate, additives as required, mixed into a uniform coated mass, constructed on a prepared foundation, and compacted to a specified density.

304.1.02 HOT MIX

Hot mix asphalt treated base (ATB) is defined as a mixture of asphalt cement, well graded, high quality aggregate, mineral filler and additives as required, heated and plant mixed into a uniformly coated mass, hot laid on a prepared foundation, and compacted to specified density.

304.2.00 MATERIALS

Aggregate and asphalt will be subject to acceptance prior to mixing. Mixtures will be subject to final acceptance after blending and mixing either at the plant for plant mixes or at the place of delivery for road mixes. Acceptance will be based on periodic sampling of the materials.

304.2.01 AGGREGATES

Aggregates shall conform to material requirement of ***Section 205 Materials***, with grading requirements conforming to ***Section 303 aggregate Bases*** or to the following gradations:

Sieve Size Passing	**1 1/2" – 0**	**1" - 0**	**3/4" – 0**	**1/2" - 0**
	Percentages (by weight)			
1½"	100			
1"	70-90	100		
¾"	65-85		100	
½"	50-80	45-75	60-80	100
⅜"				90-100
¼"				51-71
No. 4	5-30	5-30	5-35	
No. 10	0-6	0-6	0-10	5-15
No. 40				
No. 200	0-2	0-2	0-2	2-6

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Sixty-five percent of the material retained on the ¼ inch screen shall have at least one fractured face.

304.2.02 ASPHALT

Conform to requirements of ***Section 205 Materials***.

304.2.03 MIX FORMULAS AND TOLERANCES

At least 30 days prior to producing any ATB, furnish representative samples of materials to be used in the mix for use in determination of the proportions of aggregate asphalt and any additives, if required. From this, the Engineer will establish a job mix formula comprising a single percentage of aggregate and asphalt and water or other additives if required. This job mix formula shall be held uniform within a tolerance of plus or minus 0.5 percentage point.

Should a change in source of material be made or other conditions arise which the Engineer determines is justified; he/she may establish a new job mix formula.

304.3.00 CONSTRUCTION

304.3.01 PREPARATION OF SUBGRADE

Preparation of subgrade shall conform to the applicable requirement of ***Section 301 SUBGRADE***.

304.3.02 MIXING

Mix asphalt treated base in an approved stationary or travel plant or road mixing machine. The plant machine shall be equipped with controls to accurately measure and monitor various components of the mix and shall produce a uniform homogeneous mixture. Stationary continuous mixing plants shall be fitted with a hopper or other suitable holding device at the discharge end of the pug mill. The mix so produced shall not exhibit excessive loss or runoff of asphalt or water, shall remain workable during the laydown operation without tearing or dragging under the screed, and shall have a mass viscosity sufficiently low to permit compaction to the required density.

304.3.03 WEATHER

Weather conditions under which hot mix ATB may be constructed shall conform to the requirements for placing in ***Section 306 ASPHALT CONCRETE PAVEMENT***.

Place cold mix ATB only when there is no standing water on the surface, when the air temperature is above 50 degrees Fahrenheit, when not raining, and when the Engineer determines that weather conditions are proper for construction and no rain or low temperatures are forecast for the paving period.

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304.3.04 PLACING

Placing shall conform to the applicable requirements of ***Section 303 Aggregate Bases***. Use motor graders only when permitted, and then only where conditions preclude the use of other approved types of spreading equipment.

304.3.05 COMPACTION

Conform to requirements for compaction in ***Section 306 Asphalt Concrete Pavement***, except as follows:

Use static or vibratory steel wheel rollers for breakdown rolling of open graded ATB. As soon as practicable after breakdown rolling, choke material at the rate of six to nine pounds per square yard may be applied to the surface to prevent tire pick up if necessary.

304.3.06 DENSITY

Density requirements for dense graded hot or cold ATB shall conform to the applicable requirements of ***Section 306 Asphalt Concrete Pavement***. Achieve maximum density of open graded mixes by rolling until all roller marks disappear.

304.3.07 TRANSVERSE JOINTS

Placing of a course or strip of ATB shall be as nearly continuous as practicable. Construct transverse joints carefully with vertical faces and thoroughly compact to provide a smooth riding surface.

When the end of a course or strip of ATB is to be temporarily subjected to traffic, the end shall be left on a bevel of approximately 20:1 (horizontal to vertical), being later cut back to a vertical edge to provide a fresh surface when construction resumes.

304.3.08 SURFACE FINISH

Final surface course of the asphalt treated base section, whether constructed in one or more lifts, shall not vary more than 0.05 foot from Plan elevation at any point. Final surface shall not deviate at any point more than 0.03 foot from the bottom of a 10 foot straightedge 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 to satisfy the requirement and shall be done at no expense to Owner.

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304.4.00 MEASUREMENT AND PAYMENT

304.4.01 MEASUREMENT

304.4.01A Asphalt Treated Base Mixture and Bituminous Cement

When the pay items in the Proposal so indicate, the quantity of ATB mixture, and the quantity of bituminous cement contained in the mixture will each be separately measured for payment as follows:

1. The quantity of ATB used in the accepted work as specified will be measured on a ton basis. Tonnage shall be the weight used in the accepted work and no deduction will be made for weight of the bituminous material in the mixture. Measurement will be made on the number of tons of mixture, as weighed on approved and tested scales. Give trip tickets to Engineer for his/her signature as the material is delivered. Each trip ticket shall show date and time of deliver, truck number or driver's name, net weight of material, and will be considered as valid delivery receipts only when signed by the Engineer.

2. The quantity of each kind of bituminous cement used in the accepted work as specified will be measured on a ton basis. For volume-temperature corrections, see ***Subsection 109.01 Measurement of Quantities***.

304.4.01B Square Yard Basis

Measurement will be made on a square yard basis. Measurement will be made of the width and length of each separately constructed strip of ATB wherein the width is design width or edge-to edge width of ATB whichever is the lesser and length is from end to end along the center of the strip. Measurement will be on the surface of the ATB to the nearest 0.1 foot and the square yardage will be to the nearest full square yard.

Extra thickness of ATB, if directed by the Engineer, will be measured by conversion on a proportionate volume basis to an equivalent number of square yards of specified standard thickness ATB.

304.4.02 PAYMENT

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract.

Payment Item	Unit of Measure
1. Asphalt treated Base (specify thickness)	Per S.Y. or Ton
2. Bituminous Cement in Asphalt Concrete	Per Ton

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305 Surface Treatments

305.1.00 DESCRIPTION

This Section covers work necessary to construct asphalt and mineral aggregate surfaces by treating an existing crushed rock, screened gravel, or bituminous roadway surface to obtain a surface thoroughly cemented to the roadway to the contour and section shown and ensuring good riding and nonskid qualities.

305.1.01 SEAL COAT

Seal Coat is defined as one or more applications of bituminous binder, either with or without a cover of aggregate.

305.1.02 PENETRATION MACADAM

Penetration Macadam is defined as asphalt penetration of graded aggregates with bituminous material applied in successive spreads by the penetration method to bind the aggregates together into a firm surfacing.

305.2.00 MATERIALS

305.2.01 ASPHALT

Asphalt materials incorporated in the mix shall conform to requirements of ***Section 205 Materials***.

305.2.02 AGGREGATES

Aggregates shall conform to requirements of ***Section 205 Materials*** and to additional requirements contained herein.

Mineral aggregate shall have a record of approved performance, or be subject to the Stripping Test for Bituminous Aggregate Mixtures, AASHTO T 182, using a sample of asphalt to be used in the major portion of the work. When so tested the retention of asphalt shall be above 95 percent. Mineral aggregate failing to conform to this requirement will not be approved for use in the work except if approved anti-stripping additives or other approved measures correct the deficiency.

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The grading of the several designated sizes that may be required in the work shall be as follows:

Sieve Size Passing	Designated Sizes					
	2½"–1¼"	1½"–¾"	1¼"–¾"	¾"–½"	½"–¼"	¼"–No. 10
	Percentages (by weight)					
3"	100					
2 1/2"	95-100					
2"		100				
1 1/2"		95-100	100			
1 1/4"	0-10		90-100			
1"				100		
3/4"	0-1	0-15	0-15	90-100	100	
1/2"		0-2	0-2	0-15	85-100	100
1/4"				0-3	0-15	85-100
No. 10					0-4	0-15
No. 40						0-5

305.3.00 CONSTRUCTION

305.3.01 SEAL COAT

The rates of application for bituminous binders for the various types of seal coats shall be within the ranges specified in the following table. The exact rates will be as directed.

Rate of Application Per Square Yard			
Seal Coat Types	**Bituminous Size of Screenings**	**Screenings (pounds)**	**Binder (gallons)**
Fog			0.05 to 0.10
Fine	¼" to No. 10	12 to 16	0.15 to 0.30
Coarse	½"–No. 4	25 to 35	0.25 to 0.35
Double			
1st application	½"–No. 4	25 to 35	0.20 to 0.35
2nd application	¼"–No. 10	12 to 16	0.15 to 0.25

305.3.02 PENETRATION MACADAM

The order and number of spreads, designated sizes of aggregates, and rates of spreads of aggregate and bituminous material shall be as shown on the table in the OSHD Standard Drawings entitled Asphalt Penetration Macadam.

Rates of spreads and quantities of materials are subject to variance as directed to adjust for variable conditions encountered or experienced during construction. Also, recognize that the

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nature of the work calls for equipment in varying number and versatility and modification of procedures to some extent. Generally, the ratio of bituminous cement to aggregate shall be held closely constant to that specified.

305.3.03 PREPARATION OF BASE

Conform to the applicable requirements for preparation of bases in ***Section 306 Asphalt Concrete Pavement***.

305.3.04 PLACING

305.3.04A Weather and Seasonal Limitations

Do not place asphalt penetration macadam or seal coat on any wet surface, or when air temperature is below 60 degrees Fahrenheit, or when the Engineer determines that weather conditions are detrimental to proper construction. Normally, work shall be done between May 1 and September 15.

305.3.04B Equipment

The equipment to be used shall include approved power brooms, self-propelled aggregate spreaders, bituminous material distributor, and hauling vehicles, all of which shall be pneumatic tired. Provide equipment in such number and capacities that will provide coordinated and uniform progress.

Mechanical spreaders for spreading aggregate of less than 1 inch in maximum size shall be of a design which will place the larger fraction ahead of the finer fraction of the aggregate.

The bituminous material distributor shall provide controls for regulating and monitoring the spread of bituminous material at even heat on variable widths of surface up to 15 feet at rates from 0.05 to 2.0 gallons per square yard, with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.02 gallon per square yard. Distributors shall have a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

Use rollers of self-propelled pneumatic tire type capable of exerting a ground pressure of not less than 80 pounds per square inch of tire contact area. Steel wheel rollers shall be used only with prior approval.

305.3.04C Sequence of Operations

The order of the several spreads of aggregates and bituminous material shall be as directed. In construction of a seal coat, place spreads of aggregate while the immediately preceding spread of bituminous material is at or near its application temperature. Each spread of designated size aggregate shall be shaped and compacted

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at established line and grade just prior to being covered. Do not apply the seal coat spread of bituminous material and aggregate until the underlying spreads have been in place for at least three days and have become stabilized.

305.3.04D Application of Bituminous Material

Engineer may vary the amount of asphalt and aggregates to be applied as in his/her judgment will give the best results.

To ensure uniform distribution of asphalt, prior to beginning work, operate the distributor bar over a pit or vat. To avoid laps and ridges at transverse junctions of separate applications of asphalt, spread sufficient building paper over the treated surface to ensure that spray jets will be functioning normally when the untreated surface is reached. Omissions (skips) by the distributor must be immediately covered by hand patching with the same grade of asphalt.

Area covered by any one spread of asphalt shall be no more than can be covered with mineral aggregate within ten minutes from the time of application upon any part of the spread.

Spread asphalt toward the source of mineral aggregate to avoid injury to the freshly treated surface.

Before application to the roadway, heat asphalt materials to the temperatures directed, but within the applicable limits for material used, as shown in the following table:

Type and Grade Of Asphalt	**Spraying Temperature**	
	Minimum ° F:	**Maximum °F:**
Asphalt Cements:		
AR 1000	275	325
AR 2000	285	350
AR 4000	290	350
Liquid Asphalts:		
MC and RC 250	165	220
MC and RC 800	200	355
Emulsified Asphalts:		
CRS-1	75	130
CRS-2	100	160
CMS-2S	100	160
CMS-2	100	160
CMS-2h	100	160
CSS-1	75	130
CSS-1h	75	130

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Building paper shall be placed over the end area of previously placed spreads and the adjoining application shall start on the paper, after which the paper shall be removed. Rates of application shall not vary from prescribed rates by more than 10 percent. Protect structures and vegetation from being spattered, stained, or marred. Remove any stains and remedy disfigurements as approved. Use hand application or other approved means on areas inaccessible to the distributor.

305.3.04E Hauling and Spreading Aggregates

Do not operate hauling and spreading equipment on uncovered bituminous material. Hand spreading shall be done to correct deficiencies or on areas inaccessible to specified mechanical equipment. Hauling over aggregate-covered bituminous material shall be held to a practicable minimum until the surface has become firm. Perform hauling at moderate speeds on newly placed penetration macadam or seal coat materials to prevent loss of, or hazardous movement of, materials. Hauling shall be routed as uniformly as is practicable over the full width of material in place.

305.3.05 COMPACTION

Each spread of each designated size of aggregate shall be shaped and dry rolled until material is interlocked, firm, partially bound with underlying bituminous material, and does not creep or wave ahead of the roller. Begin rolling at the low side of the cross section and progress with passes parallel to roadway centerline, each pass overlapping the preceding pass by at least one-half the roller width. Places not accessible to rollers shall be tamped thoroughly with approved mechanical or hand tampers.

Irregularities in surface smoothness, uniformity of texture, segregations of materials, dirt pockets, spots of excess bituminous material, and other deficiencies and defects shall be corrected by removal, replacement, addition of material, repetition of construction operations, or other suitable means, as directed.

305.3.06 CURING AND MAINTENANCE

During the curing period when construction is open to traffic and for three days following completion of the final course, perform the following operations:

1. Blade or broom the course to correct bleeding of asphalt, to provide coverage with aggregates, to keep the surface free of gravel, traffic grooves, holes, and other deformations and to eliminate other defects that may appear.

2. Perform rolling and compacting of materials to maintain or restore firmness and stability to the materials.

3. Trim abutting shoulders. Remove materials which come into side ditches or on to curbs, sidewalks, or driveways and dispose of as approved.

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4. Perform above operations under traffic and at frequencies directed to develop and establish the course to uniform firmness and stability throughout.

305.3.07 REMOVAL OF EXCESS MATERIAL

Where excess rock has been applied, either remove it or drift it uniformly over the adjacent roadway be using an approved motor patrol grader equipped with a wire broom mold board. Hold this type of brooming to a minimum, and where necessary, perform it very carefully so as not to disturb the mat in any way. Correct thin or bare spots in the spread of cover stone by hand spreading or by use of a grader as described above. The cost associated with removal of excess material as described hereinabove will be considered incidental to other Contract items performed under this Section.

305.3.08 SURFACE TOLERANCE, PENETRATION MACADAM

The surface of the course, when finished and established, will be tested for trueness to specified grade and transverse slope at selected locations and shall not deviate at any point more than 0.03 foot from the bottom of a 10 foot straightedge.

305.4.00 MEASUREMENT AND PAYMENT

305.4.01 MEASUREMENT

305.4.01A Aggregate by the Cubic Yard

Measurement of aggregate will be made on a cubic yard basis for the materials in the hauling vehicle at points of deposit. See ***Subsection 109.01 Measurement of Quantities***.

305.4.01B Bituminous Cement

Measurement of bituminous cements will be made on a ton basis. See ***Subsection 109.01 Measurement of Quantities***.

Water added to emulsion will not be paid for as emulsified asphalt. Pay quantity shall be the amount of undiluted emulsion used.

305.4.01C Surface Treatment by the Square Yard

Measurement of surface treatment will be made on a square yard basis, complete in place as specified and accepted. Measurement will be made of width and length of each area completed, wherein width is the edge-to-edge width of the surface treatment, and length is from end-to-end of the area along the centerline. Measurement shall be on the surface to the nearest 0.1 foot and square yardage shall be to the nearest full square yard.

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305.4.02 PAYMENT

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract.

Payment Item	Unit of Measure
1. Asphalt in Seal Coat	Per Ton
2. Aggregate (gradation specified) in Seal Coat	Per C. Y.
3. Asphalt in Penetration Macadam	Per Ton
4. Aggregate (gradation specified) in Penetration Macadam	Per C. Y.
5. Seal Coat in Place	Per S.Y.
6. Asphalt Penetration Macadam in Place	Per S.Y.

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306 Asphalt Concrete Pavement

306.1.00 DESCRIPTION

This Section covers work necessary for the construction of hot mix asphalt pavements upon prepared foundations or base surfaces.

Hot mix asphalt concrete is defined as a mixture of asphalt cement; well graded, high quality aggregate; mineral filler and additives as required; heated and plant mixed into a uniformly coated mass, hot laid on a prepared foundation, and compacted to specified density.

306.2.00 MATERIALS

306.2.01 GENERAL

Asphalt and aggregate will be subject to approval preceding mixing. Plant mixed mixtures will be subject to final approval after blending and mixing, either at the plant or at the place of delivery prior to rolling. Approval will be based on periodic sampling of the materials.

306.2.02 ASPHALT

Asphalt materials incorporated in the mix shall conform to requirements of ***Section 205 Materials***.

306.2.03 AGGREGATES

Aggregates shall conform to requirements of ***Section 205 Materials*** and to additional requirements contained herein.

Grading of designated sizes of coarse aggregate shall be as follows:

Designated Sizes			
Sieve Size Passing	**¾" – ¼"**	**½" – ¼"**	**⅜" – ¼"**
	Percentages (by weight)		
1"	100		
¾"	900-100	100	
½"	60-75	85-100	100
⅜"			85-100
¼"	0-15	0-15	0-15

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Grading of the fine aggregate shall conform to the following:

Percentage passing 3/8 inch sieve	100
Percentage passing ¼ inch sieve	85-100

Of the fractions passing the ¼ inch sieve, the following percentages thereof shall pass the No. 10 sieve:

Class B Hot Mix	43-57 percent
Class C Hot Mix	43-57 percent
Class E Hot Mix	7-22 percent

Of the fraction passing the No 10 sieve, the following percentages thereof shall pass the No. 40 sieve:

Class B Hot Mix	30-55 percent
Class C Hot Mix	30-55 percent

Of the fraction passing the No 40 sieve, the following percentages thereof shall pass the No. 200 sieve:

Class B Hot Mix	9-19 percent
Class C Hot Mix	9-19 percent
Class E Hot Mix	20-28 percent

Aggregate grading for Class D Hot Mix shall conform to the requirements specified hereinbefore under "Grading of designated sizes of coarse aggregate."

306.2.04 MINERAL FILLER

Mineral filler shall conform to the requirements of AASHTO M 17.
Collector dust may be used as mineral filler, in whole or in part, provided the dust or the resultant mineral filler mixture conforms to the above requirements.

306.2.05 ADDITIVES

Additives and admixtures may be used to prevent stripping or separation of bituminous coatings from aggregates, and to aid in the mixing or use of bituminous mixes, or for experimental purposes. Use admixtures and additives of standard recognized products of known value for the intended purpose and obtain approval on the basis of laboratory tests prior to their use. They shall have no deleterious effect on the bituminous material and shall be completely miscible.

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306.2.06 COMPOSITION AND PROPORTION OF MIXTURES

The class of asphalt concrete to be used shall be as shown and shall conform to the following requirements:

Sieve Size Passing	Class B	Class C	Class D	Class E
	Percentages of Total Aggregate (by weight)			
1"	100			
¾"	95-100	100		
½"		95-100		100
⅜"			100	80-100
¼"	52-72	65-85	85-100	51-71
#10	21-41	30-45	48-66	10-20
#40	8-24	8-26	20-35	
#200	3-7	3-7	4-8	2-6
Asphalt Cement	4-8*	4-8*	4-8*	4-9*
Portland Cement or Hydrated Lime**				0.5-1.5*

* The exact percentage used (mix formula) shall be as designed or approved by the Engineer on the basis of preliminary laboratory tests and analysis of aggregated.

** Contractor's option.

Class "E" is an open-graded mix and separation of asphalt from aggregate may occur. Any noticeable separation at the point of delivery will be cause for rejection.

Class "B," "C," and "D" asphalt concrete shall meet the following qualifying test requirements:

Test	Test Method	Requirements
Stability, First Compaction	OSHD Standard Test*	32 minimum
Voids, First Compaction	OSHD Standard Test*	7% maximum
Voids, Second Compaction	OSHD Standard Test*	1 % minimum
Retained Strength	AASHTO T 165-Mod.	70% minimum

* Available from Engineer of Materials, ODOT, Salem, Oregon 97310.

306.2.07 MIX FORMULA AND TOLERANCES

At least 15 days prior to producing any of the mixture for use in asphalt concrete pavement, furnish representative samples of acceptable materials proposed for use in determination of the proportions of each of several constituents to be used in the mixture. The proportions so determined shall be known as the "mix formula" and shall be changed only upon order of the Engineer. No mixture will be accepted for use until the "mix formula" for the project is determined.

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After the mix formula is determined, the several constituents shall meet the following tolerances, but always within the range of proportions specified in Subsection 306.2.06.

Constituent of Mixture	**Tolerance (Plus or minus to mix formula)**
All aggregate of sieve sizes specified in Subsection 306.2.06 except aggregate passing No. 200 sieve	6.0 percent
Aggregate passing No. 200 sieve	2.0 percent
Asphalt Cement	0.5 percent
Temperature of mixture at time of final placement	10 degrees Fahrenheit

Should a change is source of material be made, or should conditions arise, which the Engineer determines to justify, the Engineer may establish a new mix formula.

The materials to be used in the work shall be of such nature that a mixture of them, proportioned in accordance with the mix formula, will have a retained strength of no less than 70 percent when tested in accordance with AASHTO T 165 as modified by OSHD test methods. The Engineer shall be permitted to take as many samples as he/she considers necessary for checking the uniformity of mixture.

306.3.00 CONSTRUCTION

306.3.01 PREPARATION OF BASES

All pavement bases and foundations constructed under this contract shall be completed and finished as prescribed under the applicable specification for its construction.

Manholes, inlets, and other such structures shall have been completed, adjusted, cured, and otherwise prepared, as applicable, and made clean and ready for asphalt placement. Paint vertical surfaces that will come in contact with asphalt pavement with tack coat material to provide a good bond and seal. Cover top surfaces with paper or other material to prevent adherence of asphalt pavement, tack coat, or prime coat.

306.3.01A Joining Existing Pavements

All existing pavement edges to be joined with new pavement shall be saw cut such that the cut remains straight and vertical without breakouts at the time of joining the new pavement.

Thoroughly paint the saw cut edge with AR 4000 or PBA-2 asphaltic cement.
Make the finished surface of the new compacted paving flush with the existing surface unless otherwise shown or approved.

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Immediately after the new paving is compacted, paint all joints between new and original asphalt pavement with AR 4000 or PBA-2 asphaltic cement and, if necessary, cover with dry paving sand before the asphalt solidifies to prevent pick-up by traffic.

Emulsified asphalt for edge sealing and joint sealing may be used in lieu of the PBA-2, PBA-5, or AR 4000 asphalt cements. The emulsified products are classified as CRS-1, CRS-2, CMS-2, CMS-2h, CMS-2s, CSS-1, and RS-LTP (polymer-modified). The proper choice of product shall be approved by the Engineer and will depend on temperature and weather conditions. Generally, CRS (rapid setting) emulsions will be used when surface temperatures are 70 degrees or less and CMS (medium setting) emulsions will be used when the surface temperature is higher than 70 degrees. The RS-LTP product can be used in temperatures as low as 40 degrees. Choice of product shall be approved by the Engineer. In no case will Hot Mix Asphalt (HMA) be allowed to be placed until the emulsion has "broken" as indicated by the color change from brown to black. Follow the manufacturer's recommendations for precleaning, dust and moisture control, and application temperature. The emulsified asphalt products can be applied with some moisture, however, they shall not be applied in saturated conditions without approval of the Engineer and drying of saturated surface to the satisfaction of the Engineer. Random samples may be taken at "point of use" to be analyzed for water content.

306.3.02 RECONDITIONING OLD ROADBED

This work consists of reconditioning and preparing previously constructed roadbed subgrades existing stone bases and surfacings, and existing pavements; none of which were constructed by the Contractor under the pertinent Contract but on which an additional layer or course of material is to be placed.

Existing aggregate subbases, bases, and surfacing shall be bladed, scarified, leveled, and compacted in conformance to lines, grades, and cross sections as established and the density and tolerance requirements of ***Section 303 Aggregate Bases***.

Prelevel uneven or broken bituminous, cement concrete, or brick surfaces with asphalt concrete as specified. Spread and compact preleveling asphalt concrete to the density and surface condition as directed.

306.3.03 PRIME COAT

Where specified, construct prime coat in conformance with applicable requirements of ***Section 305 Surface Treatments*** with the following modifications: Asphalt shall be spread at a rate normally within a range of 0.25 to 0.40 gallon per square yard of surface. Cover aggregate if required shall be spread at a rate of .006 to 0.009 cubic yards per square yard and may include one or another of the materials specified in ***Section 303 Aggregate Bases*** or ***Section 305 Surface Treatments***.

Following application of the prime coat, it shall be allowed to cure for a period of up to three days before a succeeding course is placed upon it.

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When using the emulsified asphalt products, application rates must be calculated to provide *residual* asphalt within the specified range after the water has left the emulsion. Calculations must be approved by the Engineer. The proper choice of product shall be approved by the Engineer and will depend on temperature and weather conditions. Generally, CRS (rapid setting) emulsions will be used when the surface temperatures are 70 degrees or less and CMS (medium setting) emulsions will be used when the surface temperature is higher than 70 degrees. The RS-LTP product can be used in temperatures as low as 40 degrees. Hot Mix Asphalt (HMA) will not be allowed to be placed until the emulsion has "broken" as indicated by the color change from brown to black. Follow manufacturer's recommendations for precleaning, dust and moisture control, and application temperature. The emulsified asphalt products can be applied with some moisture, however, they shall not be applied in saturated conditions without approval of the Engineer and drying of saturated surface to the satisfaction of the Engineer. Random samples may be taken at "point of use" to determine water content.

306.3.04 TACK COAT

Except as modified herein, apply tack coat in conformance with applicable requirements for Seal Coat in S***ection 305 Surface Treatments***.

Spread asphalt by means of pressure spray equipment which will provide uniformity of application at prescribed rates. Do not apply aggregate cover material to the tack coat. Normally, asphalt shall be applied to the prepared surface at a rate within a range of 0.02 to 0.06 gallon per square yard of surface, actual rate to be as directed. The tack coat shall not be applied during wet or cold weather or during darkness and apply only so far in advance as is appropriate to maintain a tacky, sticky condition of the asphalt. Apply tack coat in such manner as to offer the least interference to traffic and to permit at least one-way traffic without pickup or tracking of asphalt.

When tack coat is used in conjunction with overlay fabrics, ONLY AR 4000, PBA-2, or PBA-5 asphalt cements will be allowed.

When using the emulsified asphalt products, application rates must be calculated to provide *residual* asphalt within the specified range after the water has left the emulsion. Calculations shall be approved by the Engineer. The proper choice of product shall be approved by the Engineer and will depend on temperature and weather conditions. Generally, CRS (rapid setting) emulsions will be used when the surface temperatures are 70 degrees or less and CMS (medium setting) emulsions will be used when the surface temperature is higher than 70 degrees. The RS-LTP product can be used in temperatures as low as 40 degrees. Hot Mix Asphalt (HMA) will not be allowed to be placed until the emulsion has "broken" as indicated by the color change from brown to black. Follow manufacturer's recommendations for precleaning, dust and moisture control, and application temperature. The emulsified asphalt products can be applied with some moisture, however, they shall not be applied in saturated conditions without approval of the Engineer and drying of saturated surface to the satisfaction of the Engineer. Random samples may be taken at "point of use" to determine water content.

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306.3.05 MIXING

Mix the asphalt concrete by combining aggregate, asphalt, and additives at an approved central mixing plant equipped with controls to accurately measure and monitor the various components of the mix to produce a uniform homogeneous mixture at the specified temperature.

The discharge temperature of the mix will vary with the type of mixing plant, climatic conditions, and other variables. However, the temperature shall be sufficient to provide thorough mixing and coating and to provide a mass viscosity of the mix on the grade which will permit compaction to required density. Mix temperatures and asphalt in storage shall generally not exceed 325 degrees Fahrenheit.

306.3.06 PLACING

Conform to the plan of work, order of paving, and other details of performance as approved. Lift thickness shall be as shown.

Transport the asphalt concrete mixture from the mixing plant to the point of use in trucks, as approved. Send no loads so late in the day as to prevent the spreading and compacting of the mixture during daylight, unless approved lighting is provided.

Hot mix asphalt concrete mixture from the mixing plant to the point of use in trucks, as approved. Send no loads so late in the day as to prevent the spreading and compacting of the mixture during daylight, unless approved lighting is provided.

Hot mix asphalt concrete shall normally be placed on dry prepared surfaces and when air temperature in the shade is 40 degrees Fahrenheit and warmer. Place Class E wearing surface only when the existing pavement temperature is at least 60 degrees Fahrenheit. Placing during rain or other adverse weather conditions normally will not be permitted, except that mix in transit at the time these adverse conditions may occur may be laid provided it is of proper temperature, the mix has been covered during transit, and is placed on a foundation free from pools or flow of water. The temperature of hot mix at the time it is spread into final position shall be between 240 and 300 degrees Fahrenheit, except Class E mix shall be between 200 and 250 degrees Fahrenheit.

Lay the mixture in strips of such width as to hold to a practical minimum the number of longitudinal joints required. The longitudinal joints in any layer of pavement shall offset those joints in layers below by not less than 6 inches. Take special care at longitudinal joints to provide positive bond and required density.

Bituminous paving machines shall be self-contained, power-propelled units, provided with an activated screed or strike-of assembly, heated if necessary, and capable of spreading and finishing layers of bituminous mix material in lane widths applicable to the specified typical sections, and to required thicknesses, lines, grades, and cross sections. When paving shoulders

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or similar work, the Contractor will be permitted to place the mixture with a towed-type paving machine provided the machine meets the following requirements:

1. The machine is equipped with a receiving and distribution system of a sufficient capacity for a uniform spreading operation without segregation of materials.

2. The machine is equipped with a screed which will produce a finished surface of the specified thickness and smoothness and will not tear or gouge the mixture.

When the capacity of the paver top properly spread and finish exceeds the rate of delivery of mixture, operate the paver at a reduced and uniform speed to give continuous spreading and finishing.

Take care at all times to prevent segregation in the mixture as evidenced by areas of fine and coarse materials , and correct any such segregation with fresh mixture either spread and worked into the surface or by complete removal and replacement of segregated mixture, as directed, at no expense to the Owner.

On areas to be patched with asphalt concrete mixture and on areas of irregular shape or limited size, the spreading and finishing requirements may be modified as approved.

Boils and slicks occurring in the pavement must be immediately removed and replaced with suitable materials, at no expense to Owner.

306.3.07 COMPACTION

The Contractor will not be permitted to use any equipment which crushes the aggregate to any extent. However h/she will be required to obtain the densities required in Subsection 306.3.08.

306.3.08 DENSITY REQUIREMENTS

The density of asphalt concrete as determined by AASHTO T 230 or AASHTO T 238 (Method A or B) shall be at least 95 percent of the maximum density determined in accordance with AASHTO T 245 or T 246.

Samples and tests will be taken as frequently and at such locations as the Engineer elects, and the results will be made know to the contractor as soon as is practicably possible. However, it shall be the responsibility of the Contractor to obtain specified density at all times, and delay in advising the Contractor of test results shall not act as a waiver of this responsibility. When it is determined that specified density is not being obtained, discontinue all paving operations until corrective measures have been taken.

Any displacement occurring as a result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture when required. Do not displace the line and grade of edges. Moisten steel roller wheels with water

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or other approved material to the least extent necessary to prevent pickup of mixture and yet not cause spotting or defacement of the surface of the mixture.

Along curbs and walls, on walks, irregular areas, and other areas not practicably accessible to specified rollers, compact the mixture with small rollers, mechanical tampers, hot hand tampers, or smoothing irons. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

Remove and replace any mixture that becomes loose and broken, mixed with dirt, or is any way defective. Remove and replace any area showing an excess or deficiency of bituminous cement. Removal and replacement under these provisions shall be at no expense to Owner unless the Engineer determines that the defects, excesses, or deficiencies are not caused by or the fault of Contractor's operations.

The density of asphalt concrete is determined by AASHTO T 230 or AASHTO T 238 (Method A or B) shall be at least 95 percent of the maximum density determined in accordance with AASHTO T 245 or T246.

306.3.09 TRANSVERSE JOINTS

Unless otherwise approved, form transverse joints by cutting back on the previous run to expose the full depth of the layer or course.

Place a course or strip of asphalt concrete as nearly continuous as practicable. Carefully construct transverse joints using vertical faces and thoroughly compacted to provide a smooth riding surface. Apply a coat of bituminous material to contact surfaces just before mixture is placed against previously rolled mixture.

At bridge ends or at joints with other rigid type structures, existing bases shall be conditioned and compacted, and place asphalt concrete to extra thickness and compact in transverse direction as well as longitudinally, all as directed.

When the end of a course or strip of asphalt concrete is to be temporarily subjected to traffic, the end shall be left on a bevel of approximately 20:1 (horizontal to vertical), being later cut back to a vertical edge.

306.3.10 SURFACE FINISH

The finished surface of each course or layer of mixture shall be of uniform texture, smooth, free of all defects, and shall closely parallel that specified for the top surface of the finished pavements. The surface of each layer will be tested for trueness to specified grade and transverse slope at selected locations with a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge between any two contact points with the surface shall at no point exceed 0.02 foot on the underlying courses or pavements and 0.025 foot on the top courses or wearing surfaces of pavements.

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306.3.11 USE TABLE FOR TACK AND PRIME

Asphalt Product	Surface Temperature Degrees Fahrenheit	Surface Moisture	Typical Application
PBA-2, PBA-5, AR4000	40+	Dry only	Tack, primer, tack with fabric
CRS-1	70-	Light or dew	Tack or primer only, do not use with fabric
CRS-2	70-	Light or dew	Tack or primer only, do not use with fabric
CMS-2	70+	Light or dew	Tack or primer only, do not use with fabric
CMS-2h	70+	Light or dew	Tack or primer only, do not use with fabric
CMS-2s	70+	Light or dew	Tack or primer only, do not use with fabric
RS-LTP	40+	Wet, no standing water or puddle	Tack or primer only, do not use with fabric
CSS-1	70+	Light or dew	Tack or primer only, do not use with fabric

306.4.00 MEASUREMENT AND PAYMENT

306.4.01 MEASUREMENT

Pay quantities for hot mix asphalt concrete and other bituminous construction under this Section will be measured by on e or another of the methods as set forth hereinafter.

306.4.01A Asphalt Concrete on a Single Unit Basis

When pay items in the Proposal so indicate, the quantity of asphalt concrete used in the accepted work as specified will be measured on a ton basis. There will be no separate measurement of bituminous cement or additives contained in the mixture or used otherwise in the work. Measurement will be made on the number of tons of asphalt concrete, as weighed on approved and tested scales. Give trip tickets to the Engineer for his/her signature as the material is delivered. Each trip ticket shall show date and time of delivery, truck number, or driver's name, net weight of material, and will be considered as valid delivery receipts only when signed by the Engineer.

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306.4.01B Asphalt Concrete on Square Yard Basis

When the pay items in the Proposal so indicate, asphalt concrete, complete in place as specified and accepted, will be measured on a square yard basis. Measurement will be made of width and length of each separately constructed strip of pavement, wherein width is the design width or edge-to-edge width of pavement, whichever is the lesser, and length is from end to end of pavement along the center of the strip. Measurement will be on the surface of the pavement to the nearest 0.1 foot and the square yardage will be to the nearest full square yard.

The Engineer may take core samples of the pavement or use other methods to determine the actual pavement thickness constructed. Extra thickness of pavement as shown or as directed will be measured by conversion on a proportionate volume basis to an equivalent number of square yards of specified standard thickness pavement.

No additional payment over the Contract unit price will be made for pavement having a thickness greater than shown or ordered. When the pavement is found deficient in thickness by more than 0.2 inch, but not more than 1 inch, as determined by test cores of reasonable test samplings, payment for pavement will be made at an adjusted price as specified in the following table:

Deficiency in Thickness Inches	Proportional Part of Contract Unit Price Allowed
0.00 to 0.20	100 percent
0.21 to 0.30	80 percent
0.31 to 0.40	72 percent
0.41 to 0.50	68 percent
0.51 to 0.75	57 percent
0.76 to 1.00	50 percent

No payment will be made for any area of pavement found deficient in thickness by more than 1 inch, even though such pavement is permitted by the Engineer to remain in place.

306.4.02 PAYMENT

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract:

Payment Item	Unit of Measure
1. Asphalt concrete mixture (specify class)	Per Ton
2. Asphalt concrete (specify class)	Per Ton
3. Asphalt concrete (specify class and thickness)	Per S. Y.

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A deduction of 1 percent of the in place price will be made for each 1 percent cumulative deviation from the allowable tolerance of each component of the job mix formula required by the specification, except as follows:

Deviations in asphalt cement shall be weighted eight times, and deviations in 200-minus material shall be weighted two times the deviation in the other specified aggregate sieve sizes.

All materials furnished where the cumulative deviation equals or exceeds 12 percent shall be removed and replaced with acceptable material at no cost to the Owner.

When asphalt paving materials with a cumulative deviation of less than 12 percent are furnished, the Owner shall notify Contractor, in writing, to remove and replace defective materials at no cost to the Owner or to pay to the Owner liquidated damages in accordance with the above deduction schedule, as determined by the Engineer.

If no in place price has been established, the price shall be equal to: (1) the price under the City's current annual supply Contract for furnishing such materials, plus the cost of hauling and placing by City equipment to the area or district in which the work under the Contract or permit is to be done, or (2) the Contractor's cost as established by a Subcontract for such materials in place, whichever is greater.

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307 Portland Cement Concrete Pavement

307.1.00 DESCRIPTION

This Section covers work necessary for construction of Portland Cement concrete pavements, with or without reinforcement, on a prepared subgrade or base course, complete.

307.2.00 MATERIALS

All materials shall conform to requirements of ***Section 205 Materials***.

307.3.00 CONSTRUCTION

307.3.01 GENERAL

The plant, equipment, and tools required in the performance of the work must be approved as to design, capacity, and condition to efficiently perform their respective functions of the work. Schedule and coordinate all operations involved in constructing the pavement so that regardless of the daily or seasonal variations in weather, temperature, and humidity under which the work is permitted to proceed, such work will result in a finished pavement conforming in all respect to specified requirements. Provide and have available at all times adequate equipment, tools, materials, and labor to achieve these results and failure to so provide will be cause for discontinuance of the work upon order of the Engineer. Conform to applicable requirements of concrete construction in ***Section 602 Concrete Structures***.

307.3.02 HAULING

Hauling of Portland Cement concrete mixed at a central plant or in transit will conform to the provisions of ***Section 602 Concrete Structures***.

307.3.03 FORMS

Conform to the applicable requirements of forms in ***Section 602 Concrete Structures***.

307.3.04 HANDLING AND PLACING

Conform to requirements for Handling and Placing in ***Section 602 Concrete Structures***.
During the placing of concrete, make provision for the construction of joints and the placing of dowels, tie bars, and other devices shown or as shown or as directed. The Contractor is referred to Subsection 308.3.01C.

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307.3.05 SLIP FORM PAVING

Place the concrete uniformly in final position by the slip form method in one complete pass in such a manner that a minimum of finishing will be necessary to provide a dense and homogeneous pavement in conformance to true grade and cross section. The machine shall vibrate the concrete for the full width and depth of the pavement being placed. Such vibration shall be accomplished with vibrating tubes or arms working in the concrete. The sliding forms shall be rigidly held together to prevent spreading of the forms. Use forms of sufficient length so that no appreciable slumping of the concrete will occur.

Operate the slip form paver with as nearly continuous forward movement as possible and coordinate all operations of mixing, delivery, and spreading concrete to provide uniform progress. Stopping and starting the paving machine shall be held to an absolute minimum. If, for any reason, it is necessary to stop the forward motion of the paver, stop the vibrator and tamping elements immediately. Apply no tractive force to the machine, except that which is controlled from the machine.

Ensure that supports of the slip form paver and other equipment which ride on previously placed pavement are offset over that pavement sufficiently to prevent breakage of the edge thereof and provide such supports with suitable protective means to avoid marring or chipping of the previously placed pavement.

307.3.06 TAMPING AND SCREEDING

Compact the concrete pavement by means of vibrating screeds, mechanical tamper, tamping templates, and such other implements as approved. A vibrating screed or an automatic screeding and tamping machine may be substituted for a tamping template, subject to approval. Operate the equipment in such a manner that a satisfactory compaction of the concrete is produced and the surface of the pavement is uniform, true to grade, and cross section.

Immediately after placing concrete upon the subgrade and before initial set has occurred, strike off the concrete and tamp by means of a tamping template, used at right angles to the centerline of the street, until the concrete is thoroughly consolidated to specified grade and crown section and sufficient mortar is brought to the surface for finishing purposes. If the design or location of the base is such as to preclude the possibility of tamping as previously described, such as a variable crown section, curb being constructed monolithic with base, in alleys, or where the grade exceeds 10 percent; employ other approved methods to obtain the prescribed results.

307.3.07 ROADWAY AND ALLEY FINISHING

After the concrete is placed and compacted, strike it true to line, grade, and cross section as shown and float to a smooth, even texture with an approved long handled wood float having a troweling or smoothing surface from 6 to 12 inches wide, or other approved floating device. Apply the float to the surface of the concrete with its length parallel to the centerline of the

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street and operate it from bridges, planning off the high places, and filling the low places. Lap preceding applications of the float by at least one-half its length. If, after such planning, low places are discovered in the surface of the concrete, add additional concrete to fill in and bring such low places to grade, as approved. Floating shall leave the surface finish at specified grade, cross section, and surface tolerance, with a surface free from laitance, soupy mortar, marks, or irregularities.

Following the float finish and at the proper set, broom finish the surface. Draw the broom transversely across the pavement with not more than one stroke per width of broom. Fill any areas of minor honeycomb or other minor defect in co0mpositon of the concrete along the exposed edges with a stiff mortar or cement and fine aggregate applied to the moistened concrete in a workmanlike manner. Areas showing serious defects in composition of the concrete shall be cause for removal of affected pavement and replacement with pavement of specified quality for the full width of strip between longitudinal joints or edges and for a length not less than 10 feet.

Tool the free edges of new pavement and joints with previously placed Portland Cement concrete with an approved edging tool to remove laitance and mortar resulting from finishing operations and to provide a clean rounded edge to the new pavement. Tooling shall not form ridges on the surface of the concrete. Perform tooling of edges at transverse joints and longitudinal joints as directed.

307.3.08 JOINTS

Conform to applicable requirements of ***Section 602 Concrete Structures***.
Place 3/8 inch thick expansion joints at a maximum of 25 feet apart, the depth of the concrete pavement in height and the width of the pavement in width.

307.3.09 TOLERANCES

At the conclusion of the finishing operation the surface of the pavement shall not vary from a true surface, when tested with a 10 foot testing straightedge, more than .02 of a foot in 10 feet. The finished surface shall not vary more than 0.03 foot from the Plan elevations at any point.

307.3.10 CURING

307.3.10A Curing of Concrete

Immediately after the final floating, surface finishing, and edging has been completed and while the concrete surface is still moist, cover the entire exposed concrete and cure in accordance with one of the following provisions as specified:

1. Apply membrane-forming compound of the white pigmented type uniformly to damp concrete by pressure-spray methods at a rate which will form an impervious membrane when tested in accordance with AASHTO T 155.

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2. Apply white polyethylene film, waterproof paper, or burlap-polyethylene sheets to damp concrete as soon as it can be placed without marring the surface. Place in intimate contact with the surface; extend over and beyond the sides or edges of the slabs or forms and weight as approved to hold the covering in position as a moisture proof covering. Laps shall be of approved dimensions and design to maintain tightness equivalent to the covering.

3. Apply burlap cloth to damp concrete as soon as it can be placed without marring the surface. Saturate the cloth with water, and keep fully wetted during the curing period.

Regardless of which of the above methods the Contractor chooses, keep the curing medium intact and effective for a period of not less than 72 hours after application.

307.3.10B Protection of Concrete

Erect and maintain suitable barriers to protect the concrete from traffic or other detrimental trespass until the pavement is opened to traffic. If necessary, maintain watchmen to ensure that barriers remain effective.

Wherever it is necessary that traffic including Contractor's vehicles and equipment be carried from one side of the pavement to the other, construct and maintain suitable bridges over the pavement as directed.

Prior to allowing equipment or traffic on the new surface, the concrete must have attained the specified compressive strength and shall be free from scarring, abrasion, stones, loose mortar, and other matter apt to be deleterious to the concrete surface. Operate all equipment without damage to the new concrete.

Repair or replace any part of the pavement, as directed, which has been damaged by traffic or from any other cause, prior to its official acceptance, at no expense to Owner.

307.4.00 MEASUREMENT AND PAYMENT

307.4.01 MEASUREMENT

307.4.01A Portland Cement Concrete Pavement

Measurement of Portland Cement concrete pavement will be made on a square yard basis for the pavement complete in place as specified, and accepted. Measurement will be made of width and length of each separately constructed strip of pavement, wherein the width is the design width or edge-to-edge width of pavement, whichever is the lesser, and the length is from end-to-end of pavement to the nearest 0.1 foot and the square yardage shall be to the nearest square yard.

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Extra thickness of pavement, when shown or specifically directed to be placed, will be measured by conversion on a proportionate volume basis to an equivalent number of square yards of specified standard thickness pavement.

307.4.02 PAYMENT

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract.

Payment Item	Unit of Measurement
1. Continuous Reinforced Concrete Pavement (specify class, thickness, reinforcing steel)	Per S. Y.
2. Reinforced Concrete Pavement (specify class, thickness, reinforcing steel)	Per S. Y.
3. Plain Concrete Pavement (specify class, thickness)	Per S. Y.

Payment for concrete pavement, whether continuously reinforced, reinforced, or plain shall be full compensation for furnishing and placing all materials including water, reinforcement, joint materials, dowels, tie bars, and performing all work specified to complete the item including preparation of the base.

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308 Curbs, Gutters, Driveways, Sidewalks, and Pathway

308.1.00 DESCRIPTION

This Section covers work necessary for the construction of curbs; gutters; combination curb and gutter; combination curb, gutter, and sidewalk; islands; traffic separators; and driveways, sidewalks, and pathways, hereinafter referred to collectively as structures.

The respective structure names are specific in their use and refer specifically to those names as shown.

308.2.00 MATERIALS

308.2.01 GENERAL

Materials shall conform to requirements of ***Section 205 Materials*** and to additional requirements contained herein.

308.2.02 PORTLAND CEMENT CONCRETE

Portland Cement concrete shall conform to Subsection 205.2.02 except that extruded curbs and/or gutters shall have a maximum slump of 2 inches as specified in Subsection 308.3.03A and sidewalks and pathways may have a design strength of 3,000 psi.

308.2.03 ASPHALT CONCRETE

Conform to Class C Hot Mix in ***Section 306 Asphalt Concrete Pavement***.

308.2.04 AGGREGATE

Aggregate materials for base, foundation courses, leveling courses, or bedding shall conform to ¾" -0 gradation in ***Section 303 Aggregate Bases***.

308.3.00 CONSTRUCTION

308.3.01 PREPARATION OF BASE

308.3.01A Earthwork

When roadway earthwork is called for in connection with other items of work under the same Contract which includes structure construction under this Section, all excavation, backfilling, and berm construction for the structures and in the vicinities thereof as required, or as shown, shall conform to applicable requirement of ***Section 204 Excavation, Embankment, Bedding, and Backfill***.

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When the Contract, which includes structure construction under this Section, does not call for roadway earthwork to be performed as set forth in ***Section 204 Excavation, Embankment, Bedding, and Backfill***, perform required earthwork as follows: make excavations for the structures to required depths and widths and the bottoms thereof to a firm, even surface. Remove all soft and unsuitable material and replace with material as directed. Backfill prior excavations at sites and in the vicinity of the new structures with approved material placed and compacted in successive layers to a dense and firm condition. Areas adjacent to the work shall be trimmed and shaped to a neat condition and restore disturbed areas to their original condition.

308.3.01B Aggregate Foundation or Bedding

Construct sidewalk structures on aggregate foundation course or bedding of selected granular material as specified or directed.

When structures are to be constructed on areas where approved aggregate material is already in place, such materials may be salvaged and reused as bedding.

Foundation courses or beddings involving the furnishing of new materials shall be constructed in conformance to the applicable requirements of ***Section 303 Aggregate Bases***.

308.3.01C Base for Portland Cement Concrete

All bases upon which new cement concrete structures are to be constructed shall be firm and free of all deleterious matter. Dampen thoroughly surfaces upon which new cement concrete is to be placed. No payment will be made for water and the work of placing base materials. The cost of preparing bases shall be considered as incidental to the construction of structures.
When new concrete is placed by the mechanical extrusion method, vertical dowel fastening to underlying concrete or asphalt may be eliminated and the bond between new concrete and underlying concrete or asphalt provided with epoxy cement applied in conformance with the manufacturer's recommendations as approved. Spread epoxy at a rate which will provide a thorough coating to the surface with all voids and depressions filled. Place new structure on the epoxy cement within 15 minutes after spreading.

308.3.01D Base for Asphalt Concrete

Bring the base of new asphalt concrete structures to proper grade, firm, dry, and free of deleterious matter.

Where asphalt concrete is to come in contact with previously placed Portland Cement concrete, asphalt concrete, or bituminous surfaces, give the area of contact an application of epoxy cement as specified for use with Portland Cement concrete in ***Section 205 Materials – Types and Use***, or a light coating of emulsified asphalt

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conforming to the requirements for Tack Coat in ***Section 306 Asphalt Concrete Pavement***.

Where dowel fastenings between new asphalt concrete and the underlying foundation are shown, the dowels may be eliminated when the asphalt concrete is placed by mechanical extrusion method provide an application of epoxy cement, as set forth herein for use with Portland Cement concrete, is used to provide positive bond between the new and old materials.

308.3.02 FORMS

308.3.02A Forms

Conform to requirements for Forms in ***Section 602 Concrete Structures***.

Sidewalk ramps shall conform to details of Standard Plan No. 307. In situations where a sidewalk ramp is being retrofitted to an existing curb, the curb forms shall be set by the Contractor to provide drainage away from sidewalk ramps. For ramps in areas where gutter grade is less than or equal to 2 percent in either direction, construction curb stakes shall be placed at the beginning, end, and quarter points of the curb return.

For sidewalk ramps in areas where gutter grade is greater than 2 percent, construction curb stakes shall be placed as needed to comply with plan details.

Approval of forms does not relieve Contractor from the responsibility of setting forms per plan requirements.

308.3.02B Equipment

Plant and equipment requirements as described in ***Section 306 Asphalt Concrete Pavement*** and ***Section 307 Portland Cement Concrete Pavement*** may be modified as approved, when circumstances warrant. For asphalt sidewalks or islands, spread asphalt concrete by small or special pavers, by spreader boxes, or by blade graders. Compact with small, self-propelled rollers, vibratory compactors, or mechanical tampers. Spread or compact the mixture by hand methods only when approved.

The machine for extruding cement concrete curb or asphalt 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 cement concrete or asphalt concrete to the lines, grades, and cross section as shown, in an even homogeneous manner. Cement concrete curb shall be free of honeycomb and cracks.
Set top of curb grade by an offset guide line using the survey marks established by the Engineer. The forming tube portion of the extrusion machine shall be readily adjustable vertically during the forward motion of the machine to provide, when necessary, a variable height of curb conforming to the predetermined curb grade. A grade line gauge or pointer shall be attached to the machine in such manner that a continual comparison

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can be made between the curb being placed and established curb grade as indicated by the offset guide line.

In lieu of the above method for maintaining the curb grade, the extrusion machine may be operated on approved rails or forms set at the proper relative grade.

308.3.03 PLACING MATERIAL

No asphalt or concrete shall be laced until the surface and forms, where used, have been inspected and approved.

308.3.03A Portland Cement Concrete

Construct Portland Cement concrete structures between approved forms or by an approved mechanical extrusion method, as the Contractor may elect. If forms are used, maintain a 2 to 4 inch slump, and thoroughly compact and strike off. If the structures are constructed by an approved mechanical extrusion method, maintain a maximum slump of 3 inches. Feed cement concrete into the extruding machine at a uniform rate and operate the machine under sufficient restraint in a forward motion to produce a well-compacted mass of concrete.

308.3.03B Asphalt Concrete

Asphalt concrete curbs may be placed by mechanical extrusion methods or between suitable forms, as the Contractor may elect. Spread asphalt concrete for sidewalks, driveways, and pathways, where specified, uniformly by hand or by a paving machine and thoroughly compact in conformance with the requirements in ***Section 306 Asphalt Concrete Pavement***.

308.3.04 FINISHING

308.3.04A General

Construct all structures within ¼ inch of true line, within ¼ inch of established surface grade, cross section, and slope, and within 1/8 inch of specified thickness, and all finished surfaces shall be free from humps, sags, or other irregularities. When a straightedge 10 feet long is laid on a finished surface tangent, the surface shall not vary more than 0.02 foot from edge of the straightedge.

Where asphalt concrete or Portland Cement concrete sidewalks or pathways are to be placed around or adjacent to manholes, pipe inlets, or other miscellaneous structures, do not construct such structures to final grade until after the sidewalks or pathways have been constructed for an approved distance on each side of the structures.

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308.3.04B Portland Cement Concrete

Sidewalks and Other Structures:

Finish surface of concrete to grade and cross section with a bull float, trowel smooth, score if required, then finish with a broom. Use floats of not less than 10 feet in length for straight grade sections and not less than 6 inches in width. Finish concrete adjacent to expansion joints with an edger tool. Light brooming shall be transverse to the line of traffic and if water is necessary, it shall be lightly applied to the surface immediately in advance of brooming.

The surface of concrete sidewalks shall be marked into rectangles with a scoring tool which will leave the edges rounded. Scoring and dimensions shall be as shown on the appropriate Standard Plan or as directed. Sidewalks shall have a slope of ¼ inch per foot from the top of curb to the back of walk unless otherwise shown.

Curbs:

Remove forms after the concrete has taken initial set and while the concrete is still green. Minor defects shall be repaired with mortar containing one part Portland Cement and two parts sand. Plastering will not be permitted on the faces and exposed surfaces. Honeycombed and other structurally defective concrete shall be removed and replaced at no expense to Owner. While the concrete is still green, finish exposed surfaces as required to provide a uniform texture and smooth surface.

When constructing precast concrete curbs, the proportions of sand, gravel and cement, the type of forms used, and the method of compacting the concrete in the forms shall all be such that as dense, smooth and uniform a 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 5 percent of the curb units having slight cracks, small chips not larger than ½ inch, or air holes not more than ½ inch in diameter or depth, the imperfections will not be deemed grounds for rejection.

Furnish and install a minimum of two 3 inch PVC Schedule 40 pipe curb drains to serve each lot. Use 4 inch PVC pipe for blockouts. PVC pipe shall conform to ASTM D 2241. Curb drains will be considered incidental work for which no separate payment will be made.

308.3.05 CURING PORTLAND CEMENT CONCRETE

After the concrete has been placed and finished in curb structures, as specified, it shall be cured by application of a white pigmented liquid membrane-forming compound applied uniformly to the damp concrete by pressure spray methods, or by keeping the concrete protected and moist for at least 72 hours. The concrete structure shall be kept from contact and strain for at least seven days.

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Curing of concrete in all other structures shall conform to the requirements for Curing in ***Section 307 Portland Cement Concrete Pavement***.

308.3.06 JOINTS IN WALKS AND INCIDENTAL SURFACING

Form transverse contraction joints of the weakened plane or dummy type in the exposed surfaces of cement concrete walks and incidental surfacings at such locations as are required to confine the contraction joint spacing to a maximum of 10 feet. The joints shall be formed to a depth of one-third of the thickness of concrete and to a width of about 1/8 inch. Joint edges shall be tooled.

Contraction Joints in Curbs:

Place contraction joints in curbs at 10 foot intervals and coincident to sidewalk joints. Contraction joints shall be of the open joint type and shall be provided by inserting a thin, oiled steel sheet vertically in the fresh concrete to force coarse aggregate away from the joint. The steel sheet shall be inserted one-half the depth of the curb. After initial set has occurred in the concrete and prior to removing the front curb form, the steel sheet shall be removed with a sawing motion. Finish top of curb with a steel trowel and finish edges with a steel edging tool.

Expansion Joints:

Provide expansion joints between driveways and Portland Cement concrete pavements, around poles, boxes, and other fixtures which protrude through, into, or against the structure, and other locations detailed on the Plans, or Standard Plans. Place each expansion joint at right angles to the structure alignment, vertical to the structure surface, and provide complete separation between concrete surfaces.

The width of joints and thickness of filler shall match those of the joints in abutting or underlying concrete; elsewhere it shall be not less than ½ inch.

Requirements Near Existing Structures:

Cut back existing curbs, walks, driveways, and other such structures to permit the new construction and where the new structures are to be constructed against or within 4 inches of the end, edge, or side of other structures, the new construction shall include the construction of approved connections therewith, using the same kind of concrete as is used in the new construction. Make the joint between the old and new material with a saw cut.

In this work, furnish and place preformed expansion joint filler, minimum ½ inch thickness, between new and old Portland Cement concrete.

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308.3.07 DOWELS, TIE BARS, REINFORCING

Provide metal reinforcing bars and wire fabric reinforcement when and as shown. When shown, provide and place dowels with "slip sleeves" as load transfer mediums. Provide and place dowels, but without "slip sleeves" as fastenings or ties between new concrete and existing underlying concrete when shown. Provide tie bars when shown. Place reinforcing, dowels and tie bars in conformance to the applicable requirements in ***Section 603 Reinforcement***.

308.3.08 FLOOD TESTING

Contractor shall be required to conduct a flood test of the ramp after concrete is cured to demonstrate that the ramp does not hold water. A quantity of water, as determined by the Inspector, shall be poured into the ramp area. The Inspector shall check the ramp 15 minutes later to determine if water is ponding in the ramp or gutter area. If water is ponding in the ramp or gutter area and the pond is more than 1 foot in length or ½-inch in depth, the Contractor shall be required to make repairs in an approved manner at no cost.

308.4.00 MEASUREMENT AND PAYMENT

308.4.01 MEASUREMENT

308.4.01A Curb

Curb will be measured on a linear foot basis along the face of the curb for the actual length constructed.

308.4.01B Combination Curb and Gutter

Combination curb and gutter will be measured on a linear foot basis along the face of the curb for the actual length constructed.

308.4.01C Curb, Gutter, and Sidewalk

For purposes of measurement and payment, the combined curb, gutter, and sidewalk will be considered as two component sections.

The first component, sidewalk, shall comprise that portion of the combined section beginning 6 inches behind the face of curb and shall be measured on a square yard basis for the actual square yards of sidewalk constructed.

The second component, curb and gutter, shall comprise that portion of the combined section beginning at the back of curb and through the gutter section, and shall be measured on a linear foot basis for the actual linear feet of curb and gutter constructed.

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308.4.01D Precast concrete Curb

Precast concrete curb will be measured on a linear foot basis along the face of the curb constructed, or on a per each basis for the actual number of precast concrete curb sections constructed.

308.4.01E Concrete Valley Gutter

Concrete valley gutter will be measured on a square yard basis for the actual square yards of gutter constructed.

308.4.01F Traffic Islands

Traffic islands will be measured by component parts of curb, and sidewalk as described above for combined curb, gutter and sidewalk.

308.4.01G Driveways, Sidewalks, and Pathways

Measurement of Portland Cement or asphalt concrete driveways, sidewalks, or pathways will be made on a square yard basis on the actual surface of the specified thickness concrete or asphalt completed and accepted.

308.4.01H Sawed Joints

Sawed joints will be measured on a linear foot basis for each joint sawed, cleaned, and sealed as specified and directed.

308.4.01I Aggregate Base

Pay quantities of aggregate base material will be measured as set forth in ***Section 303 Aggregate Bases***.

308.4.02 PAYMENT

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular contract:

Payment Item	Unit of Measure
1. Curb (specify asphalt or concrete)	Per L.F
2. Precast Concrete Curb	Per L.F or EA.
3. Concrete Curb and Gutter	Per L.F.
4. Sidewalk (specify asphalt or concrete)	Per S.Y
5. Concrete Valley Gutter	Per S.Y
6. Driveways, Sidewalks, and Pathways (specify thickness and Asphalt or Portland Cement Concrete)	Per S.Y.
7. Sawed Joints	Per L.F.
8. Aggregate Base	Per C.Y.

NEWER VERSION PUBLISHED

309 Street Lighting

309.1.00 DESCRIPTION

This section covers work necessary to procure and install street lighting poles, luminaires, wiring, and other related items.

309.2.00 MATERIALS

309.2.01 POLES AND ARMS

Fiberglass poles shall be designed to produce a 25-foot mounting height (unless otherwise indicated), be gray in color, have a natural finish, and be of the direct burial type. They shall be Whatley or Shakespeare catalog numbers as follows:

Whatley catalog number	E-4030-01-58/PGE 93 with T06-2 (arm)
Shakespeare catalog number	BH30-99N2BL20D1 (PGE) with OPAR-6 (ARM)

If a different mounting height is called for, use the same model numbers as listed above changed only by the pole length.

309.2.02 JUNCTION BOXES AND COVERS

Junction boxes and covers shall be made of polymer concrete. Covers shall have a skid resistant surface marked "ELECTRIC" and bolt to the junction box. Boxes shall be 14¾" x 14¾" x 12¾" in size. They shall be manufactured by Quazite and identified by PC1211BA12. The City may choose to accept and approved equal junction box.

309.2.03 WIRING

Street light wire shall be 3-#10 conductors as manufactured by Okonite, Rome, or Southwire, and meet the following specifications:

> #10 AWG, 600 volt, 3 conductor, Class B stranding, Type TC with Sunlight resistant 45-mil PVC jacket, suitable for direct burial installations. Insulation to be black, red, and green per NEMA WC-7 for NEC applications (TFN, THWN, THHN), with fillers or binding tape added to produce rounded outer jacket, rate 90°C dry and 75°C wet.

309.2.04 LUMINAIRES

All luminaires shall be Cobra head type using a 100 watt (unless otherwise shown) high pressure sodium light source that can be energized by either 120 or 240 volts through a normal power factor reactor ballast. The luminaire shall have an Acrylic lens. The fixture shall produce a medium distribution, semi-cutoff, Type II lighting pattern. One of the following preapproved luminaires shall be used:

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American Electric	#113-53712-6
Cooper	#OVZ10SNF2E4
General Electric	#M2RR10S7N2AMS2

If a different wattage size luminaire is called for on the plans, use the same model luminaires as listed above, change only watt size.

309.2.05 PHOTOELECTRIC CONTROL RELAY

One of the following preapproved photoelectric control relays (twist-lock) shall be used:

Fisher-Pierce	#6690B SLS
Fisher-Pierce	#7790B SLS
General Electric	#PEC0TL
Lampas	#6390-CH1

309.3.00 CONSTRUCTION

Street lighting shall be installed after all other earthwork and utility installations are completed, including rough grading of the property (lots), to prevent damage to the poles.

The Contractor shall notify the Public Works Inspection Section prior to any work starting on the street lighting system so an inspector can be present to inspect the work.

309.3.01 POLES

Street light poles shall be set to a depth according to the manufacturer's specifications (minimum five feet). Crushed rock backfill is required, with sand or clean soil cushion surrounding the conductors, or with protective hose through the rock-backfill zone. Refer to Standard Plan No. 701.

309.3.02 TRENCHING

Trenching shall be kept to a minimum 12 inches in width and provide for 30 inches of cover over wire. If rock or shale is encountered in the trench, a sand cushion or conduit is required. A conduit is also required where conductors pass under concrete or graveled driveways. Size and type of conduit shall be as required by the National Electrical Code, current edition.

The trench will be dug from the street light pole to a splice pit at one of these three locations as indicated on the plans:

1. To the street light conductor "stub up."
2. To a point two feet from the transformer.
3. To a point over the existing street light conductors as determined by the utility.

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When street light conductor “stub ups” are not present at a pole location, the Contractor will be required to install a trench to reach the power supply.

NOTE: If existing “stubbed up” wires are long enough to be pulled inside the pole base and spliced inside, no junction box will be required.

309.3.03 WIRING

Install the street light wires from the luminaire to the junction box or to the point of splice in the pole base. The Contractor will then complete one of the following installations as indicated on the plans:

1. Pull existing street light “stubbed up” wires into the junction box or into the pole base as shown.

2. Install wires from the junction box to a 3’ x 3’ splice pit located 2 feet from the existing transformer leaving 6 feet of spare wire for utility crews to extend into the transformer.

3. Install wires from junction box to a 3 x 3’ splice pit over existing street light wire circuit leaving 6 feet of spare wire for utility crews to splice.

NOTE: All splices are to be made by the utility providing the power source.

309.3.04 INSPECTION AT POWER SOURCE

It shall be the Contractor’s responsibility to give Portland General Elctric (PGE) or Salem Electric (SE) (based on project location) a 48-hour notice before excavating within 24 inches of their primary conductors. PGE or SE may then choose to have their inspector on site at the time of that excavation. Contractor shall document time and number of inspections that are made (for the City’s use).

309.4.00 MEASUREMENT AND PAYMENT

The Lump Sum bid item for street light installation will be full compensation for all work accepted in place to include excavation and backfill; all labor, materials, and equipment to install poles, junction boxes, luminaires and wiring; and coordination of final connection with the utility involved.

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310 Permanent Traffic Control and Guidance Devices

All pavement markings shall meet or exceed the specifications contained in the latest edition of the Oregon Department of Transportation Standard Specifications for Highway Construction including any supplemental guides referenced or specified.

All signs shall meet or exceed the standards set by the Federal Manual of Uniform Traffic Control Devices and State of Oregon revisions.

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Division 4 – Sanitary Sewers and Storm Drains

401 Tunneling, Boring, and Jacking

401.1.00 DESCRIPTION

401.1.01 TUNNELING

Tunneling shall include all methods by which the underground passageway is first excavated and then pipe or conduit is either brought in and placed or cast into place.

401.1.02 BORING

Boring shall include all methods by which a pipe or conduit is pushed or pulled into place and by which the excavation method precludes the stationing of a workers within the pipe or conduit without stopping or removing the excavation equipment.

401.1.03 JACKING

Jacking shall include all methods by which a pipe or conduit is pushed or pulled into place and one or more workers inside the conduit to excavate and assist in keeping the conduit on a straight and true grade and alignment.

401.1.04 PERMITTER

Within this Section, permitter shall designate the owner of railroad tracks or other facilities with prior rights, under which a pipe or conduit must be tunneled, bored, or jacked.

401.2.00 MATERIALS

401.2.01 PIPE BEDDING AND PIPE ZONE MATERIAL

Conform to the requirements of ***Section 204 Excavation, Embankment, Bedding, and Backfill***.

401.2.02 PIPE

Conform to ***Section 402 Pipe and Fittings (Sanitary Sewers and Storm Drains)*** for the strength, class, and type as shown or specified.

NEWER VERSION PUBLISHED

401.2.03 CASING

Corrugated metal pipe may be used for casing in tunneled, bored, or jacked applications where specified and approved. Give coupling bands a protective coating similar to pipes. Provide galvanized bolts for connection. Corrugated metal pipe shall conform to the requirements in ***Section 402 Pipe and Fittings (Sanitary Sewers and Storm Drains)***.

Provide casing of size to permit proper construction to the required lines and grades. Casing shall be the type shown in the table below.

Use a minimum gauge or wall thickness corresponding to the size of casing selected from the following; however be responsible for selecting the gauge consistent with the operations and the specified requirements of the permitter.

Diameter Inches	AASHTO M36 Corrugated Metal Pipe U.S. Standard Gauge	Smooth Steel Pipe Minimum Thickness
15-24	12	¼ ASTM A 53
30-36	10	5/16 AWWA C 201
48-78	8	Not Allowable

Equip jacked casings with nipples at the spring line and crown at 10 foot centers when pressure grouting is specified.

Optionally construct the casing of galvanized standard, offset tunnel liner plate with gauge and section modulus per inch of width, as approved. Nipples for pressure grouting, when specified, shall be installed at the spring line and crown at 10 foot centers.

401.3.00 CONSTRUCTION

401.3.01 GENERAL

Conform to all Federal, State, and local laws and regulations pertaining to tunneling and specifically to the standards set forth in the Oregon Safety Code for Places of Employment, Chapter 24, Safety Code for Mining, Tunneling, and Quarrying published by the Oregon Industrial Accident Commission, latest revision.

Before the start of the work, submit satisfactory evidence to the Engineer that all insurance coverage requirements called for by the permitter have been complied with. All proposed construction methods and materials shall be approved by the Engineer and permitter before the start of construction. Written approval to proceed from the permitter shall be submitted to the Engineer before the start of construction.

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401.3.02 EXCAVATION

Excavation shall be unclassified and shall include whatever materials are encountered to the depths as shown or as required.

401.03.03 TUNNELING DETAILS REQUIRED

Submit details of the following to the Engineer for approval before beginning the tunnel construction:

1. Tunnel shaft bracing and dimensions
2. Tunnel supports
3. Method of backpacking tunnel supports
4. Bracing to prevent pipe or conduit shifting and flotation
5. Backfill material or pressure grout mix, placement method, and equipment.

401.3.04 JACKING AND BORING DETAILS REQUIRED

Submit details of the following to the Engineer for approval before beginning the jacking or boring construction:

1. Jacking pit bracing.

2. Casing, pipe, or conduit.

3. Jacking head.

4. Excavation method.

5. Tee or wye installation.

6. A substitute design for any part of the system that must be changed as result of the jacking or boring operation (manhole, headwall, etc.).

7. Any structure that is required because of the particular method or procedure used by the Contractor.

8. If placed in a casing, bracing to prevent pipe shifting and flotation, backfilling material, method, and equipment.

9. Backfill material or pressure grout mix, placement method, and equipment.

NEWER VERSION PUBLISHED

401.3.05 TUNNELING

Tunneling will be permitted only where shown, specified, or approved.

Make the subgrade, upon which the pipe is to be placed or constructed, firm, thoroughly compacted, and true to grade. Pipe bedding shall conform to the Standard Plans for the type of bedding specified. Restore to grade by backfilling with approved Bedding Material, at no expense to the Owner, all excavation below grade, which is made inadvertently or without authority

401.3.06 ALTERNATE OF JACKING OR BORING

Jacking or boring may be allowed in lieu of the open trench method or tunneling. However, written approval by the Engineer must first be obtained. The Engineer retains the right to reject either the jacking or boring method without rejecting the other. Approval by the Engineer shall in no way relieve the Contractor of the responsibility for making a satisfactory installation meeting the requirements set forth herein.

401.3.07 JACKING AND BORING

Equip the leading section of pipe or conduit with a jacking head securely anchored thereto to prevent any wobble or alignment variation during the jacking or boring operation. For jacking, all excavation shall be carried out entirely within the jacking head, and no excavation is advance thereof shall be permitted. For jacking, every effort shall be made to avoid any loss of earth outside the jacking head. Remove excavated material from the pipe or conduit as excavation progresses, and do not allow such material to accumulate within the pipe or conduit.

Once the jacking operation has commenced, it shall be continued uninterrupted around the clock until the conduit has been jacked between the specified limits.

Jack or bore all pipes or conduits to true line and grade. Should any deviation from true line and grade be considered excessive, in the judgment of the Engineer, take up and relay that portion of the pipe or conduit at no expense to the Owner.

Should appreciable loss of ground occur during the jacking or boring operations, backpack all voids promptly. Fill all remaining voids upon completion of the operations; such filling or backpacking shall be with grout or approved granular material.

The design of all sewer pipe or conduit is based upon the superimposed loads and not upon the loads resulting from the jacking or boring operations. Be responsible for any increase in pipe strength necessary to withstand jacking or boring loads.

NEWER VERSION PUBLISHED

401.3.08 CONCRETE PIPE AND BOX SECTION

Protect the driving ends of concrete pipe or conduit against spalling and other damage. Intermediate joints shall be similarly protected by the installation of sufficient baring shims to properly distribute the bearing stresses. Remove any section of pipe or conduit showing signs of failure and replace with a new section or with a cast-in-place section which, in the judgment of the Engineer, is adequate to carry the loads imposed upon it.

401.3.09 SMOOTH STEEL CASING

Join sections of smooth steel casing to be jacked or bored by welding the joints with a continuous weld for full circumference or by other approved means. Provide joints which are capable of resisting the jacking and boring forces without failure.

Brace pipe or conduit installed in a casing to prevent shifting and flotation. Fill the void between the casing and the pipe or conduit with grout, or other material as specified or approved.

If not shown or specified, the casing diameter shall be the option of the Contractor. Provide casing of such strength as to withstand the jacking or boring loads and of such diameter to allow filling the void between the pipe or conduit and casing with the approved materials.

401.3.10 GROUTING VOIDS OUTSIDE CASING OR TUNNEL LINER

When grouting is specified, after the casing has been jacked into position or the liner plates have been placed in the tunnel, pressure grout to fill all voids outside the casing or liner plates through the grout holes provided. Start grouting at the spring line hole at one end and pump grout until grout appears in the grout hole at the crown, then start grouting through the opposite spring line hole until grout appears in the next set of holes along the pipe. Plug the holes at the starting point and move to the next set of holes and repeat grouting sequence until full length of jacked, bored, or tunneled pipe has been grouted. Grouting once commenced at any one point shall be completed without stopping.

401.3.11 CASED OR TUNNELED PIPE

Where timber cradles are shown, provide strapped timber cradle under barrel of pipe, join pipe, and slide into casing. Pipe barrel shall bear continuously on cradles. Pipe installation shall conform to applicable requirements in ***Section 402 Pipe and Fittings (Sanitary and Storm Sewers)***, including hydrostatic or air testing and line and grade.

401.3.12 PLACING BACKFILL OUTSIDE CARRIER PIPE

Where shown, or when directed, completely fill the annular space between the casing or tunnel liner and the carrier pipe or conduit with specified or approved backfill material. Accomplish backfilling by pumping material from the two ends at such intermediate points as may be necessary in a manner which will ensure all voids are filled. When grouting, use approved low pressure grouting equipment.

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401.3.13 RAILROAD CROSSINGS

The right is reserved by the Owner to require tunneling, jacking, or boring under any or all crossings.

Should open trench construction be required by the Owner at a railroad crossing, the railroad will take up and relay the tracks at no expense to the Contractor. Submit a schedule of operations to the railroad company and to the Owner 72 hours before trenching within 20 feet of the railroad tracks. Construct the pipe crossing and compact backfill through the track location within 72 hours after the tracks have been removed by the railroad unless otherwise specified.

When a tunneling alternate is chose, special attention shall be given to the backfill. Backfill as required in ***Section 204 Excavation, Embankment, Bedding, and Backfill***.

401.4.00 MEASUREMENT AND PAYMENT

401.4.01 TUNNELING, BORING, AND JACKING

Measurement and payment for tunneled, bored, and jacked pipe or conduit, will be made on a linear foot basis. Payment will include full compensation for all excavation, shafts, portals, jacking pits, tunnel stabilization, backfill, lubricant, grouting pipe, casing, and all appurtenances as approved, complete, except for tees and wyes.

Where casing is used at the option of the Contractor, the casing and the backfill between the pipe or conduit and the casing shall be included in the pay item for tunneling, boring, or jacking as applicable, and no separate payment will be made therefor.

Measurement for tunneling, jacking, and boring will be made on a linear foot basis along the centerline of the pipe or conduit between portals. Tunneling, jacking, and boring extensions beyond the limits shown shall be considered to be for the Contractor's convenience, unless ordered in writing, and measurement and payment for said extension shall be made as if the open trench method of construction had been used.

401.4.02 JACKING OR BORING IN LIEU OF TUNNELING

Where jacking or boring of a pipe or conduit is approved in lieu of tunneling, measurement and payment will be made as though the tunneling method had been used and payment shall be made at the bid price for tunneling.

401.4.03 TUNNELING, JACKING, OR BORING IN LIEU OF OPEN TRENCH

Where tunneling, jacking, or boring of a conduit is approved in lieu of open trench construction, measurement and payment will be made as though the open trench method had been used

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and will include all the pay items that would have been applicable if the open trench construction method had been used.

401.4.04 TUNNELING IN LIEU OF JACKING OR BORING

Where tunneling of a pipe or conduit is approved in lieu of jacking or boring, measurement and payment will be made as though the jacking or boring method had been used and payment shall be made at the bid price for jacking or boring as applicable.

401.4.05 RAILROAD TRACK CROSSINGS

Alternate bids for tunneling, jacking, or boring track crossings, if in the Proposal, are add or deduct adjustments per linear foot to the computed open trench cost. The computed open trench cost shall be based on the standard pay width, the depth as shown, the length as actually tunneled, portal to portal (except that it shall not exceed the maximum length as shown), and the following assumed pay items:

1. Trench excavation and granular backfill.
2. Pipe or conduit of the size and strength shown.
3. Surfacing material of the same type and thickness as exists within the track section.
4. Pavement base courses when required.
5. Crushed aggregate for Class B pipe bedding.

401.4.06 TEES AND WYES

Measurement and payment for tees and wyes in a tunneled, jacked, or bored pipe or conduit will be made at the Contract unit price for tees and wyes installed in an open trench as provided for in ***Section 402 pipe and Fittings (Sanitary Sewers and Storm Drains)***.

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402 Pipe and Fittings (Sanitary Sewer and Storm Drain)

402.1.00 DESCRIPTION

This section covers the following work:

1. Gravity and pressure sewer pipe
2. Culverts
3. Perforated pipe Underdrains
4. Fittings
5. Service line sewers

402.2.00 MATERIALS

402.2.01 GENERAL

Use all sewer pipe and fittings of the size, strength, material, and joint type specified on the Plans and/or in the Proposal. Use jointing material as hereinafter specified for each pipe material. Each piece of pipe shall be clearly identified as to strength, class, and date of manufacture. The manufacturer or fabricator shall furnish appropriate certification, based on manufacturer's routine quality control tests that the materials in the pipe and fittings meet the requirements specified herein. Strength, permeability, hydrostatic test, and pipe joints will be used as the basis of acceptance as described under proof tests herein. Minimum length of pipe shall be 3.5 feet.

It is not intended that materials listed herein are to be considered equal or generally interchangeable for all applications. The Engineer shall determine the materials suitable for the project and so specify.

Use pipe and fittings for service lines of one type of material throughout; no interchanging of pipe and fittings will be allowed. Use 4 inch diameter pipe for residential services when not otherwise specified.

Do not coat pipes for sewers internally or externally with any substance of any type in an attempt to improve its performance when air or hydrostatically tested.

402.2.02 CONCRETE PIPE

402.2.02A Non-reinforced Concrete Pipe

Use non-reinforced concrete pipe conforming to ASTM C 14 with ASTM C 150, Type II cement.

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402.2.02B Reinforced Concrete Pipe

Use reinforced concrete pipe conforming to ASTM C 76 with ASTM C 150, Type II cement. Elliptically reinforced pipe shall have top and bottom clearly marked.

402.2.02C Monolithic Concrete Pipe

Use monolithic concrete pipe conforming to the requirements specified.

402.2.02D Cast-in-place Pipe

Use cast-in-place pipe conforming to the requirements specified.

402.2.02E Perforated Concrete Pipe

Use perforated concrete pipe and fittings conforming to ASTM C 444, class and end type as specified.

402.2.03 CLAY PIPE

Use vitrified clay pipe, extra strength, conforming to ASTM C 700 and Clay Pipe Institute, West Coast Standards. Use perforated clay pipe conforming to ASTM C 278 with perforations conforming to ASTM C 211.

402.2.04 ASBESTOS-CEMENT PIPE – Deleted

402.2.06 DUCTILE IRON PIPE

Use ductile iron pipe conforming to ANSI A21.51 Class 150 or AWWA C 151, with push-on joint or mechanical joints as specified, conforming to Federal Specification WW-P-421c and ANSI Specification A21.11. Ductile iron pipe shall be lined with cement mortar and seal coated in accordance with ANSI Standard A21.4 and AWWA C 104.

402.2.07 ABS PIPE

Use ABS single wall pipe conforming to ASTM D 2751 with solvent-cemented or bell and spigot joints as specified.

Perforated ABS pipe and fittings shall be virgin rigid ABS plastic and shall conform to ASTM D 2751, Type I and Type IV, except that the minimum heat deflection temperature (ASTM D 648) shall be 180 degrees Fahrenheit. Wall thickness shall be not less than 0.140 inches for 4 inch diameter and 0.200 inches for 6 inch diameter. In addition, the pipe shall be perforated with 3/64 inch holes, 3 inches on center along the pipe. Four inch pipe shall have one row on each side approximately 45 degrees above bottom centerline. Six inch pipe shall have two rows on each side approximately 45 degrees above bottom centerline.

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402.2.08 PVC PIPE

Use PVC pipe conforming to ASTM D 3034, SDR 35, (4" - 15") or ASTM F 789, minimum pipe stiffness of 46 psi, (4" - 15") or ASTM F 679, as/when required by the Uniform Plumbing Code (with State of Oregon Amendments) for sanitary sewer service lines.

Use perforated PVC pipe conforming to ATM D 1785, Schedule 40. The perforations shall consist of two rows of 2 inch slots. The slots shall be transverse to the axis of the pipe. The two rows of slots shall be 120 degrees on centers. Slot size shall be 0.4 inches.

402.2.09 GALVANIZED CORRUGATED IRON & STEEL PIPE

Use galvanized corrugated iron or steel pipe and coupling bands of the gauges and type as shown or specified, and conforming to the material, fabrication, and inspection requirements of AASHTO Designation M36 or M 219.

402.2.10 CORRUGATED ALUMINUM ALLOY PIPE

Use corrugated aluminum alloy pipe and coupling bands of the gauges and types as shown or specified and conforming to the material, fabrication, and inspection requirements of AASHTO Designations M 196, M 197, M 211, and M 219.

402.2.11 ASBESTOS-BONDED PIPE

Culvert pipe shall be asbestos-bonded metal pipe when specified. At the time the flat sheet metal is galvanized, a layer of asbestos felt shall be pressed into the molten zinc coating. The sheets shall be air cooled, corrugated, and formed into the corrugated steel pipe. The finished pipe shall be completely coated with hot bituminous material conforming to AASHTO M 190, with a minimum thickness of 0.05 inch at the crest of the corrugation.

402.2.12 FLARED END SECTIONS

Use precast concrete flared-end sections conforming to the requirements for reinforced concrete pipe herein specified. The area of steel reinforcement per linear foot of flared-end section shall be at least equal to the minimum steel requirements for circular reinforcement in circular pipe for the internal diameter of the circular portion of the flared-end section. Have all details of construction approved by the Engineer.

Use prefabricated steel flared-end sections conforming to AASHTO M 218, and prefabricated aluminum flared-end sections conforming to AASHTO M 196.

402.2.13 BITUMINOUS COATING

When specified, completely coat the inside and outside surfaces of corrugated metal pipe with bituminous material conforming to AASHTO M 190, with a minimum thickness of 0.05 inch at the crest of the corrugations.

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402.2.14 PAVED INVERTS

When specified, pave the inside surface of the corrugated metal pipe for one-quarter of its circumference with bituminous material to provide a flat invert centered in the bottom of the pipe. The pavement, except where the upper edges intersect the corrugations, shall have a minimum thickness of 1/8 inch above the crests of the corrugations. Suitable mark the outside of the pipe on both ends to clearly designate the centerline of the top of the pipe.

402.2.15 SERVICE CONNECTION MARKERS

Use new 2" x 4" utility grade lumber, or better, in one piece. No splicing will be permitted.

402.2.16 JOINTING MATERIALS

Use only lubricants for jointing materials approved the manufacturer.

402.2.16A Concrete Pipe

Use rubber gaskets for bell and spigot pipe conforming to ASTM C 443. Use captive gasket in groove design for pipe 24 inch diameter and larger. Mortar for tongue and groove pipe shall conform to ***Section 205 Materials***.

402.2.16B Clay Pipe

Use rubber gaskets for clay pipe conforming to ASTM C 425.

402.2.16C Asbestos-Cement Pipe – Deleted

402.2.16D Cast Iron and Ductile Iron Pipe

Use rubber gaskets conforming to ANSI A21 11.

402.2.16E ABS Pipe

Use solvent and cement or gaskets as specified in ASTM D 2751.

402.2.16F PVC Pipe

Use rubber gaskets for PVC pipe conforming to ASTM F 477.

402.2.19 PROOF TESTS

402.2.19A General

The intent of this requirement is to prequalify a joint system, components of which meet the join requirements, as to the water tightness capability of that joint system. This proof test shall be understood to apply to all sanitary sewers and to storm drains

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which are to be tested for water tightness prior to acceptance. Material and test equipment for proof testing shall be provided by the manufacturer. Joints shall meet the requirements of yard testing specified below. The pipe manufacturer shall submit results of the yard tests made, certified by a testing agency approved by the Engineer. When approved, internal hydrostatic pressure may be applied by a suitable joint tester. In general, each pipe material and joint assembly shall be subject to the following three proof tests at the discretion of the Engineer:

1. Pipe in Straight Alignment. No less than three nor more than five pipes selected from stock by the Engineer shall be assembled according to the manufacturer's installation instructions with the ends suitably plugged and restrained against internal pressure. The pipe shall be subjected to 10 psi hydrostatic pressure for ten minutes. Free movement of water through the pipe joint of pipe wall shall be grounds for rejection of the pipe.

2. Pipe in Maximum Deflected Position. A test section shall be deflected as described hereinafter for each pipe material. The pipe shall be subjected to 10 psi hydrostatic pressure for ten minutes. Free movement of water through the pipe joint or pipe wall shall be grounds for rejection of the pipe.

3. Joints Under Differential Load. The test section shall be supported on blocks or otherwise as described hereinafter for each pipe material. There shall be no visible leakage when the stressed joint is subjected to 10 psi internal hydrostatic pressure for ten minutes.

402.2.19B Concrete Pipe

For deflected position, create a position ½ inch wider than the fully compressed position, on one side of the outside perimeter.

For differential load, support so that one pipe is suspended freely between adjacent pipe, bearing only on the joints. In addition to the weight of the suspended pipe, add a test load as given in the following table:

Test Loads For Concrete Pipes Under Differential Load		
Pipe Size	**Load per foot laying length up to 4 feet**	**Total load for pipe 4 feet and over**
4 inches	650	2,600
6 inches	1,000	4,000
8 inches	1,300	5,200
10 inches	1,400	5,600
12 inches	1,500	6,000
15 inches	1,850	7,400
18 inches	2,200	8,800
21 inches	2,500	10,000
24 inches and over	2,750	11,000

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402.2.19C Clay Pipe

For deflected position, deflect on joint ½ inch per foot of pipe length for pipe 12 inches or less in diameter or 3/8 inch per foot of pipe length for pipe 15 inches to 24 inches in diameter.

For differential load, support so that one pipe is suspended freely, 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.

402.2.19D Asbestos-Cement Pipe – Deleted

402.2.19E Cast Iron Pipe and Ductile Iron Pipe

For deflected position, create a position ½ inch wider than the fully compressed section, on one side of the outside perimeter.

For differential load, support so that one of the pipes is suspended freely between adjacent pipe, bearing only on the joints. Apply a force per the following table along a longitudinal distance of 12 inches, immediately adjacent to one of the joints.

Pipe Size	Force-Pounds	Pipe Size	Force-Pounds
4 inches	600	15 inches	3,700
6 inches	900	18 inches	4,400
8 inches	1,200	21 inches	5,000
10 inches	1,500	24 inches and over	5,500
12 inches	1,800		

402.2.19F ABS Pipe

For deflection position, join two 12 ½ foot lengths and deflect along an arc of 720 feet radius (0.11 feet offset at the end of each length, from a tangent at the joint).

For differential load, support so that one of the pipes is suspended freely between adjacent pipe, bearing only on the joints. Apply a force of 150 pounds per inch diameter over and arc on not less than 120 degrees and along a longitudinal distance of 12 inches immediately adjacent to one of the joints.

402.2.19G PVC Pipe

For deflected position, join 12 ½ foot lengths, then deflect along an arc of 720 feet radius (0.11 feet offset at the end of each length, from a tangent at the joint).

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For differential load, join two lengths and uniformly support or at least 2 feet on both sides of the joint with vertical load supplied sufficient to deflect the joint and adjacent pipe to 95 percent of its initial vertical diameter.

402.2.20 FITTINGS

402.2.20A General

Provide tee or wye fittings in the sewer main for service line sewers and catch basin or inlet connections. Tees and wyes for service line sewers shall be 4 inches inside diameter, unless otherwise specified. All fittings shall be of sufficient strength to withstand all handling and load stresses encountered. All fittings shall be of the same materials as the pipe unless otherwise specified. Material joining the fittings to the pipe shall be fee from cracks and shall adhere tightly to each joining surface. Use the same type of joints on all fittings that are used on the main sewer pipe. Tee or wye fittings shall not be closer than 12 inches to any joint or bell of main line sewer which is 12 inches or less in diameter.

402.2.20B Concrete Pipe

Use shop fabricated fittings on 12 inch and smaller concrete pipe. Fittings on pipe 15 inches and larger may be field or shop fabricated.

Submit and obtain approval of fabrication details for shop fabricated fittings prior to delivery of fittings to the jobsite.

402.2.20C Clay Pipe

Use fitting on clay pipe which conform to ASTM C700.

402.2.20D Asbestos-Cement Pipe – Deleted

402.2.20E Cast Iron and Ductile Pipe

Use mechanical joint cast iron fittings conforming to ANSI A21.10 and AWWA C 110, and of a class at least equal to that of the adjacent pipe. Use push-on fittings of gray cast iron with body thickness and radii of curvature conforming to ANSI A21.10 and joints conforming to ANSI A21.11 and AWWA C 111 or Federal Specification WW-P-421C.

402.2.20F PVC Pipe

Use push-on type fittings for joints conforming to the same standards as the pipe.

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402.2.20G ABS Pipe

Use fittings which conform to ASTM D 2751.

402.2.21 COUPLINGS, BANDS, AND FITTINGS FOR CORRUGATED METAL PIPE

Use couplings, bands, and fittings as specified by the pipe manufacturer and approved by the Engineer.

402.3.00 CONSTRUCTION

402.3.01 LINE AND GRADE FOR GRAVITY AND PRESSURE SANITARY SEWERS

Do not deviate from line or grade, as established by the Engineer, more than ½ inch for line and ¼ inch for grade, provided that such variation does not result in a level or reverse sloping invert. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness. Establish line and grade for pipe by the use of approved lasers or by transferring the cut from the offset stakes to batter boards at maximum intervals of 25 feet. If batter boards prove impractical because of trench conditions, submit other methods of grade and alignment control for approval.

402.3.01A Line and Grade for Service Line Sewers

The Engineer will establish line and grade to the tract of land to be serviced by the sewer system. At the preselected location of the service line, a stake will be driven into the ground showing the depth of excavation required at the property line.

Lay the pipe on a straight line and at a uniform grade between the tee and the stake. Where minimum slopes are used, lay the pipe by means of a builder's level of good quality and not less than 24 inches in length. Minimum slope shall be ¼ inch per foot unless otherwise permitted by the Engineer, but in no case less than 1/8 inch per foot.

402.3.02 PIPE DISTRIBUTION AND HANDLING

Distribute material on the job no faster than it can be used to good advantage. Unload pipe only by approved means. Do not unload pipe of any size by dropping to the ground. Do not distribute more than one week's supply of material in advance of laying, unless approved.

Inspect all pipe and fittings prior to lowering into trench t ensure no cracked, broken, or otherwise defective materials are used. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

Use approved implement, tools, and facilities for the safe and proper protection of the work. Lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. Remove all damaged pipe from the jobsite. Do not drop or dump pipe into trenches.

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402.3.03 PIPE LAYING AND JOINTING OF PIPE AND FITTINGS

402.3.03A General

Proceed with pipe laying upgrade with spigot or tongue ends pointing in direction of flow. Place pipe in such a manner as to ensure solid bearing between the pipe and the full cross sectional accordance with the recommendations of the manufacturer. Take care to properly align the pipe before joints are forced entirely home. Upon completion of pipe laying all pipe joints shall be in the ***home*** position, which is defined as the position where the least gap (if any) exists, when the pipe components that comprise the joint are fitted together as tightly as the approved joint design will permit. Gaps at pipe joints shall not exceed that allowed by the manufacturer's recommendations. For curved sewers the normal gap will be the gap existing when the pipe joints are in the ***home*** position as described above, for the pipe in the specified deflected position. After installation prevent movement from any cause including uplift or floating.

Take special care to prevent movement of the pipe after installation when laid within a movable trench shield.

When laying operations are not in progress, protect the open end of the pipe from entry of foreign material and block the pipe to prevent movement or creep of gasketed joints.

Plug or close off pipes which are stubbed out for manhole construction or for connection by others.

Provide all sewer pipes, 36 inched or smaller in diameter, entering or leaving manholes or other structures, with flexible joints within 18 inches of the exterior wall. Pipes larger than 36 inches in diameter shall have this flexible joint within a distance from the exterior wall equal to one-half the inside pipe diameter.

When cutting and/or machining the pipe is necessary, use only tools and methods recommended by pipe manufacturer.

When shown or approved to deflect pipe from a straight line, either in the vertical or horizontal plane, or when long-radius curves are shown, the amount of deflection allowed shall not exceed that specified or approved by the Engineer. The pipe manufacturer's recommendations will serve as a guide but the decision of the Engineer shall be final.

402.3.03B Concrete Pipe

Use rubber ring gasket joints unless mortar joints are specifically specified. When mortared joints are used, the entire joint for the full circumference of the pipe shall be completely filled with mortar. The surfaces of the pipe joint shall be brushed clean prior to mortaring. Fill the exterior of the joint with mortar and in the case of bell and spigot joints, fill to an angle of 45 degrees.

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Lay elliptical reinforced pipe so that the top or bottom marks are not more than 5 degrees from a vertical plane.

402.3.03C Corrugated Metal Pipe

Repair all damaged areas of the protective coating with material similar to the original as approved and permit to dry of solidify before backfilling.

402.3.04 PERFORATED PIPE UNDERDRAINS

402.3.04A Trench Excavation and Backfill

Conform to applicable requirements in ***Section 204 Excavation, Embankment, Bedding, and Backfill***.

402.3.04B Pipe Bedding

Provide a minimum 4 inch bedding of special filter material under perforated drain pipe, or as shown. Hand grade the bedding to proper grade ahead of pipe laying. Provide a firm, unyielding support along the entire pipe length.

402.3.04C Backfill at the Pipe Zone

Backfill the pipe zone with special filter material, hand placed simultaneously on both sides of the pipe for the full trench width and hand tamp with approved tamping sticks supplemented by ***walking in*** and slicing with a shovel.

402.3.04D Backfill Above the Pipe Zone

Use special filter material for backfill above the pipe zone, unless otherwise specified.

402.3.04E Laying and Jointing Perforated Pipe

Securely fasten together perforated pipe with couplings, fittings, or bands as specified by the manufacturer for the type of pipe used. Close upgrade ends of all subsurface drain pipe with approved plugs to prevent entry of soil materials.

Begin pipe laying normally at the outlet end of the pipe line. The lower segment of pipe shall be in contact with the shaped bedding throughout is full length. Bell or grove ends of rigid pipe and outside circumferential laps of flexible pipe shall be placed facing the upgrade end.

Lay all perforated pipe, except perforated PVC drain pipe, with perforations facing down, unless otherwise specified or directed. Place perforated PVC drain pipe with slots facing up.

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Inspect all pipe prior to lowering into the trench and, if necessary, clean of any material tending to plug the perforations of the pipe. Have available the proper tools, labor, and equipment for efficient execution of the work. Carefully lower al pipe and fittings into the trench to avoid any contamination of the filter bedding material.

402.3.05 MONOLITHIC CONCRETE PIPE

402.3.05A Invert Placing

For the invert portion or base of the pipe between templates spaced at approved intervals to form convenient sections for construction.

Mix the concrete dry enough to stand in place after being tamped and wet enough to be dense without excessive tamping. When specified, bring the surface of the concrete in the invert to proper distance below the flow line to allow for invert lining.

402.3.05B Barrel Placing

After the invert of the pipe is constructed, place the remaining portion of the barrel between transverse joints in one continuous operation.

402.3.05C Longitudinal Joints

Place longitudinal construction joints and keyways as shown or as approved.

402.3.05D Transverse Joints

When not shown on the Plans, locate and construct transverse construction joint with keyways in order to minimize and localize transverse cracking due to contraction of the concrete. Provide transverse joints at intervals not exceeding 40 feet. The position of construction joints in the invert and the remainder of the pipe barrel shall coincide.

402.3.05E Connections to Existing Pipes

Connections of service lines to existing sewers shall be made watertight. Connection shall be made where possible to existing tees or wyes previously installed and plugged. The plug shall be removed and connection made in accordance with the requirements of Section 404. Transition couplings between dissimilar pipe materials shall be made using approved commercial adapters with stainless steel bands such as Fernco, Caulder, or approved equal.

No service line or building sewer shall be connected to an existing sewer without prior inspection and approval of the pipe for water tightness and proper construction in accordance with the State plumbing code. Previous use of the service line or building sewer for septic tank or other application, or absence of usable cleanouts for accessing the building sewer, shall not excuse the requirement for testing except as may be authorized by the Owner.

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Where tees or wyes for connection are absent or unusable, connection of service lines shall be made with and approved tap such as Fowler Inserta-Tee, or approved equal. All taps shall not be backfilled until inspected and approved by the Engineer.

Taps shall be installed without protrusion into or damage to the existing sewer. The sewer shall be supported and bedding material replaced, as necessary, to prevent settlement of the sewer grade.

All taps made on existing sewers shall be by the Owner unless otherwise approved by the Owner.

402.3.05F Tests of Workmanship

Monolithic pipes shall be substantially tight against leakage from either the inside or outside and shall pass all required tests prior to acceptance. Upon completion, and prior to final acceptance, correct any leaks to the satisfaction of Engineer by grouting or other approved means. Cut out any cracks other than hairline cracks visible from the inside to a depth permitting caulking and caulk with neat cement or lead wool.

402.3.06 INSTALLATION OF SERVICE LINE SEWERS, TEES, AND WYES

Install tee and wye fittings and service line sewers as shown on the Standard Plans. Provide a compacted crushed aggregate base of pipe bedding material under all tees and wyes and branch fittings, extending to the springline of the fittings. Place bases on undisturbed native material or compacted foundation stabilization material.

Maximum deflection permissible with any one fitting shall not exceed 45 degrees and shall be accomplished with long-radius curves or bends, except when approved.

Connect service lines to manholes only when directed. Make the connection so the standard pipe joint is located not more than 1.5 feet from the structure.

Provide ends of all service lines and fittings with approved watertight plugs, caps, or stoppers, suitable braced to prevent blow off during internal hydrostatic or air testing. Such plugs or caps shall be removable and their removal shall provide a socket suitable for making a flexible joint lateral connection or extension.

Where a water line is encountered during sewer service line construction, lay the new service pipe so that it crosses said water line at a 90 degree angle thereto and at a distance greater than 18 inches below it. Where the sewer service must cross a water line above it or closer than 18 inches under it, use an 18 foot length of ductile iron water pipe centered on the water line such that it extends an equal distance each side of the water line. The ductile iron pipe shall be jointed at each end to the specified service pipe with a cast iron mechanical coupling (long style) which relies on a minimum of four longitudinally arranged bolts to provide compression of the seal to the pipe wall: dresser Style 40 or equal. (See Standard Plan 409)

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402.3.07 MARKERS

In new subdivisions and undeveloped areas where applicable, after the service line pipe is installed, block the capped or plugged end and install 2" x 4" marker. Extend markers at least 12 inches above the ground surface. The lower end of the marker shall be placed above the plugged end of the pipe to prevent damages to the sewer. Paint the top portion of the marker after its installation with first quality white, quick drying enamel. After the paint has dried, use black, quick drying enamel and neatly indicate the distance from the natural ground surface to the top of the service line pipe in feet and inches.

Take precautions during the backfilling operation to ensure the position and location of the marker. If the marker is broken or knocked out of vertical alignment during the backfilling operation, reopen the trench and replace the marker. Omit markers in developed areas where installing the marker is not feasible, as determined by the Engineer.

402.3.08 FLARED END SECTIONS

Construct flared end sections in accordance with the details and dimensions shown, except that minor variations may be accepted to permit the use of the manufacturer's standard prefabricated sections and methods of fabrication.

Conform excavation, bedding, and backfill to applicable requirements herein for the adjacent pipe or drain to be joined.

402.3.09 CONCRETE CLOSURE COLLARS

Use concrete closure collars only when specified or approved. Construct in conformance with the details provided. Wash pipe to remove all lose material and soil from the surface on which the concrete will be placed. Wet nonmetallic pipe thoroughly prior to pouring the collars. Construct forms with materials that will ensure that no concrete shall enter the line. Make entire collar in one pour, and do not pour collars in water. After the collars are poured, and have taken their initial set, cure by covering with well moistened earth. Do not backfill the trench until the concrete has sufficient strength as determined by the Engineer.

402.3.10 DEEP CONNECTION RISERS

Where the slope of the service line between the curb and the wye or tee on the sanitary sewer is greater than 45 degrees, construct a deep connection riser in conformance with the details shown on the Standard Plan. The concrete foundation for supporting deep connection risers shall bear upon firm native ground. Avoid any concentrated load on the main sewer pipe.

Construct laying and jointing of the vertical pipe for encasement in concrete as specified herein, including the sealing of unused tee or wye branches at the top of the connections.
Backfill around vertical pipe connections by compacting approved materials in 8 inch layers with mechanical tampers. Backfill from a wide base foundation and slope up evenly to the top of the deep connection, to provide a compacted subgrade for the service line pipe.

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402.3.11 CULVERTS

Remove and replace culverts in conformance to all applicable requirements of this Section and ***Section 204 Excavation, Embankment, Bedding, and Backfill***.

402.3.12 DISCONNECTION AND RECONNECTION OF EXISTING SERVICE LINES

When shown or directed, disconnect existing service lines from existing sewers and reconnect them to the new sewers. Be responsible for locating the existing service lines prior to installing the tee or wye in the new sewer line. It is intended the Contractor reconnect only active services to the new main. Therefore, the Contractor shall verify that each service he/she intends to connect is active prior to installing the mainline tee and/or laying the service pipe. Initial verifications have been done by the Owner except where indicated on the Plans. Final verification, however, is the Contractor's responsibility. There will be no separate payment for service verification. Costs shall be incidental to the various Contract bid items for service line construction.

The Contractor is advised the Owner's receipt of Permits of Entry from Property Owners does not relieve the Contractor from tasks of liaison with and obtaining concurrence from individual Property Owners upon whose premises work must be done. The grade for the new mains is based upon an approximate depth of the service at the connection point(s). The actual grade of the service has not been determined.

Sewer service lines to be replaced shall be potholed at the plan point of reconnection to verify location prior to placing the mainline tee or manhole tap. The Contractor shall determine the precise grade of the service and verify the grade of the main at the connection point shown is adequate to allow a 2 percent grade on the service line. This shall be verified prior to laying mainline pipe. Re-excavation and re-laying of mainline pipe at a deeper grade shall be at the expense of the Contractor. The mainline tee shall be located so that the point of reconnections is approximately at right angle thereto unless otherwise shown or approved by the Engineer. Location of the tee may be altered slightly so that service line construction will avoid driveways. There will be no separate payment for potholing, it being understood that the cost thereof is included in and incidental to the various Contract bid items for service line construction.

Services are to be bid as shown on the Plans; however, adjustment in alignment, etc., may be permitted based upon a reduction of price negotiated with the Engineer prior to the work with the method approved by the Property Owner.

It is intended service work will progress along with mainline work to minimize disruption to the project area. Actual reconnection shall be completed such that disruption of the building sanitary service is less than five hours. Cleanup shall closely follow the work.

402.3.13 FIELD FABRICATED CONNECTIONS

Field fabricate tees or wyes for required connections when shown or directed. Make all field fabricated tees or wyes similar to approved manufacturer supplied tees or wyes and provide for a flexible joint at the point of connection to the tee or wye. Do not allow tee or wye to

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protrude past the inside wall surface of the sewer pipe, and finish the inside wall surface of the sewer pipe to provide a smooth surface for uninhibited flow through the sewer. Fabricate fittings by inserting a stub into a hole cut in the pipe and grout with a non-shrinking grout. Coat surfaces to receive grout with an epoxy bonding agent prior to grouting. Fabrication details for fittings shall be submitted for and approval obtained prior to fabrication.

402.3.14 TESTING SANITARY SEWERS AND STORM DRAINS

402.3.14A General

1. All gravity sanitary sewers including service line sewers and appurtenances shall successfully pass an air test prior to acceptance and shall be free of leakage. In general, use either method of testing. Manholes shall be tested as specified in ***Section 403 Manholes, Inlets, and Concrete Structures***.

2. All pressure sewer force mains shall be tested in accordance with ***Section 501 Water Pipe and Fitting***, when not otherwise specified.

3. Leakage or infiltration tests for storm drains will not be required unless called for on Plans or in the Special Provisions.

4. At the discretion of the Engineer, the City may, at no expense to the Contractor, make a televised inspection of the sanitary sewer and/or storm drain pipe. Any defects in material or workmanship shall be satisfactorily corrected prior to final acceptance of the work.

5. When the quality of materials used or workmanship performed during the construction of storm drains is in doubt for any reason, the Engineer may require the storm drain and all applicable appurtenances to be tested. When so ordered, the storm drain shall be required to pass the same air test specified hereafter for sanitary sewers.

402.3.14B Water and Equipment for Test – Deleted.

402.3.14C Cleaning Prior to Testing and Acceptance

Prior to final testing, acceptance, and final manhole-to-manhole inspection of the sewer system by the Engineer, clean all parts of the system. Remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system at or near the closest downstream manhole. If necessary, use mechanical rodding or bucketing equipment, pigging, scotters, or high velocity cleaners.

Upon the Engineer's final manhole-to-manhole inspection of the sewer system, if any foreign matter is still present in the system, re-clean the sections and portions of the lines as required.

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402.3.14D Testing Procedure

Perform the tests in a manner satisfactory to the Engineer. Any arrangement of testing equipment which will provide observable and accurate measurements of air leakage under the specified conditions will be permitted. Calibrate gauges for air testing with a standardized test gauge provided by the Engineer at the start of each testing day. The calibration shall be witnessed by the Engineer; notify him/her prior to each test.

402.3.14E Time of Test

Make tests of sections of constructed sanitary sewer for acceptance only after all service connections; manholes, backfilling, and compaction are completed between the stations to be tested. Unless otherwise approved, do not allow testing of completed sections of sewer between manholes to lag more than on completed section behind the work in progress. Owner may require testing of manhole-to-manhole sections as they are completed in order to expedite the acceptance of sections of sewer and allow connections prior to the whole system being completed.

402.3.14F Repairs

Repair or replace, in a manner approved by the Engineer, any section of pipe not meeting the air test requirements, or which has leakage.

If repairs are extensive, or if the Engineer deems it necessary, an additional air test will be required.

Infiltration of ground water in an amount greater than herein specified, following a successful air test as specified, shall be considered as evidence that the original test was in error or that subsequent failure of the pipeline has occurred. Correct such failures occurring within the warranty period in a manner approved by the Engineer at no expense to the Owner.

The Contractor, in contracting to do this work, agrees that the leakage allowances as indicated herein are fair and practical.

402.3.14G Hydrostatic Testing – Deleted.

402.3.14H Air Testing

General. The Engineer may, at any time, require a calibration check of the instrumentation used. Use a pressure gauge having minimum division of 0.10 psi and an accuracy of 0.0325 psi. (One ounce per square inch.) All air used shall pass through a single control panel.

All plugs used to close the sewer for the air test must be capable of resisting the internal pressures and must be securely braced. Place all air testing equipment above ground and allow no one to enter a manhole or trench where a plugged sewer is under

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pressure. Release all pressure before the plugs are removed. The testing equipment used must include a pressure relief device designed to relieve pressure in the sewer under test at 10 psi or less and must allow continuous monitoring of the test pressures in order to avoid excessive pressure. Use care to avoid the flooding of the air inlet by infiltrated ground water. (Inject the air at the upper plug if possible.) Use only qualified personnel to conduct the test.

Ground Water. The presence of ground water will affect the results of the test. Determine the average height of ground water over the sewer immediately before starting the test; the method of checking the ground water height shall be as approved.

Method. Use the Time-Pressure Drop Method for all air testing. The test procedures are described as follows:

1. Clean the sewer to be tested and remove all debris where noted.

2. Wet the sewer prior to testing, if desirable.

3. Plug all sewer outlets with suitable test plugs. Brace each plug securely.

4. Check the average height of the ground water over the sewer. The test pressures required below shall be increased 0.433 psi for each foot of average water depth over the sewer.

5. Add air slowly to the section of sewer being tested until the internal air pressure is raised to 4.0 psig greater than the average back pressure of any ground water that may submerge the pipe.

6. After the internal test pressure is reached, allow at least 2 minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure.

7. After the temperature stabilization period, disconnect the air supply.

8. Determine and record the time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig greater than the average back pressure of any ground water that may submerge the pipe.

9. Compare the time recorded in step 8 with the time required as determined hereinafter.

Acceptance. The sewer shall be considered acceptable when tested as described hereinbefore, if the section under test does not lose air at a rate greater than .0015 cfm per square foot of internal sewer surface.

If the sewer fails to meet these requirements, determine the reason for leakage and repair or replace all defective materials or workmanship, all at no expense to Owner.

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The completed sewer shall meet the requirements of this test before being considered acceptable.

This specification shall also be considered as satisfied if the time as measured by the preceding described method is not less than the time as computed according to the following procedure:

1. Record the diameter in inches and the length in feet of all pipe in the section to be tested, including the house branches, in a table similar to the one shown below:

Diameter Inches	Length Feet	$K = 0.011\ d^2L$	$C = 0.0003882dL$

Total

Time required by Specification = _____ Seconds

Actual Time as determined by test = _____ Seconds

2. Using the nomograph supplied by Engineer, place a straightedge from the "d" column (diameter in inches) to the "L" column (length in feet). Read the corresponding "K" and "C" values and record them in the table.

3. Add all values of "K" and all values of "C" for the section being tested.

4. If the total of all the "C" values is less than one, the time required by the Specifications shall be <u>two times</u> the total of the "K" values.

5. If the total of all the "C" values is more than one, the time required by the Specifications shall be <u>two times</u> the total of all "K" values divided by the total of all "C" values. To make this calculation with the nomograph included in these Specifications, use the "C" and "K" scales and multiply by <u>two</u> the quotient (time) read from the "tq" scale.

6. In the event that the "d" and "L" values for a particular section of sewer do not fall within the limits of the nomograph the values of "K" and "C" may be computed from the following equations:

   "K" = $0.011\ d^2L$; "C" = $0.0003882dL$

<u>402.3.15 DEFLECTION TEST FOR PVC AND ABS PIPE</u>

In addition to air testing and television inspection, a deflection test may be required of all sanitary sewers, storm drains, and culverts constructed of PVC or ABS pipe after the trench backfill and compaction has been completed. If required, deflection test will be performed by Owner in conjunction with the television inspection as stated in ***Subsection 402.3.16 Television Inspection of Sanitary Sewers and Storm Drains***. The test shall be conducted by pulling an approved solid pointed mandrel or a variable defection measuring gauge through the

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completed pipeline. The diameter of the mandrel shall be 95 percent of the pipe diameter unless otherwise specified by the Engineer. Testing will be conducted by the Owner on a manhole-to-manhole basis and only after the line has been completely cleaned by the Contractor. Locate and repair any sections failing to pass the test and to retest the section, at no expense to Owner. Do not use the solid pointed mandrel on the 11 month inspection due to live services.

402.3.16 TELEVISION INSPECTION OF SANITARY SEWERS AND STORM DRAINS

Upon completion of all sewer and/or storm drain construction, repairs, cleaning, and required tests, notify the Engineer that all lines are ready for televiewing inspection.

Subsequent to being notified, the Owner shall commence examination of the lines or may waive the television inspection. Findings will be recorded and then correct all deficiencies at no expense to the Owner.

Upon correction of deficiencies revealed by televiewing, notify the Engineer; the same steps listed above may be repeated until all work is acceptable.

The City of Salem may, at its own option, perform the mandrel deflection test at the same time it performs is television inspection.

402.3.17 ELECTRICAL LOCATOR

All nonmetallic yard building sewer piping shall have an electrically conductive tracer wire, 12-gauge, insulated copper, green in color, installed in the trench for locating the pipe in the future. The tracer wire shall run the full length of the installed pipe, with one end left above the finished grade at the building end of the pipe, or at the test tee or cleanout next to the building wall, and shall be clearly marked. The other end of the tracer wire shall be spliced into the service utilities trace wire, when present. When no serving utility tracer wire is present, securely attach trace wire at mainline tee or to point of connection to service line.

402.4.00 MEASUREMENT AND PAYMENT

402.4.01 SANITARY SEWER AND STORM DRAIN PIPE

Measurement and payment for conduits and sanitary sewer and storm drain pipe, including culverts, pressure line sewers, and pipe stub outs from manholes, will be made on a linear foot basis for the type and class of sanitary sewer pipe the Contractor selects from acceptable pipes shown on the Plans for the sizes and bedding classes of sanitary sewer pipe listed in the Proposal and as actually installed. All pipe, except service line pipe, will be measured horizontally from center-to-center of manholes or to the ends of the pipe, whichever is applicable. No deductions will be made for fittings or for structures.

Measurement and payment for service line pipe will be made on a linear foot basis for the type and class of sanitary sewer pipe the Contractor selects from acceptable pipes shown on the

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Plans for the sizes and bedding classes of sanitary sewer pipe listed in the Proposal. Length will be measured as total length of pipe installed, commencing at the centerline of the sewer main, or centerline of deep connection riser, or point of connection to manhole or pipe as applicable and terminating at the end of the pipe bell or point of connection to the existing service, including all fittings, measured along the pipe centerline.

Payment shall constitute full compensation for the pipe in place, including connection of new pipe to new manholes, testing, plugs, and the markers for service line pipe.

Measurement and payment for disconnecting and reconnecting existing service lines will be made on the same basis as payment for service line pipe, and the footage required will be included in the total footage for service line pipe as shown in the Proposal.

Payment for new tees, wyes, field taps, and permanent plugs will be made separately under the respective items shown in the Proposal. There will be no separate payment for pipe and fittings used by the Contractor to facilitate the air test or for concrete closure collars and connections to existing pipes using "Calder" coupling, or equal, in conformance with material and construction Subsections of this Section, it being understood that the costs thereof are included in and incidental to the contracted prices for the applicable fitting or pipe work items listed in the Proposal.

402.4.02 PERFORATED PIPE UNDERDRAINS

Measurement and payment for perforated drain pipe will be made on a linear foot basis for the type and size of pipe installed as shown in the Proposal. Length will be measured as total length of pipe installed, including fittings measured along the pipe centerline. Payment shall constitute full compensation for trench excavation, special filter material for pipe bedding and trench backfill, and all other work specified to complete the installation of the perforated drain pipe complete in place.

402.4.03 FLARED END SECTIONS

Measurement and payment for flared end sections will be made on a unit price basis for each type and size actually installed as shown in the Proposal. Payment shall include full compensation for the flared end section complete in place including concrete cutoff walls, and toe plates when required.

402.4.04 TEE AND WYE FITTINGS

Measurement and payment for service tees and wyes installed in the sewer lines will be made at the unit price for each size and type as shown in the Proposal and actually installed. Since no deduction will be made under the payment item for pipe for the length of the tee or wye, the unit price for tee and wye fittings shall include only the additional cost of furnishing and installing the tee or wye fitting, over the cost of furnishing and installing an equivalent straight run of pipe. Payment will include full compensation for pipe plugs, stoppers, or caps installed.

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402.4.05 CONCRETE CLOSURE COLLARS AND RECONNECTIONS

Measurement and payment for concrete closure collars, and/or reconnections will be made at the unit price each as shown in the Proposal and actually constructed. Payment shall include full compensation for all materials, equipment, and labor necessary to complete the work.

402.4.06 DEEP CONNECTION RISERS (CHIMNEYS)

Payment will be made for each ***Deep Connection Riser*** constructed in accordance with Standard Plan Number 114 for each riser pipe size listed in the Proposal. Such payment shall include full compensation for extra width mainline trench excavation and backfill, pavement removal and replacement, bedding, concrete support block, all riser pipe from mainline tee to ground surface (including 1/8 bend), and standard cleanout with cover. The mainline tee and wyes in the riser will be paid separately under Contract items for ***Tee and Wye Fittings***.

No separate payment for deep connection risers including mainline tee and wyes in the riser will be made when constructed as part of a polyethylene liner pipe system in accordance with SCS 407, it being understood that the cost thereof is included in and incidental to the contracted prices for the various ***Service Reconnection to Polyethylene Liner Pipe*** items of work listed in the Proposal.

402.4.07 FIELD FABRICATED CONNECTIONS

Measurement and payment for field fabricated connections will be made at the unit price each for the type and size as shown in the Proposal. Payment shall include full compensation for all materials, equipment, and labor necessary to complete the work.

402.4.08 ELECTRICAL LOCATOR

Payment for installation of an electrically conductive tracer wire adjacent to the building sewer pipe between the property line test tee and the building test tee or cleanout shall be incidental to other bid items.

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403 Manholes, Inlets, and Concrete Structures

403.1.00 DESCRIPTION

This Section covers the work necessary for the construction of the following items:

1. Manholes
2. Drop Assemblies
3. Sumps
4. Inlets and Catch Basins
5. Anchor Walls
6. Special Concrete Structures
7. Concrete Encasement

403.2.00 MATERIALS

403.2.01 BASE ROCK AND DRAIN GRAVEL

One and one-half inch minus base rock, conforming to the requirements for aggregate base material in ***Section 303 Aggregate Bases***. Drain gravel shall conform to ***Subsection 204.2.06B Bank-run and River-run Gravel***.

403.2.02 FORMS

Forms for exposed surfaces shall be steel or plywood. Others shall be matched boards, plywood, or other approved material. Form all vertical surfaces. Trench walls, large rock, or earth will not be approved form material

403.2.03 MANHOLES

403.2.03A Standard Precast Manhole Sections

Furnish sections as specified conforming to the details on the Standard Plans and to ASTM C 478. Manhole cone sections shall have the same wall thickness as barrel sections and conform to all the requirement of ASTM C 478 with the exception of the steel reinforcement requirement. The steel reinforcement may be replaced with Fibermesh I as manufactured by the Fibermesh Company or approved equal. The minimum length of the fibers shall be 2 inches with a minimum of 1.6 pounds of fiber per cubic yard of concrete. Top and bottom of all sections shall be parallel.

Prior to the delivery of any size of precast manhole section on the jobsite, yard permeability tests will be conducted at the point of manufacture. The precast sections to be tested will be selected at random from the stockpiled material which is to be supplied for the job. All test specimens will be mat tested, and shall meet the permeability test requirements of ASTM C14 and ASTM C 497.

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403.2.03B Standard Monolithic Manhole

Conform to details on the Standard Plans.

403.2.03C Precast Concrete Bases

When shown or specified, precast base sections may be used provided all details of construction are approved prior to fabrication. They may be used only with Portland Cement Concrete manholes. The Contractor must obtain the Engineer's written approval of his/her submitted shop drawings prior to shipment. In the vent construction details are shown on the Project Plans and the Contractor does not intend to deviate therefrom, the shop drawing requirement may be waived by the Engineer.

Previously submitted precast concrete base designs and/or shop drawings, which have been approved by the Engineer as an acceptable alternate, are on file in the City of Salem Department of Public Works. These may be used, with approval of the Engineer, in lieu of the standard precast manhole base detailed on Standard Plan 118.

403.2.03D Manhole Grade Rings

Concrete grade rings for extensions shall be a maximum of 6 inches high and shall be approved before installation.

403.2.03E Jointing Materials

Mortar shall conform to the requirements of ASTM C 387, or be proportioned one part Portland Cement to two parts clean, well-graded sand which will pass a 1/8 inch screen. Admixtures may be used not exceeding the following percentages of weight of cement; hydrated lime, 10 percent; diatomaceous earth, or other inert materials, 5 percent. The consistency of the mortar shall be such that it will readily adhere to the precast concrete if using the standard tongue and grove type joint. Mortar mixed for longer than 30 minutes shall not be used.

Non-shrink Grout shall be Sika 212, Euco N-S, Five-Star, or approved equal nonmetallic cementitious commercial grout exhibiting zero shrinkage per ASTM C 827 and CRD-C-621. Grout shall not be amended with cement or sand and shall not be reconditioned with water after initial mixing. Unused grout shall be discarded after 20 minutes and shall not be used.

Non-shrink grouts shall be placed or packed only with the use of an approved commercial concrete bonding agent applied to all cured concrete surfaces being grouted. The bonding agent shall be compatible with the brand of grout used. Water shall not be used as a substitute for the commercial bonding agent.

Preformed Plastic Gaskets shall meet all the requirements of Federal Specification SS-S-00210.

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Rubber Gaskets. Materials shall conform to ASTM C 443.

403.2.03F Metal Manholes

Where corrugated metal manholes are shown or specified, submit shop drawing by the manufacturer for approval prior to shipment.

403.2.03G Manhole Steps

Manhole steps shall be a minimum of 11 inches wide by 9 inches deep by ½ inch diameter, safety type, using ASTM A 36 structural steel or ASTM 615 grade 40, rebar completely encapsulated in a corrosion-resistant, resilient compound, pressure molded to the steel. Finished steps shall be non-sparking and non-conductive and shall meet current OSHA and ASTM C 478 requirements. They shall be driven 2 ½ inches into pre-drilled holes in the manhole wall providing a compression fit that will resist a pullout force of at least 300 pounds per leg.

Steps that are not encased in a resilient compound shall be ¾ inch diameter and shall be galvanized in accordance with ASTM A 123. Steps for installation during casting of manhole barrel sections shall have a lip of at least 1 inch at the embedded end thereof.

403.2.04 PIPE AND FITTINGS

Conform to requirements of ***Section 402 Pipe and Fittings (Sanitary and Storm Sewers)***.

403.2.05 PRECAST INLETS AND CATCH BASINS

Precast units may be used in lieu of cast in place units when approved by the Engineer. Details of proposed units shall be submitted for approval. Concrete risers for extensions shall be a maximum of 6 inches in height and of the same quality as the main section. Risers shall only be used where approved.

403.2.06 PRECAST SUMP

Conform to requirements shown on the Standard Plans and the applicable requirements herein for precast units and drain gravel.

403.2.07 MANHOLE FRAMES AND COVERS

403.2.07A General

All castings shall be true to size, weight, and tolerances shown on the Standard Plans. Delivered weight shall be ± 5 percent of the specified weight. The bearing seat shall not rock when checked by the test jig. The foundry shall supply all test gauges and shall not subcontract any of the work other than testing procedure, patterns, machining, and cartage. The casting shall not be made by the open mold method and shall be free of porosity, shrink cavities, cold shuts, or cracks, or any defects which would impair

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serviceability. Repair of defects by welding or by the use of ***smooth-on*** or similar material will not be permitted. All castings shall be shot or sandblasted, and the application of paint or other coating will not be permitted. Each casting shall have distinctly cast upon it the initials of the manufacturer and the year of the cast. These characters shall be minimum 1 ¼ inch in height and 1/8 inch in relief.

403.2.07B Materials

Conform to ASTM A 48, Class 30B, with the following revisions:

Tensile Strength	30,000 psi
Traverse Strength: (1.2" dia. bar - 18" centers)	
Load – Pounds	2,600 – 3,000
Deflection – Inches	0.22 – 0.34
Brinell Hardness (as cast)	173 – 200

The foundry shall certify as to the tensile and traverse properties and the Brinell Hardness. The Owner reserves the right to require a rough transverse bar (Size of bar: 1.2 inch diameter by 20 inches long) and/or tensile bar as per ASTM A 48 for each 20 castings or heat when less than 20 castings are made.

403.2.07C Inspection

Notify the Owner at least 24 hours in advance of casting the units or bars. At least 24 hours notice shall also be given prior to final gauging and inspection. When directed, the following strength test shall be made on the manhole cover. the cover, while resting in its frame, shall sustain a concentrated load of 40,000 pounds applied at its center through a 2½ inch plug. The Engineer may, at any time, require up to 5 percent of the job and/or order and in no case less than one cover to be tested in this manner. In case of failure during the test, additional covers shall be furnished until the tests prove satisfactory. All covers that ass this test will be returned. The Owner will not be responsible for those that fail the test.

403.2.07D Cap Screws

Cap screws and washers for tamperproof and watertight manhole covers shall be stainless steel with 60,000 psi minimum tensile strength conforming to ASTM A 453.

403.2.08 STANDARD FRAMES AND GRATES FOR INLETS AND CATCH BASINS

Frames and grates for catch basins and storm drain inlets shall be fabricated of steel conforming to ASTM A 7, A 36, or A 373 in accordance with the details shown on the Standard Plans. All connections shall be welded. Welding shall conform to requirements of current code for welding in building construction of the American Welding Society. Frames and gratings shall be tested one within the other and there shall be no more than 1/16 inch rock. When checked by a test jig, the bearing seat of either component shall have no more than 1/16 inch rock. Test jugs shall be furnished by the manufacturer.

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403.3.00 CONSTRUCTION

403.3.01 GENERAL

403.3.01A Excavation and Backfill

Conform to applicable provisions in ***Section 204 Excavation, Embankment, Bedding, and Backfill***. Back fill around manholes and other appurtenances shall be of the same quality as the trench backfill immediately adjacent.

403.3.01B Base Rock

When specified or directed, place crushed aggregate base rock thoroughly compacted to the required thickness and density.

403.3.01C Foundation Stabilization

If material in bottom of excavation is unsuitable for supporting manholes and other sewer appurtenances, excavate below subgrade as directed and backfill to required grade with rock conforming to Foundation Stabilization in ***Section 204 Excavation, Embankment, Bedding, and Backfill***.

403.3.02 MANHOLES

403.3.02A Base and Sections

Construct manholes as shown on the Detail Drawings or Standard Plans. Densify the concrete base by vibrating or working as approved and screed to provide a level, uniform bearing for precast sections or formed wall extensions.

Deposit sufficient mortar on base to assure watertight seal between base and manhole wall or place the first precast section of manhole in concrete base before concrete has set, if preferred. First section shall be properly located and plumb. When installing a precast base, assembling precast manhole sections or elsewhere, when cured concrete is joined to cured concrete, use neoprene or mastic at the joint to provide a compression seal which will be watertight when complete. grout the joint at the inside surface to provide a smooth wall surface.

All lift holes shall be thoroughly wetted, then completely filled with mortar and smoothed and pointed both inside and out to ensure water tightness.

Preformed plastic or rubber gaskets shall be used on all sanitary manholes. Mortar will be allowed on storm manholes, and on 24 inch extension rings above the cone. all mortar joints between precast elements shall be thoroughly wetted, then completely

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filled with mortar. On proposed street grades, a minimum of one 24 inch precast riser will be required between the cone and manhole cover frame.

When the keylock joint is used, it is the intent that the void between the tongue and groove be completely filled with mortar and that the interior and exterior end faces of the section to be placed seat fully on the previously placed section.

Prevent mortar from drying out and cure by applying an approved curing compound or comparable approved method. Chip out and replace all cracked or defective mortar. Other types of jointing materials may be used in lieu of mortar only when approved by the Engineer. Preformed plastic gaskets shall be installed in strict accordance with the manufacturer's recommendations. Only pipe primer furnished by the gasket manufacturer will be approved. When using preformed plastic gaskets, manhole sections with chips or cracks I the jointing surfaces shall not be used. Completed manholes shall be rigid and all manholes for sanitary sewers shall pass the hydrostatic test. Construct manhole inverts in conformance with the Standard Plans with smooth transitions to ensure an unobstructed flow through manhole. Where a full section of pipe is laid through a manhole, break out the top section to the full width of pipe and diameter of the manhole. Cover exposed edges of pipe completely with mortar. Trowel all mortar surfaces smooth.

403.3.02B Pipe Connections

Special care shall be taken to see the openings through which pipes enter the structure are completely watertight. All pipe shall be connected to manholes according to the manufacturer's recommendations. All rigid non-reinforced pipe entering or leaving the manhole shall be provided with flexible joints within 1 foot of the manhole structure and shall be placed on firmly compacted bedding.

Concrete pipe connections to sanitary manholes shall be grouted watertight with non-shrink grout conforming with Subsection 403.2.03E.

PVC pipe shall be connected to sanitary manholes using an approved adapter specifically manufactured for the intended service. PVC pipe adapters shall be Fowler Inserta-Tee, Kor-N-Seal, Sealtite, Z-Lok-XP, or approved equal. Field fabricated water stops or improvised adapters shall not be used. Adapters requiring the use of grout for installation shall be anchored and finished using non-shrink grout conforming with Subsection 403.2.03E.

403.3.03 DROP ASSEMBLIES

Construct drop assemblies at locations indicated and as shown on the Standard Plans.

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403.3.04 PIPE STUB OUTS FROM MANHOLES

Install stub outs from manholes as shown or directed. Grout pipes into manhole walls or manhole base to provide water tight seal around pipes.

403.3.05 MANHOLE GRADE RINGS

Manhole grade rings shall be installed in such a manner as to prevent infiltration of surface or ground water between the grade ring(s) and the concrete of the manhole section. All mortared sanitary sewer manhole joints shall be constructed using an approved commercial concrete bonding agent applied to all cured concrete surfaces being mortared.

Install grade rings as shown on Standard Plans to the height directed. Lay grade rings in mortar with sides plumb and tops level. Seal joints with mortar as specified for manhole sections. Extensions shall be watertight.

In general, manhole grade rings will be used on all manholes in streets or roads, or in other locations where a subsequent change in existing grade may be likely. Extensions will be limited to a maximum height of 12 inches. Finish grade for manhole covers shall conform to finished ground or street surface unless otherwise directed.

403.3.06 MANHOLE FRAME AND COVERS

Manhole frames and covers shall be installed in such a manner as to prevent infiltration of surface or ground water between the frame and the concrete of the manhole section. All mortared sanitary sewer manhole frames shall be constructed using an approved commercial concrete bonding agent applied to all cured concrete surfaces being mortared.

Set frames in a bed of mortar with the mortar carried over the flange of the frame as shown on the Standard Plans. Set frames so tops of covers are flush with surface of adjoining pavement or ground surface, unless otherwise shown or directed.

403.3.07 HYDROSTATIC TESTING

This item of work pertains in general to sanitary sewers. See ***Subsection 402.3.14 Testing Sewers***.

The test shall consist of plugging all inlets and outlets and filling the manhole with water. Each manhole shall be filled to the rim at the start of the test. Leakage in each manhole shall not exceed 0.2 gallons per hour per foot of head above the invert. Leakage shall be determined by refilling to the rim using a calibrated known volume container. Manholes may be filled 24 hours prior to the time of testing to permit normal absorption into the manhole walls. Comparably stringent vacuum testing procedures may be substituted for hydrostatic testing with the approval of the Owner.

Repair all manholes that do not meet the leakage test, or are unsatisfactory from visual inspection, to conform to the requirements herein.

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403.3.08 MONOLITHIC CONCRETE CONSTRUCTION

Conform to details shown on the Detail Drawings or Standard Plans and with applicable provisions herein.

Remove and keep all water clear from the excavation. Construct forms to the dimensions and elevations required. Forms shall be tight and well braced. Remove all water and foreign material from the forms prior to placing the concrete. Moisten forms just prior to placement. Bar splices shall be 24 diameters, but in no case less than 12 inches. Wire tie all splices and intersections. Obtain approval prior to placing any concrete.

Place concrete so that there is no segregation of the aggregate and vibrate or work concrete as approved to prevent rock pockets. Do not place concrete when the ambient temperature is below 40 degrees Fahrenheit without special protection as approved. Screed the top surface of the exposed slabs and trowel to a smooth finish free from marks or irregularities. Finish exposed edges with a steel edging tool. Cure concrete for seven days in an approved manner. After removal of the forms, patch all rock pockets, form tie holes, and irregularities with a stiff mixture of Portland Cement and sand mixed in the same proportion as the original mix. Finish exposed walls to produce a uniform, flat surface. Protect concrete from damage during the seven day curing period.

403.3.09 METAL MANHOLES

Conform to the details as shown on the approved manufacturer's shop drawings and to applicable provisions for manholes herein.

403.3.10 CONCRETE ENCASEMENT FOR SANITARY SEWER OR STORM DRAIN PIPE

Conform to the requirements shown on the Standard Plans and to applicable requirements of ***Section 204 Excavation, Embankment, Bedding, and Backfill***. Foundation stabilization, if required, shall be completed and the bottom of the trench compacted, as approved. Sides of encasement shall be formed, not poured against soil or rock, unless directed or approved by the Engineer.

Support pipe true to line and grade as approved before and during placement of concrete. Encasement may be placed in two lifts only with prior approval. If concrete is approved to be placed in two lifts, provide a keyway on both sides of the encased pipe and vertical reinforcing bond steel as shown or as directed. Place concrete starting at the lower end of the encasement.

After concrete encasement has been placed and taken an initial set, cure by covering with well-moistened earth or backfill material or five days before conducting hydrostatic or air tests.

403.3.11 ANCHOR WALLS

Conform to details shown on the Standard Plan. Do not over excavate in the areas where anchor walls are to be poured. Construct suitable forms that will allow the downhill wall to

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have a full bearing surface against undisturbed earth. Cure concrete for five days before conducting hydrostatic or air tests.

403.3.12 SPECIAL CONCRETE STRUCTURES

Conform to the details as shown and to the applicable provisions for monolithic concrete construction specified herein.

403.3.13 PLACING PRECAST UNITS

When precast units are approved, if material in bottom of trench is unsuitable for supporting unit, excavate as directed and backfill to required grade with foundation stabilization material in conformance with ***Section 204 Excavation, Embankment, Bedding, and Backfill***. Set units to grade at locations shown or as directed.

403.3.14 INLET AND CATCH BASIN EXTENSIONS

When approved, install extensions to height as directed. Lay risers in mortar with sides plumb and tops to grade. Joints shall be sealed with mortar, with interior and exterior troweled smooth. Prevent mortar from drying out and cure by applying an approved curing compound or other approved method. Extensions shall be watertight.

403.3.15 INSTALLATION OF INLET AND CATCH BASIN FRAMES AND GRATES

Set frames and grates at elevations shown or as directed. Frames may be cast in, or shall be set in mortar. Bearing surfaces shall be clean and provide uniform contact. Anchor bolts and other fastenings shall be firmly bedded in concrete or otherwise secured as approved.

403.3.16 PRECAST SUMP

Construct Precast Sump in conformance with the Standard Plan.

403.3.17 CLEANING

Upon completion, clean each structure of all silt, debris, and foreign matter.

403.4.00 MEASUREMENT AND PAYMENT

403.4.01 MANHOLES

Measurement and payment for manholes, including standard precast concrete or monolithic concrete manholes will be made on a unit price basis for each type shown in the Proposal for manholes 8 feet deep, plus the unit price per foot shown in the Proposal for extra depth of manholes over 8 feet. No deduction will be made for depths less than 8 feet. Measurement of manhole depth will be from the top of the manhole frame and cover to the manhole invert at the center of the manhole to the nearest one-tenth of a foot. There will be no separate

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payment for pavement removal and replacement, excavation, including removal of an existing manhole or lamp hole, and backfill, foundation stabilization and/or base rock and any materials, equipment and labor necessary to reconnect all existing pipes when constructing manholes, it being understood that the cost thereof is incidental to and included I the contracted price for Standard Manhole or Manhole Drop Assembly, work items.

403.4.02 DROP ASSEMBLIES

Measurement and payment for drop assemblies, regardless of size, will be made on a unit price basis as shown in the Proposal for drop assemblies 0-6 feet in depth, plus the unit price per foot shown in the Proposal for extra depth over 6 feet. No deduction will be made for depths less than 6 feet. Drop assemblies will be vertically measured from the invert of the pipe at the top of the assembly to the invert of the pipe into the manhole base at the bottom of the assembly to the nearest one-tenth of a foot. Payment shall include full compensation for all materials, labor, and equipment required to construct the work complete in place.

403.4.03 PIPE STUB OUTS FROM MANHOLES

Measurement and payment for pipe stub outs from manholes shall be made on a linear foot basis in accordance to ***Section 402 Pipe and Fittings (Sanitary Sewers and Storm Drains)***.

403.4.04 TAMPERPROOF AND WATERTIGHT MANHOLE FRAME AND COVERS

Measurement and payment for tamperproof and watertight manhole frame and covers will be made on a unit price basis for each type installed. Since payment for furnishing and installing standard frame and covers is already included in the bid price for manholes, this unit price will include only the additional compensation for providing the watertight frame and cover complete in place.

403.4.05 CONCRETE ENCASEMENT

Measurement and payment for concrete encasement will be made on a linear foot basis as shown in the Proposal for the size pipe to be encased. Length shall be measured along the centerline of the pipe and shall be the total length of encasement actually constructed. Payment shall include full compensation for all materials, equipment, and labor required to construct the work complete in place.

403.4.06 ANCHOR WALLS

Measurement and payment for anchor walls will be made on a unit price basis for each unit installed. Payment shall include full compensation for all materials, equipment, and labor required to construct the work complete in place.

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403.4.07 SPECIAL CONCRETE STRUCTURES

Measurement and payment for special concrete structures will be made on a lump sum each basis. Payment shall constitute full compensation for materials, equipment, and labor required to construct the work complete in place.

403.4.08 CATCH BASINS AND INLETS

Measurement and payment for catch basins and inlets will be made on a unit price basis per each catch basin or inlet for the number and type actually constructed. Payment shall include full compensation for all materials, equipment, and labor required to construct the work complete in place.

403.4.09 PRECAST SUMP

Measurement and payment for precast sump will be made on a unit price basis for each unit installed. Payment for pipe stub outs, if required, will be made as provided for in ***Section 402 Pipe and Fitting (Sanitary Sewers and Storm Drains)***. Payment shall include full compensation for all materials, equipment, and labor required to construct the work complete in place.

403.4.10 SANITARY SEWER CLEANOUT

Payment will be made at the contracted price for each "Standard Cleanout" work item constructed in accordance with Standard Plan 105, using frame and lid per Standard Plan 108. Such payment shall include all necessary labor, equipment, and material necessary to construct the cleanout above the wye, including the pipe plug, riser section, frame and cover, concrete frame encasement, all pavement removal and replacement, and excavation and backfill measured horizontally from the center of the vertical branch of the wye to the center of the cast cover. The wye will be paid at the contracted price for “Tee and Wye Fittings" as listed in the Proposal.

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404 Work on Existing Sanitary Sewers and Storm Drain Structures

404.1.00 DESCRIPTION

This Section covers the work necessary for joining new work to existing, the abandoning of sanitary sewer lines, storm drains and structures, and adjusting of existing utility structures to finished grades, complete.

404.2.00 MATERIALS

Conform to the requirements of ***Section 205 Materials*** and to the requirements for related work referred to herein.

404.3.00 CONSTRUCTION

404.3.01 EXCAVATION AND BACKFILL

Conform to requirements of ***Section 204 Excavation, Embankment, Bedding, and Backfill***. Excavation shall be classified as either common or rock excavation.

404.3.01A Screening Manholes

Prior to excavation, the Contractor shall install a 1.5 inch x 14 Ga. expanded metal screen, or equal, on the outlet of a manhole downstream of the construction work to prevent debris and other foreign objects from entering the sanitary/storm sewer system. the screen shall remain in place as long as any excavation is not yet backfilled and when work is being done in an upstream manhole.

Prior to the end of the work day, the Contractor shall enter, inspect, and clean the screening manhole. Additionally, the screen shall be maintained by the Contractor in such a way that sewer/drain flow is accommodated at all times.

The Contactor will be charged for all maintenance expenses and/or damage resulting from entry of debris or foreign objects into the sanitary/storm sewer facilities of the Owner. See also SCS Subsection 406.3.01A.

404.3.02 MANHOLES OVER EXISTING SEWERS

Advise Engineer of plans for diverting sewage flow and obtain approval before stating. Approval will not relieve Contractor of responsibility for maintaining adequate capacity for flow at all times and adequately protecting new and existing work.

Construct manholes over existing operating sewer lines at locations shown. Perform necessary excavation and construct new manholes in conformance with applicable requirements of ***Section 403 Manholes, Inlets, and Concrete Structures***.

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Manholes shall be constructed over existing concrete sanitary sewers after first cleaning and applying approved commercial concrete bonding agent to all surfaces of the pipe that will be in contact with the manhole. Manholes shall be constructed over existing PVC sanitary sewers after first applying a dense coating of clean mortar sand to all pipe surfaces that will be in contact with the manhole, using PVC solvent cement. After the cement has cured, commercial concrete bonding agent shall be applied to the sand prior to placement of concrete.

All sanitary sewer manholes shall be hydrostatically tested in accordance with Subsection 403.3.07. After completion of the manhole test, the top of the pipe shall be broken out to the spring line for the full width of the manhole. The exposed edge of the pipe shall be smoothed and pointed with mortar.
Prevent broke material or debris from entering sewer flow. Maintain flow through existing sewer lines at all times. Protect new concrete and mortar for a period of seven days after placing.

404.3.02A Manhole Sealing

This Subsection covers the rehabilitation of existing manholes via interior repair and sealing using a compound that reacts chemically with the salts in the concrete or mortar to form a waterproof crystalline barrier yet allowing the concrete to breathe. The rehabilitated manhole shall have all hopes, cracks, and joints, including those in the manhole base, plugged in accordance with the manufacturer's recommendations and the total interior surface coated with the appropriate sealant. A minimum of two coats is required. Extra coats shall be applied if the Engineer determines it necessary to stop infiltration under sever groundwater pressure situations or extremely deteriorated manholes.

Manhole rehabilitation shall consist of the following steps performed in strict accordance with the manufacturer's recommendations:

1. High pressure water wash
2. Plug holes
3. Patch cracks, joints, and
4. Seal the concrete using materials in conformance with the minimum structural standards listed below.

Materials Test	Standard	Result
Tensile Strength	ASTM C 190	325 psi at 59% R.H.
Flexural Strength	ASTM C 580	675 psi
Compressive Strength	ASTM C 109	5,000 psi
Permeability	ARMY CRD-C48-55	8.1×10^{10} cm/sec
Adhesion	ASTM E 149	40 psi

Repair and sealing compound shall be HEY'DI K-11 as manufactured by HEY'DI American Corporation or approved equal.

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404.3.03 CONNECTION TO EXISTING MANHOLES

The Contractor shall construct openings in the existing manhole base or sections as required and construct connections that are watertight and will provide a smooth flow into and through the manhole. All sanitary sewer pipe connections, including those at invert level as well as penetrations for drop connectors, conduits, and carry-throughs, shall conform to the requirements of Section 404. The Contractor shall provide all diversion facilities and perform all work necessary to maintain flow in existing lines during the connection to the manhole.

Provide all diversion facilities and perform all work necessary to maintain sewage flow in existing sewers during connection to the manhole. Break out existing manhole base for new flow channel as specified or directed. Core drill existing manhole wall as necessary to accept new pipe as specified or directed. Grout I new pipe to provide watertight seal, and when applicable, smooth flow into and through existing manhole as specified in ***Subsection 404.3.09 Reconstruct Manhole Base***. All pipe connections to the manhole shall be watertight and shall preclude infiltration by inclusion of an elastomeric seal/waterstop unit grouted to or into the manhole. Repair any damage to existing base and channels as required.

404.3.04 REMOVAL OF EXISTING PIPES, MANHOLES, AND APPURTENANCES

Existing pipelines, manholes, and appurtenances which lie in the line of and are to be replaced by the new construction shall be removed from the site and disposed of as provided for in ***Section 203 Clearing and Grubbing***.

404.3.05 FILLING ABANDONED MANHOLES

Existing manholes shown to be abandoned shall be filled with granular material as specified in ***Section 204 Excavation, Embankment, Bedding, and Backfill***. Compact to 95 percent optimum density as determined by ASTM D 698. Remove manhole frame and cover and plug all pipes with permanent plugs as specified herein. Break or perforate the bottom to prevent the entrapment of water. Remove the manhole cone to facilitate specified compaction of fill material. Construct the granular base and pavement or gravel or sod surfacing to render the work site compatible with the surrounding area.

404.3.06 EXISTING MANHOLE FRAMES AND COVERS

Manhole frames and covers removed by eth Contractor and not to be reused on the project shall become the property of the Owner. Deliver these in accordance with Subsection 206.3.02 as modified herein.

404.3.07 PERMANENT PLUGS

Clean interior contact surfaces of all pipes to be cut off or abandoned as approved. Construct concrete plug in end of all pipe 18 inches or less in diameter. Minimum length of concrete plugs shall be 8 inches. For pipe 21 inches and larger, the plugs may be constructed of common brick or concrete block. Plaster the exposed face of block or brick plugs with mortar. All plugs shall be watertight and capable of withstanding all internal and external pressures without leakage.

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404.3.08 ADJUST STRUCTURES TO GRADE

Manholes, inlets, catch basins, and similar structures shall be brought to the specified finished grade by methods of construction as required in ***Section 403 Manholes, Inlets, and Concrete Structures,*** and ***Section 206 Adjustment of Incidental Structures to Grade***.

Excavation necessary for bringing structures to grade shall center about the structure and be held to the minimum are area as approved. At the completion of the structure adjustment, the void around the structure shall be backfilled with crushed aggregate and thoroughly compacted.

404.3.09 RECONSTRUCT MANHOLE BASE

Conform to applicable requirements of ***Section 403 Manholes, Inlets, and Concrete Structures***. Exercise caution in chipping out existing concrete base so as to prevent cracking of manhole walls. Prevent all material from entering the sewer flow. Pour new base to a minimum of 6 inches below the lowest projection of the pipe. Construct new channels to the elevations shown. Conform to details for channel construction in the Standard Plans. Repair any cracks which occur as a result of work operations with new grout to form a watertight seal, as approved.

404.3.10 CONNECT PIPE TO EXISTING INLETS

Conform to applicable requirements of ***Section 403 Manholes, Inlets, and Concrete Structures***. Break into existing inlet and grout in a watertight seal between the new pipe and inlet wall. Plaster mortar smooth inside pipe opening. Alignment, slope of pipe, and other construction details shall be as approved.

404.3.11 MAINTENANCE OF FLOW IN EXISTING SEWERS

The flow in the existing sanitary sewer may be restricted and/or pumped around the work site during construction as approved by the Engineer. Flow shall be restored at the end of each day. Contractor shall provide all diversion facilities and perform all work required to divert the flow of sewage around the section (s) of pipes and manholes during construction of new and/or connection to existing manholes and gravity mains. The diversion shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of watertight construction, and of adequate capacity and size to handle the flow. Bypass volumes may vary throughout the sewer system and during the day. The Contractor is responsible for and shall provide pumps capable of handling the maximum flows.

Discharge or spillage of sewage onto or into the ground and bypassing of sewage to surface waters or drainage courses is prohibited. Penalties imposed on the Owner as a result of any bypass caused by the actions of the Contractor, his/her employees, or Subcontractors, shall be borne in full by the Contractor, including legal fees and other expenses of the Owner resulting directly or indirectly from the bypass.

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The following restrictions shall apply to sewer services and reconnections:

1. Dwelling occupants shall be notified by the Contractor in writing 48 hours in advance of sewer service interruptions. The notice shall include the following items:

   a. Day and date of prospective service interruption.
   b. Estimated time, in hours, sewer service will be interrupted.
   c. Approximate time service interruption will begin.

   A written record of these notifications shall be maintained by the Contractor and turned over to the Engineer each day.

2. No buildings shall be without sewer service longer than five hours in one day.

   There will be no separate payment for by-pass sewer pumping, it being understood that the cost thereof is included in and incidental to the contracted prices of the various trench excavation and backfill or flow control (Insituform job) work items.

404.3.12 ABANDON CLEANOUT/LAMPHOLE

The work on existing lampholes or cleanouts shown on the Plans to be abandoned shall be accomplished as specified in Subsection 404.3.05 and all castings shall be delivered to the Owner per Subsection 206.3.02. When located under pavement, the upper three feet of the structure shall be removed; elsewhere, the upper 18 inches shall be removed. A cap shall be placed on the top and sealed with oakham, tar, grout, or other approved material. Do not break the bottom of the structure, but plug it with concrete.

404.3.13 SAFETY

The Contractor is hereby alerted to the dangers of working in sewers and manholes where the organic material present could result in the formation of hydrogen sulfide gasses. Hydrogen sulfide gas can be toxic in high concentrations. Also in high concentrations, hydrogen sulfide gas is odorless; therefore, it is not detectable without specialized equipment. The Contractor should provide gas detection equipment that would detect the presence of hydrogen sulfide gas and/or the lack of oxygen. The Contractor shall also provide ventilation equipment to insure that hazardous gasses or conditions are eliminated prior to workers entering existing sewer manhole or sewer lines. The contractor shall ensure that all personnel entering manholes wear a harness with attached safety line so that said personnel can be removed from the manhole if he/she is unable to climb out unassisted.

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404.4.00 MEASUREMENT AND PAYMENT

404.4.01 MANHOLES OVER EXISTING SANITARY SEWERS AND STORM DRAINS

Measurement and payment for manholes over existing sanitary sewers or storm drains will be made in accordance to ***Section 403 Manholes, Inlets, and Concrete Structures***.

404.4.02 REMOVAL OF EXISTING PIPES, MANHOLES, AND APPURTENANCE

Payment for removal and disposal of existing pipes, manholes, and appurtenances will be considered as incidental to the work and included in the bid item for excavation and backfill as specified in ***Section 204 Excavation, Embankment, Bedding, and Backfill*** or included in the bid item for "Standard Manhole" as specified in Section 403.4.01.

When listed separately in the Proposal, payment for "Remove Manhole" shall be at the contracted unit price each. A bid item for this work will generally be added only when the manhole to be removed lies outside of and distant from the mainline sewer trench.

404.4.03 CONNECTION TO EXISTING MANHOLES

Measurement and payment for connection to existing manholes will be made on a unit price each basis. There will be no separate payment for modifying the manhole base or channel, it being understood that the cost thereof is included in and incidental to the contracted prices for ***Connection to Existing Manhole, Polyethylene Liner Pipe*** or ***Insituform Liner*** work items.

404.4.04 FILLING ABANDONED MANHOLES

Measurement and payment to filling abandoned manholes will be made on a unit price each basis. There will be no separate payment for work necessary to reconstruct the ground surface after removing the manhole cone consistent with adjoining materials, including but not limited to, pavement, curb, driveway, sidewalk, or sod or for replacement of landscape or improvements removed during construction it being understood that payment therefore is included in and incidental to the contracted price for the ***Fill Abandon Manhole*** work item.

404.4.05 ADJUST STRUCTURES TO GRADE

Measurement and payment for adjusting manholes, catch basins, inlets, and similar structures will be made on a unit price each basis for the type and size as shown in the Proposal.

404.4.06 RECONSTRUCT MANHOLE BASE

Measurement and payment for reconstructing manhole base will be made on a unit price each basis.

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404.4.07 CONNECT PIPE TO EXISTING CATCH BASIN

Measurement and payment for connecting new pipe to existing catch basins will be made on a unit price each basis.

404.4.08 PLUGS, ABANDON CLEANOUT/LAMPHOLE

Measurement and payment for permanent plugs or temporary plugs will be made at the contracted unit price when specifically added to the Proposal. When omitted therefrom their cost shall be borne solely by the Contractor incidental to performance of other various work items.

Measurement and payment for abandon cleanout/lamphole will be made on the same basis as specified under Subsection 404.4.04.

404.4.09 SAFETY

No separate payment will be made for providing safety equipment as required by Subsection 404.3.13, it being understood that the cost thereof is included in the contracted prices for the various items of work, and is therefore a const to be borne solely by the Contractor incidental to performance of the work.

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405 Resurfacing

405.1.00 DESCRIPTION

This Section covers the work necessary to replace all pavement, pavement base, curbs, sidewalks, rock surfacing, and other surface features damaged either directly or indirectly by the operations incidental to the construction of sewers, water mains, and conduits.

405.2.00 MATERIALS

405.2.01 HOT MIX ASPHALT CONCRETE

Use Class C asphalt concrete hot mix. Conform to the requirements for hot mix asphalt concrete in ***Subsection 306.2.00 Materials***.

405.2.02 COLD MIX ASPHALT CONCRETE

Use cold mix asphalt concrete and ½ inch – 0 gradation with either MC 250 liquid asphalt or CRS-2 cationic emulsified asphalt. Conform to the requirements for cold mix asphalt concrete in ***Section 304 Asphalt Treated Bases***.

405.2.03 ASPHALT PRIME

Tack coat shall be AR 4000, PBA-2, or PBA-5 asphalt cement or CRS-1 and CRS-2, and CMS-2, CMS-2h, CMS-2s and CSS-1. The proper choice of product shall be approved by the Engineer and will depend on weather conditions and temperature. Generally, CRS (rapid setting) emulsions will be used when surface temperatures are 70 degrees or less and CMS (medium setting) emulsions will be used when the surface temperature is higher than 70 degrees. The RS-LTP product can be used in temperatures as low as 40 degrees. Hot mix asphalt (HMA) will not be allowed to be placed until the emulsion has "broken" as indicated by the color change from brown to black. Follow manufacturer's recommendations for precleaning, dust and moisture control, and application temperature. The emulsified asphalt products can be applied with some moisture, however, they shall not be applied in saturated conditions without approval of the Engineer and drying of saturated surface to the satisfaction of the Engineer. Random samples may be taken at "point of use" to determine water content.

405.2.04 SEAL AND COVER COAT – Deleted.

405.2.05 PAVEMENT BASE

Use pavement base material for resurfacing trenches which conform to ***Section 303 Aggregate Bases***.

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405.2.06 FORMS

All forms shall be approved by the engineer and shall conform to requirements for forms in ***Section 602 Concrete Structures***.

405.3.00 CONSTRUCTION

405.3.01 STREET MAINTENANCE

Maintain all trenches as specified under ***Section 204 Excavation, Embankment, Bedding, and Backfill***.

405.3.02 TEMPORARY COLD MIX ASPHALT

When shown or directed, place and compact temporary cold mix asphalt over the approved trench areas to the depth shown or approved. Spread with and approved mechanical spreading machine, or in areas inaccessible to the spreading and finishing machine, place by hand methods. Immediately after each load is dumped, distribute into place by means of hot shovels or suitable forks and spread with hot rakes in a loose layer of uniform density.

After spreading, the mixture shall be thoroughly and uniformly compacted with an approved power-driven roller as soon after being raked as it will bear the roller without undue displacement. Roll longitudinally at the sides and proceed toward the center of the pavement overlapping on successive trips by at least one-half the width of the roller. Alternate trips of the roller shall be of slightly different lengths. The speed of the roller shall at all times be slow enough to avoid displacement of the mixture, and any displacements occurring from any cause shall at once be corrected by the use of rakes and of fresh mixture where required. Roll continuously until all roller marks are eliminated and no further compaction is possible. Compact areas inaccessible to the roller by tamping with hot iron tampers. After compaction, the temporary cold mix asphalt shall have the thickness shown or approved and conform to the grade as directed.

405.3.03 ASPHALT CONCRETE PAVEMENT

405.3.03A Prime Coat

Tack coat all edges of existing pavement, manhole, and cleanout frames, inlet boxes, and like items with 100 percent coverage using materials specified in Subsection 405.2.03.

405.3.03B Asphalt Concrete Placement

Trim existing pavement to a straight line to remove any pavement which has been damaged or which is broken and unsound. Provide a smooth, sound edge for joining the new pavement. All final pavement sawcuts shall be to the dimensions shown on the applicable Standard Plan. Resaw as necessary just prior to repaving trench so no loose

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or jagged edges remain. Final sawing shall be substantially parallel to the trench centerline with angle points not to exceed 45 degrees. Any angle points shall be at least five feet apart.

Place the asphalt concrete on the prepared subgrade over the trench to the specified depth; and, when not specified, to a depth of not less than 4 inches or the depth of the adjacent pavement, whichever is greater. When a prime coat is specified, place asphalt concrete after the prime coat has set. Maximum thickness for any one lift of pavement shall normally not exceed 2 inches, and in no case shall it exceed 2½ inches. Spread and level the asphalt concrete with hand tools or by use of a mechanical spreader, as approved, depending upon the area to be paved. Bring the asphalt concrete to the proper grade and compact by rolling or the use of hand tampers where rolling is impossible or impractical. When it is necessary to place asphalt concrete in successive lifts to achieve the required thickness, use tack coat applied at a rate within a range of 0.05 to 0.10 gallons per square yard between each successive lift. In areas where successive lifts are placed in the same day and the previous lift of asphalt concrete has remained clean, tack coat will not be required between successive lifts.

Use tack coat applied at a rate of 0.05 to 0.10 gallons per square yard on surfaces which are to be overlaid with asphalt concrete.

Roll with power rollers capable of providing compression of 200 to 200 pounds per linear inch. Begin the rolling from the outside edge of the replacement progressing toward the existing surfacing, lapping the existing surface at least one-half the width of the roller. If existing surfacing bounds both edges of the replacement, begin rolling at the edges of the replacement, lapping the existing surface at least one-half the width of the roller, and progress toward the center of the replacement area. Overlap each preceding track by at least one-half the width of the roller and make sufficient passes over the entire area to remove all roller marks and to produce a smooth, uniform surface as directed.

Make the finished surface of the new compacted paving flush with the existing surface and conform to the grade and crown of the adjacent pavement, as directed.

Immediately after the new paving is compacted paint all joints between new and original asphalt pavement with tack coat and cover with dry paving sand before the asphalt solidifies to prevent pick up by traffic.

405.3.03C Application, Quantity, and Temperature of Tack Coat

The Engineer may vary the amount of tack coat to be applied within rates specified elsewhere in this Section as in his/her judgment will give the best results. AR 4000 or PBA-2 tack coat shall be spray-applied unless otherwise approved, and applied at a temperature between 290°F and 350°F.

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405.3.03D Surface Smoothness

The surface smoothness of the replaced pavement shall be such that when a straightedge is laid across the patched area between the edges of the old surfacing and the surface of the new pavement, the new pavement shall not deviate from the straightedge more than ¼ inch provided surface drainage is maintained. Areas which contain depressions that impound water shall be replaced.

405.3.03E Weather Conditions

Do not apply asphalt during rainfall, sand, or dust storms, or before imminent storms that might adversely affect the construction. The Engineer will determine when surfaces and material are dry enough to proceed with construction. Asphalt concrete shall not be placed when the atmospheric temperature is lower than 40 degrees Fahrenheit, or when the surface upon which it is to be placed is frozen.

405.3.03F Protection of Structures

Provide whatever protective coverings may be necessary to protect the exposed portions of bridges, culverts, curbs, gutters, posts, guard fences, road signs, and any other structures from splashing oil and asphalt from the paving operations. Remove any oil, asphalt, dirt, or any other undesirable matter that may come upon these structures by reason of the paving operations, as approved.

Where water valve boxes, manholes, catch basins, or other underground utility appurtenances are within the area to be surfaced, make the resurfacing level with the top of the existing finished elevation of these facilities. If it is evident that these facilities are not in accordance with the proposed finished surface, notify the Engineer to have the proper authority contacted in order to have the facility altered before proceeding with the resurfacing around the obstruction, unless otherwise approved. Consider any delays experienced from such obstructions as incidental to the paving operation. No additional payment will be made. Protect all covers during asphalt application.

405.3.03G Excess Materials

Dispose of all excess materials as approved. Make arrangements for the disposal and bear all costs or retain any profit incidental to such disposal.

405.3.03H Resealing Cracks and Over-saw

Where asphalt concrete is to be removed and replaced over-sawing shall be held to a minimum. Where over-sawing does occur, the kerf shall be filled with a mixture of tack coat and fine sand. Overfilling of the kerf shall be held to a minimum, however, if it does occur, sprinkle with dry sand to prevent pick up by traffic.

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If a crack between the new paving and old pavement appears, or the filler placed in a saw kerf settles during the warranty period, clean out void with compressed air and reseal with AR 4000 asphalt cement. Overfilling shall be held to a minimum, however, if it does occur, sprinkle with dry sand to prevent pick up by traffic.

Temperature requirements for asphalt materials shall be between 270° F and 300°F. Use of materials shall be limited by minimum air temperatures specified in Subsection 405.3.03E.

405.3.04 PORTLAND CEMENT CONCRETE PAVEMENT

Pavement replaced shall be the same thickness as that removed, or a minimum of 6 inches. Protect the newly placed concrete from traffic for a period of 7 days.

Handle, place, finish and cure concrete pavement in conformance with the applicable provisions of ***Section 307 Portland Cement Concrete Pavement***.

405.3.05 PAVEMENT BASE

Place pavement base to the specified depth; when not specified, place to a compacted depth of 12 inches. Bring the top of the pavement base to a smooth, even grade at a distance below finished grade equivalent to the required pavement depth.

Compact the pavement base with mechanical vibratory or impact tampers to a density of not less than 95 percent of the maximum density as determined by AASHTO T 99.

405.3.06 ROCK SURFACING

Place rock surfacing only where shown or directed on streets, driveways, parking areas, street shoulders and other areas disturbed by the construction. Rock surfacing shall be 1½ inch or ¾ inch minus crushed aggregate, as directed. Spread the rock by tailgating and supplement by hand labor where necessary. Level and grade the rock surfacing to conform to adjacent existing grades and surfaces as directed.

405.3.07 CONCRETE DRIVEWAYS, SIDEWALKS, AND CURBS

Replace concrete driveways, sidewalks, and curbs to the same section, width, depth, line, and grade as that removed or damaged. Saw broken or jagged ends of existing concrete on a straight line and to a vertical plane. Place new concrete only on approved compacted trench. When directed, replace concrete driveways and sidewalks between scored joints. Make replacement to prevent a patched appearance. Provide a minimum 2 inch thick compacted leveling course of clean ¾ inch minus crushed aggregate.

Construct forms to match existing. Place concrete and finish exposed surfaces similar to adjacent surface in conformance with ***Section 308 Curbs, Gutters, Driveways, Sidewalks, and Pathways***.

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405.4.00 MEASUREMENT AND PAYMENT

405.4.01 TEMPORARY COLD MIX ASPHALT

No separate payment will be made for furnishing and placing temporary cold mix asphalt pavement when directed by the Engineer to be maintained over trench backfill, it being understood that the cost thereof is included in and incidental to the contracted prices for the associated permanent pavement replacement items of work.

405.4.02 ROCK SURFACING

Payment for rock surfacing will be made on a cubic yard basis. The volume for payment shall be computed on the following measurements for length, width, and depth of rock surfacing.

Length: The actual horizontal length of trench where rock was specified or directed to be placed.

Width: The pay width for trench excavation as specified in ***Section 204 Excavation, Embankment, Bedding, and Backfill***, plus 12 inches.

Depth: The actual depth of the thickness of rock surfacing specified or directed to be placed in the trench.

Payment for this item shall constitute full compensation for furnishing all materials, labor, and equipment necessary to complete the work in place.

405.4.03 PAVEMENT BASE

Payment for pavement base will be made on a cubic yard basis. The volume will be computed on the following measurements for length, width, and depth:

Length: Actual horizontal length of trench where rock was specified or directed to be place.

Width: Trench pay width as specified in ***Section 204 Excavation, Embankment, Bedding, and Backfill***, plus 12 inches.

Depth: Depth of pavement base specified for the particular project. When not specified, depth shall be 12 inches.

Payment for this item shall constitute full payment for furnishing all material, labor, and equipment necessary to complete the work in place.

405.4.04 ASPHALT CONCRETE AND PORTLAND CEMENT CONCRETE PAVEMENT REPLACEMENT

Payment for replacement of asphalt concrete or Portland Cement concrete pavement will be made on a square yard basis. Payment will be limited to pavement actually replaced within the

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pay width specified for trench excavation in ***Section 204 Excavation, Embankment, Bedding, and Backfill***, plus 6 inches additional width on each side of the trench excavation pay width. The area for payment shall be computed on the following measurements for length and width:

Length: The actual horizontal length of trench where pavement was specified or directed to be replaced.

Width: A variable width, being the width of pavement actually replaced within the limits specified. All pavement damaged as a result of the Contractor's operations lying outside the above-stated pay limits will be removed and replaced at the Contractor's expense.

On roadways or streets that do not have curbs, when the cut in asphalt concrete pavement falls 2 feet or less from the edge of the existing pavement, remove and replace the remaining strip at the Contractor's expense.

Payment shall include full compensation for all excavation and disposal of temporary cold mix asphalt required to provide space for the pavement, and all materials, labor, and equipment necessary to complete the work in place.

On Portland Cement concrete streets, when the pavement cut falls one foot or less from an expansion or contraction joint, remove and replace the remaining strip and restore said joint. There will be no separate payment for removal and replacement of this extra width, it being understood that the cost thereof is included in and incidental to the contracted prices for ***Pavement Removal and Replacement***.

405.4.05 SIDEWALK REPLACEMENT

Payment for sidewalk replacement will be made on a square foot basis. Payment will be limited to sidewalk actually replaced within the pay width specified for trench excavation in ***Subsection 204 Excavation, Embankment, Bedding, and Backfill***, plus 6 inches additional width on each side of the trench excavation pay width. The area for payment shall be computed on the following measurements for length and width:

Length: The actual horizontal length of sidewalk specified or directed to be replaced.

Width: A variable width, being the width of sidewalk actually replaced within the limits specified. All sidewalk damaged as a result of the Contractor's operations lying outside the above stated pay limits will be removed and replaced at the Contractor's expense.

Payment shall include full compensation for all materials, labor, and equipment necessary to complete the work in place.

There will be no separate payment for replacement of roof drains damaged or removed during excavation or for constructing bicycle and wheelchair ramps at locations shown on the Plans and in conformance with Standard Plans, it being understood that the cost thereof is included in and incidental to the contracted prices for the ***Sidewalk Removal and Replacement*** work item.

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405.4.06 DRIVEWAY REPLACEMENT

Payment for driveway replacement will be made on a square yard basis. Payment will be limited to driveway actually replaced within the pay width specified for trench excavation in ***Section 204 Excavation, Embankment, Bedding, and Backfill***, plus 6 inches additional width on each side of the trench excavation pay width. The area for payment shall be computed on the following measurements for length and width:

Length: The actual horizontal length of driveway specified or directed to be replaced.

Width: A variable width, being the width of driveway actually replaced within the limits specified. All driveway damaged as a result of the Contractor's operations lying outside the above stated pay limits will be removed and replaced at the Contractor's expense.

Payment shall include full compensation for all materials, labor, and equipment necessary to complete the work in place.

405.4.07 CURB REPLACEMENT

Payment for replacement of curb will be made on a linear foot basis. Payment will be limited to curb actually replace within the pay width specified for trench excavation in ***Section 204 Excavation, Embankment, Bedding, and Backfill***, plus 6 inches additional width on each side of the trench excavation pay width. Measurement for payment will be the actual horizontal length of curb specified or directed to be replaced. All curb damaged as a result of the Contractor's operations lying outside the above stated pay limits will be removed and replaced at the Contractor's expense.

Payment shall include full compensation for all materials, labor, and equipment necessary to complete the work in place.

There will be no separate payment for constructing week holes in curbs at locations directed by the engineer or for constructing depressed curbs or dropped curbs for bicycle and wheelchair ramps and driveways, in conformance with Standard Plans, where shown on the Plans or as otherwise directed, it being understood that the cost thereof is included in and incidental to the contracted prices for the ***Curb Removal and Replacement*** work item.

405.4.08 PAYMENT

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular contract:

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Pay Item	Unit of Measure
1. Temporary Cold Mix Asphalt	S.Y.
2. Rock Surfacing	C.Y.
3. Pavement Base	C.Y.
4. Asphalt Concrete Pavement Removal and Replacement	L.F.
5. Portland Cement Concrete Pavement Removal and Replacement	L.F.
6. Portland Cement Concrete Pavement With Asphalt Concrete Pavement Overlay Removal and Replacement	L.F.
7. Sidewalk Removal and Replacement	S.F.
8. Driveway Removal and Replacement	S.Y.
9. Curb Removal and Replacement	L.F.

405.4.09 ALTERNATE METHOD

Should the contractor choose the bore, jack, or tunnel to avoid cutting pavement, sidewalk, driveway, or curb, which would otherwise require removal and replacement had the open trench type of construction taken place, and the Engineer concurs with said choice, he/she will be paid as if work had been done by conventional removal and replacement methods of construction and at the contracted prices for the work as set forth in the Proposal.

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406 Internal Grouting of Existing Sanitary Sewer Lines

406.1.00 DESCRIPTION

This Section covers all work necessary to clean and inspect (via TV) the sanitary sewer lines, test the joints or cracks and to retest and approve the work including television inspections complete in place.

406.1.01 DEFINITIONS

A. The elimination of ground water infiltration as used in these Specifications shall mean the elimination of infiltration of soil and water through any sewer joint as determined from earlier surveys, the television monitor, and the specified testing procedures.

B. The term ***manhole section***, as used in these Specifications, shall mean the length of sewer between a manhole and a manhole, cleanout or lamphole. This term is synonymous with the term ***reach***, which is also used in these Specifications. When one term is used the other is implied.

C. The term ***joint***, as used in these Specifications, shall mean the junction point of two adjacent lengths of sewer pipe or a crack or other pipe defect which can be made leak free by grouting.

D. The term ***clean***, as used in these Specifications, shall be defined as the removal of sufficient materials to render the sewer line to 95 percent of its original capacity or to allow passage of the necessary inspection, testing, and sealing equipment, whichever is greater.

406.1.02 WORKMANSHIP

The Contractor shall perform all work necessary to the completion of the grouting work as defined by this Contract. This work shall include, but not be limited to, the following:

A. Do all cleaning preparatory to the grouting operation.
B. Do manhole taps to determine average ground water pressure.
C. Do the low pressure air testing of all joints.
D. Do the sealing, by injection of chemical grout, of all joints failing the air test.
E. Do the removal of all grout residue left at sealed joints and the periphery of the pipe.
F. Do the retesting (post-sealing pressure test) of each joint sealed.
G. Submit the required documents to the Owner.

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406.2.00 MATERIALS AND EQUIPMENT

406.2.01 GENERAL

Since the success of the other phases of work depends a great deal on the cleanliness of the lines, the importance of this phase of operation cannot be stressed too strongly. Particular emphasis is made to the removal of accumulations of grease so that cracks and breaks can be observed during TV inspection and the sealing equipment can successfully isolate joints during testing and/or sealing.

406.2.02 CLEANING EQUIPMENT

Low Pressure Hydraulic Cleaning Equipment. This equipment is normally designed to utilize the existing sewer flows, but additional water may be needed in order to expedite the cleaning operations. Movable dam-type equipment shall be of equal diameter to the pipe behind cleaned, and shall provide a flexible scraper around the outer periphery to insure the total removal of debris and grease. Balling-type equipment shall be inflated so that a tight contact is made with the pipe wall to restrict the movement of water around the ball and to assure the removal of all debris from the invert of the pipe as well as grease from the pipe wall.

High-velocity Hydrocleaning Equipment. All high-velocity sewer clean equipment shall be truck-mounted for ease of operation. The equipment shall have a minimum of 500 feet of 1 inch ID high-pressure hose with a selection of two or more cleaning nozzles.

The equipment shall have a minimum capacity of 60 gallons per minute and a working pressure of 1,200 pounds per square inch. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. The equipment shall also include a high-velocity gun for washing and scouring manhole walls and floors. The equipment shall carry its own 1,200 gallon water tanks, capable of holding corrosive or caustic cleaning or sanitizing chemicals, auxiliary engines, pumps, and a hydraulically driven hose reel.

All controls shall be located so that the equipment can be operated above ground at minimal interference to existing traffic and/or danger to the operator.

Mechanical Cleaning Equipment. Bucket machines shall be operated in pairs with each machine powered by an engine with a minimum of 16 horsepower to insure sufficient pulling power.

Power rodding machines shall be of a continuous rod-type capable of holding a minimum of 1,000 linear feet of rod. The machine shall have a positive rod drive to produce a 2,000 pound rod pull. To insure safe operations the machine shall have a fully enclosed body and an automatic safety throw-out clutch and other safety equipment by law.

Bucket machines and rodders shall be equipped with proper tools for all types of cleaning in the sized of pipe in which work is to be performed.

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406.2.03 SEALING EQUIPMENT

Chemical grouting of sewer joints shall be accomplished by forcing sealing materials into and through the joints of the sewer pipe from within the sewer pipe in order to completely eliminate infiltration. The chemical grouting equipment and material will have the ability to successfully seal pipe line joints which are offset up to 1 ½ inches or gaped up to 1 ½ inches as viewed from the interior of the pipe. An offset joint is a joint where there is transverse displacement of adjacent pipe sections. Offset and/or separated joints beyond the limits specified shall be sealed only with the approval of the Engineer and the concurrence of the Contractor's supervising technician.

The sealing equipment shall contain two separate pumping systems capable of supplying an uninterrupted continuous flow of the sealing material at rates of between one-quarter and ten gallons per minute at a minimum pressure of 60 psig, for a continuous period of up to ten minutes. Each pumping system shall include a tank for mixing polymerizing materials and additive solids and liquids which will form the final grout mixture. Each of these tanks shall be equipped with mixing and/or recirculation systems to allow continuous or frequent agitation of suspended solid additives such as Celite 209, an additive used for added viscosity and strength. Suspended solids shall be agitated continuously throughout the grouting operations. No system of pumps or pressure devises which does not continuously maintain the exact proportioning of the fluids contained in the mixing tanks will be allowed.

The sealing device is referred to hereafter as a packer and shall be a cylindrical case of a size less than pipe size with cables at either end used to pull it through the sewer line.
The packer device shall be constructed in such a manner as to allow a restricted amount of sewage to flow at all times.
Air impervious sleeves constructed so that they can be pneumatically expanded, shall be mounted over the cylinder. When the packer is inflated, two widely spaced annular bladders shall be formed, producing an annular void between the cylinder on which they are mounted and the inside wall of the pipe to be sealed. No sealing device which is expanded hydraulically or mechanically will be allowed in order to prevent damage to the pipe.

To insure the complete mixing of the grouting materials from the dual pumping systems, the catalyzed liquid shall be injected from a single orifice into the void area formed by the packer and pipe wall.

The Contractor's equipment shall be constructed so that he/she can furnish representative samples of the grouting material at the request of the Owner. These samples shall be used to test the composition of the material in order to ascertain that it is in conformance with the specifications governing these materials.

406.2.04 SEALING MATERIALS

Sealing Material. Sealing materials shall be a chemical sealant solution containing the principal chemical sealant constituent and a catalyst system recommended by the manufacturer. The principal chemical sealant constituent and the catalyst system shall be of the same manufacturer, specifically recommended for the purpose of sealing leaks in sanitary sewer lines

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and/or stabilization of earth masses. The chemical sealant used shall have a documented service of satisfactory performance in similar usage.

The base solution shall be varied by the addition of from 3 percent to 5 percent by weight of total mix, of suspended solids for increased strength. This material may be of a diatomaceous earth like Celite 209 or an approved equal, and which also must be agitated to remain in suspension.

Because of the possible toxicity of mixing and handling the sealant materials by passing through the unbroken skin, by inhalation of dust or droplets of the material, or by swallowing, the Contractor will be required to provide whatever protection necessary to prevent anyone from coming in contact with the chemicals.

Handling and mixing shall be performed with proper equipment and personnel thoroughly familiar with the chemical involved and in accordance with the provisions of the Occupational Safety and Health Act of 1970 of the U.S. Department of Labor.

All grouting materials shall be delivered to the project in the unopened, clearly labeled, manufacturer's containers. Labels shall include no less information than the name of the manufacturer, name and chemical formula of the contents, weight, and date produced. Materials not listing this minimum of information may be rejected.

406.2.04A Types of Grout

Acrylamide Gel. This chemical grout shall consist of an intimate mixture of dry Acrylamide and dry N,-Methylenebiserylamide, in proportions of no less than 10 percent or approved equal.

The chemical sealant in its gel form, after final reaction, shall be a stiff gel (shall not be rigid or brittle) that is impermeable.

The catalyst may be Triethanelamine.

Where roots were encountered during cleaning operations, a root inhibitor such as Diclobenil shall be added according to manufacturer's recommendations.

Urethane Foam. This chemical grout is a liquid prepolymer (such as 3M Brand Grouting compound or approved equal) that cures when mixed with water to form a flexible cellular-rubber foam gasket.

The Urethane foam sealing materials shall have the following basic properties:

a) A controllable cure time from 15 minutes at 40 degrees Fahrenheit to 4.8 minutes at 100 degrees Fahrenheit when reacted by water only.

b) When an accelerator is used, cure time shall range from 5.5 minutes at 40 degrees Fahrenheit to 2.6 minutes at 100 degrees Fahrenheit.

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c) Viscosity of the sealing material shall be controlled to between 300 and 350 centipoise.

d) The liquid prepolymer shall contain solid or active material constituting 82-88 percent of its weight.

e) During injection foaming and expansion should take place causing steadily increasing viscosity.

f) Physical properties of the cured foam should be approximately 14 lbs/ft. density, 80-90- psi tensile strength and 700-800 percent elongation.

406.2.05 WATER

The Contractor is referred to SCS 105.12, as amended by these Specifications.

406.3.00 CONSTRUCTION

406.3.01 CLEANING PROCEDURES

The Contractor shall remove all solid or semi-solid debris from the sewer prior to grouting. In addition, intruding roots shall be removed from the sewer to ensure integrity of the seals to be made. Satisfactory precautions shall be taken to protect the sewer lines from damage that might be inflicted by the improper use of cleaning equipment. Whenever hydraulically propelled cleaning tools, which depend upon water pressure to provide their cleaning force or any tools which retard the flow of water in the sewer lines are used, precautions shall be taken to insure that the water pressure created does not cause any damage of flooding to public or private property being served by the manhole section involved. The flow of sewage in the sewer lines shall be utilized to provide necessary pressures for hydraulic cleaning devices whenever possible.

All sludge, dirt, sand, rocks, grease, and other solid or semi-solid material resulting from the cleaning operation shall be removed at the downstream manhole of the reach being cleaned. Passing material from manhole section to manhole section which could cause line stoppages, accumulations of sand in wet wells or damage pumping equipment shall not be permitted. When hydraulic cleaning equipment is used, a suitable weir or dam shall be constructed in the downstream manhole in such a manner that the solids shall be trapped.

Under no circumstances shall sewage or solids be dumped onto streets, ditches, catch basins, or storm drains. All removed material shall be disposed of by the Contractor away from the site of the work.

An inspection of the sewer interior shall be made by the Contractor after he/she completes the cleaning work. If the Contractor believes that the sewer line shows damage, etc., which may interfere with his/her work, he/she shall obtain a clear photograph from the monitor of the

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damaged sewer and immediately notify the Owner. Failure to notify the Owner shall shift responsibility for repair of the damage to the Contractor.

406.3.01A Screening Manholes

Whenever cleaning of the sewer is called for in the Contract Documents or when an excavation will be opened over a live sewer, the lowest manhole in the area shall be screened so that hard materials larger than 2 inches can be stopped and removed by the Contractor before he/she leaves the job site.

406.3.02 SEALING PROCEDURES

Sealant materials shall be pumped at pressures in excess of ground water pressure into the void area between the pipe and the packer, and through the leak into the soil surrounding the pipe. The pressure used shall be less than that necessary to cause grout leakage at the end elements of the packer.
The method and procedure of sealing shall be similar to that used by Gelco Grouting Service or the Penetryn System, Inc., or equivalent as approved by the Engineer.

The sealing repair shall be performed by skilled operators thoroughly familiar with the handling of the chemicals involved. Chemicals for the sealing shall be approved by the Engineer prior to use.

The method of sealing shall be such that the original crossing sectional area and shape of the interior of the sewer pipe shall not be permanently reduced or changed. Sealing materials that set to a hard rigid product that might intrude into the sewer line will not be acceptable. In the event that damaged or root-filled service connections and structural failures are discovered during the inspection of the line, the Contractor shall accurately locate such and report them to the Owner. It will be the Owner's option to repair the damaged or root-filled service connections and structural failures with his/her own forces. If in the course of the Contractor's work, the sewer pipe is damaged by the application of air pressure to the packer or by and other cause directly attributable to the Contractor's work under the Contract, he/she shall immediately cease work and report the problems encountered to the Owner. It will then be the Owner's responsibility to determine the course of action to be taken. Failure of the Contractor to report pipeline damage shall shift responsibility for repair thereof to the Contractor.

Prior to performing the post sealing pressure tests, the contractor shall scrape or otherwise dislodge any of the gelled grouting material adhering to the inside of the pipe.

The ***packer sleeve*** used to isolate the area to be sealed shall be so constructed so as to be able to regulate and monitor the pressures exerted on the inside of the pipe. These pressures shall not exceed 30 psig without prior consent of the Engineer.

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406.4.00 TESTING AND INSPECTIONS

The Owner has made closed-circuit television inspections of each manhole section to be grouted. Written reports based on this television inspection are included in these Contract Documents for the Contractor's review. These written TV inspection reports are for information purposes only. Any variance in these reports or conditions subsequently found to differ shall be recorded by the Contractor in his/her ***as-built*** reports which he/she submits to the Engineer upon completion of the work.

No work shall be done when the existing sewer flow cannot be restricted to less than 25 percent of the pipe diameter. This requirement shall not, of itself, be deemed to waive the Contractor's responsibilities for completion of the project within the time allotted by the Proposal.

406.4.01 TELEVISION INSPECTION

Where infiltration or other defects of the cleaned manhole sections are suspected, or where manhole sections are to be internally tested or grouted, they shall be visually inspected by means of closed circuit television. A videotape recording of all inspections shall be furnished to the Owner. The inspection will be done in one section at a time, and the section being inspected shall be suitable isolated from the remainder of the sewer line as required. Closed circuit television inspection shall be performed only after sewer lines have been thoroughly cleaned so that a clear, definitive picture of the interior of the pipe can be obtained.

The television camera used for the inspection shall be one specifically designed and constructed for such inspections. It shall be operative in 100 percent humidity conditions. Lighting and camera quality shall be suitable to allow a clear, in-focus picture of a minimum of 6 linear feet of the entire inside periphery of the sewer pipe. The operating technician shall at all times be able to move the camera through the line in either direction without loss of quality in the video presentation. The picture at all times shall be free of electrical interference and provide a clear, stable image of the resolutions specified.

To establish a working criteria for video picture quality, which must be maintained throughout the project, the Contractor shall furnish the Engineer with a video tape of an actual sewer line inspection which is satisfactory to the Engineer and meets the job specifications for television inspection. This video tape will become the property of the Engineer and will be used throughout the project as a standard which the Contractor's video picture quality must meet. The Contractor will contact the City of Salem to insure that video tape used will be compatible for playback on equipment in use by the City. The audio portion of the composite signal shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report. Audio reports shall be recorded by the operating technician on the video tapes as they are being produced.

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406.4.02 JOINT TESTING

After cleaning and TV inspection is completed, joint testing may be performed on sewer line joints in order to determine if leakage exists. Small holes, cracks, and other defects which can be successfully tested and/or sealed shall be considered in a like manner to a sewer line joint. Joint testing shall be performed by inducing a specified air pressure into the void area which has been created for the purpose of isolating the joint being tested. Continuous monitoring of the void area pressure shall be maintained at all times and recorded on a pressure metering deice which accurately displays the pressure to within plus or minus one-tenth of one psi and responds to and records all changes of the pressure in the void area. Systems which have questionable accuracy will not be approved.

Testing procedures shall consist of applying a precise pressure of no less than 6 psig in excess of ground water pressure into the void area which has been recorded on the ground level meter for a sufficient time to stabilize the system, the application of pressure shall cease. The pressure recording meter shall be observed for a period of 15 seconds. Should the pressure in the void area drop 2 psig in the 15 second period, the joint or joints in the void area will have been deemed to fail the test. Any joint failing the test will be re-sealed as detailed in these Specifications.

406.4.03 RECORDS

Records shall be kept of all cleaning performed. These records shall be a printed form showing the names of the Owner, data, manhole section cleaned, manhole section location, line size, length of the section, type of cleaning performed, and any special remarks concerning the condition of the line.

A television and work report in log form shall be maintained during the television inspection and repair work. Printed location records shall be kept by the Contractor and will clearly show the exact location in relation to the adjacent manholes of each infiltration point, building sewer connections, all joints which are infiltrating or exhibit other unusual conditions, roots, storm sewer connections, collapsed sections of pipe, joints sealed, presence of scale or corrosion, and other discernible features and will be presented to the Engineer in a typewritten report. It shall also contain notations on any irregularities of pipe alignment of grade. The log shall also show each item that is repaired. Two copies of all records shall be furnished to the Engineer. The purpose of the video tape recording shall be to supply a permanent visual and audio record of the manhole section surveyed, and the video tapes shall become the property of the Owner upon completion of the project.

406.4.04 WARRANTY AND ACCEPTANCE

The Owner will conduct the warranty test on approximately 10 percent of all joints in each of several reaches of sewer selected at random from among the reaches grouted under the Contract. The total length of these test reaches shall be approximately 10 percent of the total length of the sewers in the contracted grouting area. Each joint in these random manhole sections shall be tested. If it is found that 4 percent or more of the joints tested do not pass the warranty test, the City will then choose another random 10 percent of the total line length for

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testing. If the second inspection passes, the entire area will be accepted. If it is found that 4 percent or more of the joints tested do not pass the second required warranty test, the Owner, at its option, may require the Contractor to retest (and reseal as necessary) all of the manhole sections grouted under the original Contract. This retest and reseal operation shall be done at no additional cost to the Owner.

After the retest and reseal operation (if required) is completed, the City will then perform another warranty test of random manhole sections equaling 10 percent of the entire area. This process will be done until the City is satisfied that the Contract has been satisfactorily completed. The City will notify the Contractor ten days prior to the commencement of the warranty inspection. The Contractor's representative may attend this inspection, but it is not mandatory.

All reaches grouted under this Contract may be TV inspected by crews of the Owner at any time, after the grouting operation is completed to check for visibly leaking joints, structural damage not reported, and grout residue left in the lines. Any problems discovered during the one year warranty period shall be corrected at no additional cost to the Owner.

406.4.05 PLUGGING ABANDONED TEES AND SERVICES

Where unused or abandoned tees are shown on the Plans, the Contractor shall grout the same from the interior of the sewer main to create a leak free plug at the tee and its connection point at the mainline. Where a service and is point of connection is not shown, the Contractor shall verify the location of the active tap and plug all inactive taps in that vicinity. Any plugs installed in lines that are later found to be active shall be removed by the Contractor at no expense to the Owner.

For the purpose of payment the plug shall be considered as a joint, and payment will be made for each inactive tee grouted at the contracted price (s) for internal grouting of existing sewer (per joint) as set forth in the Proposal.

406.5.00 MEASUREMENT AND PAYMENT

Payment for the work specified herein will be made at the respective unit price stated in the Contractor's Proposal. This payment shall constitute full compensation for the work as specified and as shown.

No extra payment shall be made for the air test done at the sealed joint to show the acceptability of the repair.

When listed separately in the Proposal., TV inspection work will be paid at the unit price per linear foot and will include cleaning the sewer prior to the work and the reduction of flow to the level specified by pumping or other approved means.

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407 Installation of Liner Pipe Within Existing Sanitary Sewer

407.1.00 DESCRIPTION

This Section covers the installation of liner pipe within the existing sanitary sewer pipelines an connection of existing sewer services to the liner pipe, complete.

407.2.00 MATERIALS

407.2.01 POLYETHYLENE LINER PIPE

The liner pipe to be installed in this project shall be polyethylene pipe conforming to ASTM D 3350 with a minimum cell classification 335433C of the size and SDR shown on the Plans.

Each length of pipe and fitting shall be marked by the manufacturer with trade name, nominal size, the ASTM Specifications number, and the type and grade.

407.2.02 EPOXY MORTAR

Polymer grout shall be CR-202 ***Grouting Compound*** as manufactured by Avanti International, or equal.

407.3.00 CONSTRUCTION

407.3.01 GENERAL

The locations and size of working pits shall have prior approval of the Engineer. Working pits shall be adequately protected at night as approved by Engineer and Traffic Division.

407.3.02 PREPARATION

The sewer line shall be thoroughly cleaned and debris, sediment, and obstructions shall be removed prior to placing of any liner pipe. Television inspection records of the existing system are available for use of the Contractor. However, the Contractor may make additional television inspection, if desired.

407.3.03 WORKING PIT

The top half of the exposed existing pipe within the pit shall be removed, leaving the bottom half in place to serve as a cradle for the liner pipe and as a channel for sewage flow. Every effort shall be made to ensure that the liner pipe maintains proper grade through the pit.

Before the working pit shall be backfilled, grout a minimum of 18 inch in length of epoxy mortar at both ends of the pit at the annular space to ensure a seal between the liner pipe and the existing pipe, and so prevent any fluid movement. This practice shall apply to all open pits. If

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feasible, all grouting at the annular space shall be done after all services have been transferred to the liner pipe.

Dewatering: Provide and maintain ample means and devices to remove and dispose of ground water and prevent surface water from entering the sanitary sewer system.

Take all precautions necessary to prevent the ***uplift*** or floating of the liner pipe due to the high flow in the existing system. By-passing of sewage by pumping into other sanitary sewer systems may be permitted with prior approval of the Engineer.

407.3.04 INSTALLATION

The liner pipe may be jacked into the existing pipe or drawn by means of cables. A tapered guide shall be affixed to the leading pipe section. The Contractor shall have cable and pulling head attached firmly to the liner even if he/she opts to push same into the sewer and shall sufficiently demonstrate that refusal is obtained after diligent, simultaneous use of both methods, prior to consideration by the Engineer for Extra Work compensation for additional pull pit or pits.

The coupling for making a joint between two lengths of polyethyene pipe at the pull pit shall be as specified for ductile iron pipe in Subsection 402.3.06 herein.

Pipe handling and installation shall be in strict conformance with the pipe manufacturer's recommendations. Backfill of the working pit shall be with 1 inch minus crushed rock. Surface restoration shall be required and shall conform to Division 2 of those Specifications. In cases where excavation is necessary to remove any misalignment or obstacles in the existing system, conform to Section 204.

407.3.04A Butt Fusion

The ends of the pipe shall be squared off and heated with a joining tool with a face temperature of approximately 500° F. The molten surfaces shall be joined and allowed to cool for a minimum of ten minutes before being handled. Do not work or test the pipe until the minimum cooling time has elapsed.

407.3.04B Pipe Distribution

Distribute material on the job no faster than it can be used to good advantage. Unload pipe which cannot be physically lifted by workers from the trucks, by a forklift or other approved means. Do not drop pipe of any size from the bed of the truck to the ground. Do not distribute more than one week's supply of material in advance of laying, unless otherwise approved by the Engineer.

407.3.04C Pipe Preparation and Handling

Inspect all pipe and fittings prior to lowering into trench to ensure no cracked, broken, or otherwise defective materials are being used. Clean ends of pipe thoroughly.

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Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

When cutting and/or machining the pipe is necessary, use only tools and methods recommended by the pipe manufacturer and approved by the Engineer.

407.3.06 ANNULAR SEALING

The Contractor shall seal the annular space between the pipes by forcing epoxy mortar into the pipe for a distance of 18 inches on each side of all service reconnection saddles and also at all reconnections to manholes. Grouting shall be in strict accord to manufacturer's recommendations with equipment specially designed for application of the material. Work shall be done by personnel experienced in the placing of this type of grout (or in presence of manufacturer's representative) by the Expanded Gasket Placement, EGP, technique.

407.3.07 MANHOLES

Where existing manholes are designed to remain, remove (saw) the top half of the liner pipe within the manhole after the liner pipe is installed. Grout the annular space between the liner pipe and the existing flow line to create a waterproof seal. Further cuts of the liner pipe will be necessary to obtain flow channels for side sewer entrance. Grout also a minimum of 18 inch in length of epoxy mortar or tampered dry cement grout at the outside of the manhole at the annular space to ensure a seal between the liner pipe and the existing pipe. Where manholes are designed to be abandoned, backfill the manhole with ¾ minus crushed rock after the liner pipe is installed. Salvage for the Owner the manhole casting and lid. Restore adjacent ground surface. Surface restoration shall be required and shall conform to Division 3.

407.3.08 SEWER SERVICE RECONNECTIONS

After the liner pipe is installed, the Contractor shall excavate and reconnect the existing sewer service lines to the liner pipe. Bare the liner pipe for a minimum of 18 inches each side from the service pipe. Tapping into the liner pipe shall be done only by approved methods such as tapping machine or drill. No chisel work of any kind will be allowed. Fittings shall be installed according to manufacturer's recommendations. Grout the annular space between the liner pipe and the existing sewer line of each side of the service to prevent fluid movement into the annular space. Service connection to the liner pipe shall be polyethylene that is either heat or solvent welded to the liner or full circumferential strap-on saddle, using a half circumferential sheet neoprene gasket and CR202 or equal as a sealant.

407.4.00 TESTING AND ACCEPTANCE

407.4.01 AIR TESTING

Final Sewer Cleaning. Prior to final acceptance and final manhole-to-manhole inspection of the sewer system by the Engineer, flush and clean all parts of the system. Remove all accumulated construction debris, rocs, gravel, sand, silt, and other foreign material from the sewer system at

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or near the closest downstream manhole. If necessary, use mechanical rodding or bucketing equipment.

Upon the Engineer's final manhole-to-manhole inspection of the sewer system, if any foreign matter is still present in the system, re-flush and clean the sections and portions of the lines required.

As directed by the Engineer, the contractor shall conduct air tests between manholes. Air tests shall be conducted prior to service line reconnections.

Where physically unable to conduct air tests between manholes, the City may elect at no expense to the contractor to air test sections of the liner pipe in random locations and in random lengths.

Testing Equipment and Procedure. Furnish all necessary testing equipment and perform the tests in a manner satisfactory to the Engineer. Any arrangements of testing equipment which will provide observable and accurate measurements of either air or water leakage under the specified conditions will be permitted. Gauges for air testing shall be calibrated with a standardized test gauge provided by the Engineer at the start of each testing day. The calibration shall be witnessed by the Engineer.

Subsequent Failure. Infiltration of groundwater in an amount greater than herein specified, following a successful hydrostatic or air test as specified, shall be considered as evidence that the original test was in error or that subsequent failure of the pipeline has occurred. The Contractor will be required to correct such failures should they occur within the warranty period.

The Contractor, in contracting to do this work, agrees that the leakage allowances as indicated herein are fair and practical.

Procedure. After all the plugs are in place and securely blocked, introduce air slowly into the pipe section to be tested until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any groundwater that may submerge the pipe. Allow a minimum of two minutes for the air temperature to stabilize. Determine the height of the groundwater table, at the time of the test, as specified for hydrostatic testing.

Basis of Acceptance. Pipe and joints being air tested shall be considered acceptable where tested at an average pressure of 3.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe, when the section of lines does not lose air at a rate greater than 0.0030 cubic foot per minute per square foot of internal pipe surface.

The pipe and joints shall also be considered as acceptable when the time required in seconds for the pressure to decrease from 3.5 to 2.5 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe, is not less than computed in accordance with the ***Recommended Procedure for Conducting Acceptance Test*** appended at the end of this Specification.

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407.4.02 TELEVISION INSPECTION

At the discretion of the Engineer, the Owner will, at no expense to the Contractor, make a televised inspection of the liner pipe after service reconnection. Any defects in materials or workmanship shall be satisfactorily correct prior to final acceptance of the work.

407.5.00 PAYMENT

407.5.01 PIPE

Payment for pipe will be based upon the unit price per linear foot as set forth in the Contractor's Proposal for the various classes, types, and sizes of pipe installed as shown or as directed by the Engineer. Payment for the pipe will be based on the actual number of feet installed, as measured by the Engineer. The pipe will be measured horizontally from center-to-center of manholes or to center of cleanout wye or the termination of the installation, whichever is applicable.

There will be no separate payment for cleaning or TVing existing pipe, sealing annular spaces, by-pass pumping, bedding in the pull pits, or providing any other labor, materials, or equipment necessary to install the liner pipe as specified in this Subsection, it being understood that the cost thereof is included in the contracted price for ***Polyethylene Liner Pipe***.

Pull pits for installing the polyethylene liner pipe will be paid for under the applicable contracted prices for the following work items: pavement, curb, sidewalk, and/or driveway removal and replacement, and excavation and backfill, at the locations and not to exceed the dimensions shown on the Plans. The Engineer may authorize additional quantities for payment only if refusal is obtained as defined in Subsection 407.3.04.

The Engineer will withhold full payment on any section of pipe deemed unsatisfactory due to excessive leakage, or any other cause until such defects have been corrected in accordance with the intent of these Contract Documents.

If, within the year covered by the Performance Bond, any section of the sewer system, although originally accepted, is actually not acceptable due to subsequent excessive leakage, the Contractor shall repair or replace the affected portion. It is understood that if the Contractor fails to do such work as required, the Surety shall be liable for said costs of repair or replacement.

407.5.02 MANHOLE ABANDONMENT

Manholes to be abandoned will be paid at the unit price stated in the Contractor's Proposal.

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407.5.03 SERVICE RECONNECTIONS

Service reconnections will be paid for at the unit price stated in the Contractor's Proposal for the various sizes. The unit price shall constitute full payment for the installation of the reconnection, including, but not limited to, installation, grouting, connection pipe, couplers, excavation, backfill, and surface restoration. No additional compensation will be allowed unless the reconnection point to the existing service exceeds 5 horizontal feet from the centerline of the liner pipe, even if said reconnection requires a deep connection riser. Additional footage will be paid for at the contracted prices for ***Trench Excavation and Backfill, Sanitary Sewer Pipe/Bedding, Pavement, Sidewalk or Curb Removal and Replacement,*** or as Extra Work if said items do not appear in the Proposal.

Payments for all other work specified in this Section shall be considered incidental to the project cost, and the expense shall be included in the unit prices bid.

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408 Installation of Insituform Liner Within Existing Sanitary Sewer

408.1.00 DESCRIPTION

The intent of this portion of the SCS is to provide for rehabilitating sanitary sewer lines by the insertion of a flexible polyester felt liner saturated with a thermosetting resin into the existing sewer line. When complete, the cured liner should extend from end to end in a continuous, tight fitting, watertight pipe-within-a-pipe with all active laterals restored to leak free service at their connection to the liner.

408.2.00 MATERIALS

408.2.01 GENERAL

The Contractor shall furnish, prior to use of the lining materials, satisfactory written guarantee of his/her compliance with the Specifications for all materials used in the Insituform process furnished by others than Insituform of North America, Inc.

Should the Contractor choose to submit a deviation that does not meet all the requirements of the Owner's specifications, he/she shall include a description of the deviation with data showing the engineering aspects of the deviation. Acceptance of such deviations shall be subject to approval by the Engineer.

408.2.02 INSITUFORM LINER

The lining material shall be polyester fiber felt tubing lined on one side with an impermeable 3 mil minimum thickness membrane, such as polyurethane or polyvinyl chloride (P.V.C.). It shall be fully impregnated with the liquid thermosetting resin required. The tubing shall be properly sized to the diameter and length to be lined. The finished lining material thickness shall be as shown on the Plans. The cured lining material shall conform to the minimum structural standards listed below:

Liner Material Test	Standard	Result
Tensile Strength	ASTM D 638	3,000 psi
Flexural Strength	ASTM D 790	3,000 psi
Modulus of Elasticity	ASTM D 790	300,000 psi

408.3.00 CONSTRUCTION

408.3.01 GENERAL

The Contractor shall designate a location where the uncured resin in original containers and the un-impregnated liner will be vacuum impregnated prior to installation. The Contractor shall

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provide for the Engineer's inspection of the materials and "wet-out" procedure. A resin and catalyst system compatible with the requirement of this method shall be used. The quantities of the liquid thermosetting materials shall be sufficient to provide saturation of the lining thickness shown on the Plans.

408.3.02 PREPARATION

Preparatory to lining any sewer reach, the users of the sewer shall be notified of the work; the pie shall be cleaned per SES 406.3.01; the structural repairs and/or other work designated on the Plans shall be completed; and the flow shall be diverted in such a way that overflow of the upstream sewer is avoided, while eliminating all flow in the reach to be lined.

All preparations shall be completed to the Owner's satisfaction prior to beginning to insert the liner into the sewer. Once the insertion phase is begun, the work shall be carried through to completion without delay or interruption until all service reconnections are completed.

As part of his/her preparatory responsibilities, the Contractor shall ensure that no other work is simultaneously in progress upstream or downstream of his/her operation which may adversely affect the successful completion of his/her work.

408.3.02A Scheduling

The work shall be so scheduled and conducted such that the liner insertion water service interruption begins between the hours of 7 p.m. and 9 p.m., or 8 a.m. and 10 a.m.

Users of the sewer reach to be lined shall be notified in writing 48 hours in advance of service interruption. The notice shall include the following items:

1. Day and date of service interruption.
2. Estimated time, in hours, water service will be shutoff.
3. Estimated time, in hours, sewer service will be turned off.
4. Approximate time service interruption will begin.

A written record of these notifications shall be maintained by the Contractor and turned over to the Engineer.

The water service interruption shall not exceed eight hours and the sewer service interruption shall not exceed an additional one-half hour per connection.

The water service shall be turned off only by the Owner and shall be phased with the liner insertion such that its discontinuance time for each user is minimized. The Contractor shall restore the water service as soon as the liner is cured.

Each user shall be notified verbally when water service is restored, and again verbally when sewer service is restore.

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408.3.02B Sewer Cleaning and Clearing

The sewer shall be cleared of all obstructions such as solids, dropped joints, protruding service connections, or collapsed pipe that will prevent insertion of the liner or prevent it from obtaining a circular cross section when completed.

Obstructions that cannot be removed by conventional cleaning equipment shall be removed by excavating a repair pit. Prior to commencing the work, the Contractor shall obtain the Engineer's written approval for any work not shown on the Plans but necessary to achieving a quality product.

Television reports and tapes are available for review by the Contractor. Structural failures requiring repair prior to lining installation are noted on the Project Plans.

408.3.02C Sewer Repairs

Where shown on the Plans or approved by the Engineer, excavate a repair trench, remove the defective mainline sewer pipe, and construct new sewer per SCS 402.3.00 and 404.3.00 except that acceptance shall be contingent on the quality of workmanship as shown by TV inspection and not a pressure test of the pipe. Connections to the existing mainline at each end of the repair shall be made by e the "180 degree roll-in technique" for bell and spigot pipe and by using a Dresser 40, long style coupling or equal, for plain end pipe. The inverts of the new and existing pipe shall match at each end of the repair.

The Contractor shall furnish a video tape of each finished repair which meets the quality specified in SCS 406.4.01.

408.3.02D Flow Control

The Contractor shall at all times provide for the flow of sewage around the reach (or reaches) of pipe to be lined. The by-pass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and by-pass lines shall be of adequate capacity and size to handle the flow.

In rare situations it may be permissible to plug the upstream manhole without pumping the flow around the reach to be lined. Such a condition will be shown on the Plans or approved in writing by the Engineer prior to the work.

408.3.03 INSTALLATION

The wet-out liner material shall be inserted through an existing manhole and fully extended to the next designated manhole. The inversion head shall be adjusted to sufficient height to extend the liner from manhole to manhole, to hold the liner snug to pipe wall, and to produce dimples at side connections and flared ends at the manholes. Care shall be taken not to over

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stress the felt fiber at the elevated curing temperatures that may cause damage or failure of the liner prior to cure.

408.3.03A Curing of the Liner

After insertion is completed, the Contractor shall uniformly raise the water temperature in the entire liner above the temperature required to effect a cure of the resin as determined by the resin/catalyst system employed. The liner shall be held under positive head pressure until the resin has cured and attained the physical strengths specified in the materials section.

Water temperature in the line during the cure period shall not be less than 150° F or more than 200° F as measured at the far end of the lower quadrant (invert).

The cure period shall be of a duration recommended by the resin manufacturer during which time the recirculation of the water to maintain the temperature in the liner within the temperature range will be continued.

408.3.03B Cool Down of the Liner

The Contractor shall cool the hardened liner to a temperature below 100°F before relieving the static head. Care shall be taken in the release of the static head such that a vacuum will not be developed that could damage the newly installed liner.

While the liner is cooling, water service shall be restored to the users, and they shall be instructed to limit its use until the sewer service is reconnected.

408.3.04 SEALING LINER IN MANHOLES

If due to broken or misaligned pipe at the manhole wall, lining fails to make a tight seal, the Contractor shall apply a seal at that point. The seal shall be of a resin mixture compatible with the liner.

408.3.05 SERVICE RECONNECTION

After the liner has been cured, the Contractor shall restore the existing active service connections. The services shall have a smooth invert and capacity shall be restored to a minimum of 90 percent of the original.

408.4.00 TESTING AND ACCEPTANCE

408.4.01 INSPECTION

The finished lining shall be continuous over the entire length of an insertion run between two manholes and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The lining shall be impervious and free of any

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leakage from the pipe to the surrounding ground or from the ground to the inside of the lined pipe.

Any defects visible during the warranty period which will affect the integrity or strength of the lining shall be repaired at the Contractor's expense, in a manner mutually agreed by the Owner and the Contractor.

408.4.02 HYDROSTATIC TESTING AND TELEVISION INSPECTION

The water tightness of the liner shall be tested in accordance with SCS 402.3.14G as the liner is cured. The Owner will conduct a TV inspection of the work after the liner is installed and tested and the services have been restored at no expense to the Contractor.

408.4.03 CLEAN-UP

Upon completion of the installation work and after required testing indicates the lining is acceptable, and inspection show surface restoration is complete, the Contractor shall reinstate the project area affected by his/her operation.

408.4.04 WARRANTY

The Contractor shall warrant, to the Owner and his/her Engineer, that the methods, materials, and equipment used herein, where covered by patents, are furnished in accordance with such license and the prices included in this Proposal include applicable royalties and fees in accordance with such license. This warranty shall include the defense against all claims from infringement of patent and shall save harmless, the Owner and his/her Representative from loss on account thereof.

408.5.00 PAYMENT

408.5.01 INSITUFORM LINER

Payment will be made at the contracted price bid per linear foot of specified Insituform Liner supplied to and installed at the project site, including all royalties, fees, and taxes chargeable to the Contractor for the work.

408.5.02 FLOW CONTROL

Payment will be made at the contracted lump sum price for flow control, including mobilization, notifications to sewer user, by-pass pumping, testing, and cleanup and any ancillary items of work essential to proper and effective performance of the work.

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408.5.03 SERVICE RECONNECTION

Payment for service reconnection to the cured liner shall be at the unit price bid for each reconnection authorized regardless of the method used and shall cover all labor, equipment, and materials employed to accomplish the work, complete.

408.5.04 SEWER REPAIRS

Payment for repairs to the existing sewer pipe where called for on the Plans shall be made at the contracted prices for the various applicable items of work listed in the Proposal. Said items may include any or all of the following: common trench excavation and common or granular backfill, pavement removal and replacement, sanitary sewer pipe/bedding, tee and wye fittings, shoring, sheeting, and bracing, etc. Incidental to and included in these costs shall be all work necessary to provide the Owner with a video tape of all repair work.

408.5.05 TV INSPECTION

Payment for this work, which includes cleaning the sewer, shall be as specified under Subsection 406.5.00 herein above.

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Division 5 – Water

501 Water Pipe and Fittings

501.1.00 DESCRIPTION

501.1.01 GENERAL

This Section covers the work necessary for furnishing and installing water pipe and fittings normally used for water distribution systems.

501.1.02 CERTIFICATION

Furnish certification where specifically required by the Engineer properly executed by the manufacturer, showing compliance with the required Specifications, as requested in conformance with ***GENERAL REQUIREMENTS, Subsection 106.04***.

Furnish to the Owner the current "Certificate of Compliance" issued by Underwriters' Laboratories, Inc., prior to installation of any ductile iron pipe, cast iron fittings, or ductile iron fittings. No ductile iron pipe, cast iron fittings, or ductile iron fittings will be accepted by the Owner without a valid "Certificate of Compliance."

501.1.03 CORROSION

Take protective measures as specified by the Engineer against electrolysis and corrosion from contact between dissimilar metallic materials at all points of contact.

501.1.04 OPENING VALVES

Valves shall be opened and/or operated by City personnel only. (Reference: City of Salem Department of Public Works Departmental Policy and Procedure WA 1-13.)

501.2.00 MATERIALS

501.2.01 GENERAL

Furnish the size, strength and thickness classification, the type of joints, and type of materials as specified. Furnish catalog data for all materials and shop drawings for all fabricated items for approval prior to ordering or fabricating.

501.2.02 CAST IRON PIPE—Deleted

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501.2.03 DUCTILE IRON PIPE

Ductile iron pipe material shall conform to ASTM 536. Pipe shall be centrifugally cast, conforming to ANSI A 21.51 (AWWA C 151), and shall be cement mortar lined and seal coated, conforming to ANSI A 21.4 (AWWA C 104). Pipe shall have a current "Certificate of Compliance" issued by Underwriters' Laboratories, Inc., certifying that representative samples of pipe are in accordance with ANSI/NSF Standard 61: Drinking Water Systems Componenets—Health Effects. Pipe joints shall be mechanical, flanged, or push-on type. Furnish gaskets and joint lubricant conforming to ANSI A 21.11 (AWWA C 111), suitable for designated pipe joint, size, and pressure rating.

501.2.04 CONCRETE CYLINDER PIPE

Concrete cylinder pipe shall conform to AWWA C 300. Steel cylinder thickness reinforcing wire diameter and spacing and cement mortar lining and coating shall be as specified. Furnish flanged, welded, or Carnegie type push-on joints as required.

501.2.05 STEEL PIPE

Steel pipe shall be the diameter and wall thickness shown and shall be manufactured in accordance with AWWA C 200 unless otherwise specified. Where required, furnish steel pipe protected by coal-tar or fluroplastic coating and lining as specified by the Engineer. Steel pipe joints shall be Carnegie type as specified or flanged or plain end for use with mechanical couplings.

501.2.06 GALVANIZED STEEL PIPE

Unless otherwise specified, all galvanized steel pipe shall be Schedule 40, manufactured in accordance with ASTM A 120 and AWWA C 800, zinc coated inside and outside by the hot-dip process conforming to ASTM B 6 and ASTM A 120.

501.2.07 PIPE FITTINGS AND SPECIALS

Pipe fittings and specials used with ductile iron pipe shall conform to ANSI A 21.10 (AWWA C 110) or ANSI 21.53 (AWWA C 153). Class 250 cast (gray) iron fittings and Class 350 ductile iron fittings shall be cement mortar lined and seal coated (inside) as specified for pipe herein above. Fittings shall have a current "Certificate of Compliance" issued by Underwriters' Laboratories, Inc., certifying that representative samples of fittings are in accordance with ANSI/NSF Standard 61: Drinking Water Systems Components—Health Effects. Where joint type is not specified, the stab (push-on) type shall be used. Other joints that may be specified are mechanical, flanged, and various locking types. Manufacture fittings and specials for concrete cylinder pipe in accordance with AWWA C 300. Fittings may be furnished with plain ends for welding, flanged joints, or push-on joints, as specified.

Unless otherwise stated, manufacture fittings for steel pipe in accordance with AWWA C 200 and AWWA C 208. Furnish fittings for steel pipe that have plain ends, push-on joints as specified, or flanged ends. Protect steel pipe fittings and accessories by applying coal-tar enamel as specified in AWWA C 203 or as otherwise specified.

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501.2.08 FLANGES AND GASKETS

Provide flanges and gaskets conforming to the requirements of AWWA C 207, Class D unless otherwise specified, rated at 150 to175 psi. Flange drilling shall conform to ASA B 16.5. Provide bolts and gaskets conforming to AWWA C 207.

501.2.09 MECHANICAL COUPLINGS

Provide cast iron mechanical couplings where connecting pipes are made of cast or ductile iron. Provide steel mechanical couplings where connecting pipes are made of steel or concrete cylinder pipe. Couplings shall be capable of withstanding the designated internal hydrostatic test pressure without leakage or overstressing. Coupling diameter shall be compatible with the outside diameter of the pipe on which the coupling is installed. Steel couplings shall receive corrosion protection as specified in Subsection 501.3.06. Mechanical couplings shall have a minimum metal ring dimension as shown. Bolts shall be stainless steel or ductile iron compatible with the coupling used.

501.2.10 RESTRAINED JOINTS

Achieve joint restraint through the use of flanges, welded joint, joint harnesses, or other means as shown. Field welding of steel joints shall conform to AWWA C 206. Where joint harnesses are used, they shall consist of steel tie bolts extending across the pipe joints with lugs shop welded to the pipe barrel as shown. Joint harness assemblies shall conform to AWWA Manual M 11, sized as required to withstand the hydrostatic test pressure on the pipe. Components of joint harness shall be hot-dip galvanized after fabrication.

501.2.11 THRUST BLOCKS AND ANCHOR BLOCKS

Furnish and place thrust and/or anchor blocks sized as shown on the Plans, or if not shown, in accordance with the applicable Standard Plans. Use Portland Cement concrete conforming to ASTM C 94, developing a 28 day compressive strength of at least 2,500 psi placed as shown on the plans.

501.2.12 MAIN LINE CHLORINATION ASSEMBLY

Materials for main line chlorination assemblies are shown on the applicable Standard Plan and specified elsewhere in the SCS.

501.3.00 CONSTRUCTION

501.3.01 REMOVAL OF DAMAGED MATERIAL

Remove material from the job site that in the judgment of the Engineer is damaged beyond repair. Payment will not be made for damaged materials, their removal, or for repairs to such materials.

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501.3.02 PREPARATION OF TRENCH

Prepare the trench for pipe laying as specified in Section 204 of these Specifications. Grade the bottom of the trench to the line and grade to which the pipe is to be laid, with proper allowance for pipe thickness and for pipe base when specified. The trench bottom shall form a continuous uniform bearing and support for the pipe between bell holes.

501.3.03 PIPE LAYING

Distribute the pipe so that no hazard will be presented to occupants of the joining property pedestrians, or vehicular traffic. Lift the pipe during unloading using two slings placed at quarter points of the pipe sections. Pipe may be lifted into the trench using one sling near the center of the pipe, provided the pipe is guided to prevent its uncontrolled swinging. The sling shall bear uniformly against the pipe. When not being handled support the pipe on timber cradles or on properly prepared ground, graded to eliminate all rock points and to provide uniform support along the full length. When being transported, support the pipe at all times in a manner which will not permit distortion or damage to the lining or coating. Replace or repair any pipe damaged in handling to the satisfaction of the Engineer. Payment will not be made for damaged pipe or repairs to such damaged pipe.

Prior to lowering pipe in the trench, the Engineer will check for damages to the pipe coating. Repair all damages or flaws to the coating before the pipe is placed in the trench. Materials used for repair shall be the same as the material being repaired.

Thoroughly clean the ends of the pipe being joined by using a wire brush or other method to remove all foreign matter from the pipe joint.

Prevent foreign material from entering the pipe while it is being placed in the trench. Remove all foreign material from the inside of the pipe and joint before the next pipe is placed. If the pipe cannot be placed into the trench in place without getting earth into the pipe, the Engineer may require that wooden plugs or snugly fitted, tightly woven canvas bags be placed over each end of the pipe before lowering it into the trench. In this event, leave the plugs or bags in place until the connection is to be made to the adjacent pipe. Keep debris, tools, rags, or other materials out of the pipes at all times. Follow pipe laying operations closely with joint coating operations as required and backfilling of trenches as specified in Section 204.

Lay pipe with its bell end facing the direction of laying. For lines on an appreciable slope, face bells up grade unless otherwise allowed by the Engineer. Whenever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, do not exceed the specified allowable amount of deflection or that recommended by the pipe manufacturer. Where pipelines are intended to be laid in a straight line, do not deviate from a straight line in excess of 1 inch for line and ¼ inch for grade. In order to avoid utility conflicts the pipe shall be deflected at the joint(s) within the allowable limits recommended by the manufacturer in order to avoid the conflict.

When pipe laying is not in progress, close the open end of the pipe with a water tight plug or by other approved means to prevent entry of trench water or other foreign materials into the pipe.

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501.3.04 JOINTING

501.3.04A Push-on Joint Pipe and Fittings

Lay pipe with push-on type joints in strict accordance with manufacturer's recommendations. Provide all special tools and equipment required for the installation. Lubricate the bell and spigot end as required by the manufacturer with an approved pipe lubricant. Furnish the gaskets required for the joint being assembled. Install the gasket with uniform tension around the joint groove before placing the pipe in the trench. After assembly, check the gasket position with a feeler gauge to ensure proper seating.

501.3.04B Field Welded Joints

Where pipe is to be joined in the field by welding, perform all welding operations in accordance with AWWA C 206 unless otherwise specified.

501.3.04C Screw Joint Pipe

Ream, clean, and remove burrs and mill scale from piping before making up joint. Use joint compound acceptable for use with potable water. Cut all threads to the proper length and depth so that the pipe extends into the fitting the full depth of the fitting thread.

501.3.05 JOINT PROTECTION

501.3.05A Concrete Cylinder Pipe

After joining the pipe as specified, clean the exposed metal at the exterior space and fill the annular space with a Portland Cement grout composed of one part cement to 1 ½ fine aggregate with sufficient water to form a mixture the consistency of thick cream. Wrap the joint with a strip of woven fabric and band around the pipe at each side of the joint. The fabric shall be of such a weave as to allow the escape of air and excess water, but prevent escape of mortar. Pour the joint full of grout through a space in the woven fabric slightly to one side of the top. Rod the grout with a beaded wire or chain as it is poured into the joint. Immediately after completing the exterior joint, place damp earth over and around the joint to prevent rapid drying. Styrofoam diapers with integral banding may be used subject to prior approval by the Engineer.

After the backfill has been placed at least to the top of the pipe, dampen the inside joint space with water, or a neat cement slurry, and fill be compacting into the joint a Portland Cement mortar composed of one part cement to not more than two parts fine aggregate with sufficient water to form a stiff mix. Finish the surface to a dense troweled surface free of projections or depressions.

501.3.05B Steel Pipe

Before the pipe is joined, apply the coating specified to the interior of the pipe at the joint. Furnish and apply material in accordance with AWWA C 203. Apply the coating in accordance with manufacturer's instructions completely over the uncoated portion of

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the pipe and overlap the factory coating on the pipe barrel for at least 2 inches. Use a diaper to retain hot coal-tar enamel as required.

501.3.06 ELECTRICAL CONTINUITY AND BOND BARS

The required materials and installation for this item shall be as specified in the Special Specifications contained in the Contract Documents.

501.3.07 FITTING INSTALLATION

Install fittings at the location shown or as directed. Handle, clean, and install the fitting as specified in the appropriate sections for laying pipe. Where a cut in the pipe is necessary for inserting valves, fittings, or closure pieces, cut the pipe mechanically without damaging it or its lining and leave a smooth end at right angles to the centerline of the pipe. Do not flame cut without approval of the Engineer. Dress and bevel the cut end of the pipe to remove sharp edges and projections which may damage the gasket. Repair all damaged lining and coating to the satisfaction of the Engineer.

501.3.08 ANCHORAGE

On all pipelines, securely anchor all tees, plugs, blow-offs, caps, and bends as shown or as directed to prevent movement due to thrust. Achieve anchorage only by use of approved thrust blocking or approved joint restraint.

501.3.08A Thrust Blocking

Provide thrust blocking, as shown or as directed by the Engineer, using concrete as specified. Place the concrete blocking between undisturbed earth and the fitting to be anchored. The bearing surface shall be sized and located to adequately withstand the applied thrust force. Do not encase pipe joints or fitting joints with concrete.

501.3.08B Welding

If welding is to be used as a means of joint restraint, perform welding in accordance with AWWA C 206. Obtain the Engineer's approval of all welding procedures prior to proceeding.

501.3.08C Joint Harness

Install harness rods as shown. Do not over tighten or pull pipe out of alignment, or damage pipe or pipe coating.

501.3.09 HYDROSTATIC TESTS

Make hydrostatic pressure and leakage tests on all newly laid pipe in accordance with Subsection 504.3.04. Furnish all necessary equipment and material. Make all taps in the pipe as required and conduct the tests.

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Conduct the tests after the trench has been completely backfilled. Where any reach of pipe requires thrust blocks, do not make the pressure test until at least five days have elapsed after the concrete thrust blocks have been installed.

501.3.10 DISINFECTION

The Owner will disinfect the pipeline as required after the hydrostatic test is acceptable. No connection will be made to the existing City water system until disinfection is complete and test results have been received showing that the pipe has successfully passed the bacteriological test. No extra payment or extension of time will be allowed the Contractor for the time elapsed to achieve acceptable disinfection of the pipe.
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.

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 2 ½ inch hydrant opening will, under normal pressure, provide this velocity in pipe sizes up to and including 12 inch. See Table 1.

TABLE 1
Required Openings to Flush Pipelines
(40-psi Pressure)

Pipe Size in.	2.5 fps Flushing Velocity				4 fps Flushing Velocity		
	Flow gpm	Orifice Size in.	Hydrant Openings		Flow gpm	Hydrant Openings	
			No.	Size in.		No.	Size in.
4	100	15/16	1	2½	160	1	2½
6	220	1⅜	1	2½	350	1	2½
8	390	1⅞	1	2½	630	1	2½
10	610	2 5/16	1	2½	980	1	2½
12	880	2 13/16	1	2½	1,400	2	2½
14	1,200	3¼	2	2½	1,920	2	2½
16	1, 565	3⅝	2	2½	2,510	3	2½
					or:	1	4½
18	1, 980	4 3/16	2	2½	3,180	3	2½
					or:	1	4½

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Chlorination of Pipelines. Before being placed into service, all new mains, repaired portion s or extensions, must be chlorinated so that a chlorine residual of at least 10 parts per million remains in the water after 24 hours standing in the pipe. This residual may ordinarily be expected with an initial application of 25 parts per million although some conditions may require more. Ineffective preliminary flushing of the main may require a larger application of chlorine to produce the desired residual.

Form of Applied Chlorine. Methods of applying chlorine to a main are listed below in order of preference:

1. Liquid chlorine gas-water mixture.
2. Direct chlorine feed (dry gas).
3. Calcium or sodium hypochlorite and water mixture.
4. Chlorinated lime and water mixture.

The practice of adding a small amount of chlorine powder or tablets at each joint as the main is being laid is not an acceptable method of chlorinating a pipeline. The procedure does not permit preliminary flushing nor does it provide uniform chlorine distribution.

The Use of Liquid Chlorine (Gas). A chlorine gas-water mixture shall be applied by means of a solution feed chlorinating device or 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 chlorine gas or the gas itself must provide means for preventing the backflow of water into the chlorine cylinder. Feeding of dry gas is limited to main pressures of less than 10 psi.

Chlorine-bearing Compounds. A mixture of water and chlorine-bearing compound of know chlorine content may be used. Acceptable compounds are calcium or sodium hypochlorite and chlorinated lime. These compounds should be mixed with water to yield a 1 percent chlorine solution according to Table 2.

TABLE 2

Product	Amount of Compound	Quantity of Water Gallon
High-test calcium hypochlorite (65 – 70% Cl)	1 pound	7.50
Chlorinated lime (32-35% Cl)	2 pounds	7.50
Liquid laundry bleach (5.25% Cl)	1 gallon	4.25
Concentrated liquid bleach (15% Cl)	1 gallon	14.00

Note: *Calcium hypochlorite or bleaching powder should be made into a paste and then thinned to a 1 percent chlorine solution.*

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TABLE 3 Chlorine Requirements for 100 foot Lengths of Various Sizes of Pipe			
Pipe Size in.	Volume of 100 foot Length gal.	Amount Required to Give 25 ppm Cl	
		100 % Chlorine lb.	1 % Chlorine Water Solution gal.
4	65.3	0.0135	⅙
6	146.5	0.0305	⅜
8	261.0	0.054	⅔
10	408.0	0.085	1
12	588.7	0.120	1½

Point of Application. The preferable point of application of the chlorinating agent is at the beginning of the pipeline or any valved section and through a corporation stop in the top of the pipe. The water injector for delivery of the gas-water mixture into the pipe should be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension. Chlorine bearing compounds should be pumped or ejected into the pipe as a 1 percent solution under the same conditions as above.

Valves should be manipulated so that the strong chlorine solution in the new pipe will not flow back into the supply line. Check valves may be used if desired.

Rate of Application. Water from the existing distribution system shall be controlled so as to flow slowly into the main to be chlorinated. The feed rate of the chlorine mixture shall be in such proportion to the rate of flow of water entering the pipe that at least 10 ppm residual may be obtained after 24 hours. (The initial application should be at least 25 ppm.)

Retention Period. Treated water shall be retained in the pipe line long enough to destroy all non-spore-forming bacteria. This period should be a least 24 hours and chlorine residual of at least 10 ppm throughout the line should be obtained at the end of the retention period.

Note: Shorter retention periods with increased chlorine concentrations may be used under certain circumstances. Prior approval must be obtained from the State Board of Health when shorter retention periods are necessary.

Chlorinating Valves and Hydrants. In the process of chlorinating pipelines, all valves should be operated while the pipeline is filled with chlorinating agent.

Final Flushing and Bacteriological Tests. Following a retention period of 24 hours, all treated water in the main shall be thoroughly flushed from the newly laid pipeline at its extremities until the replacement water is of the quality of water delivered from the new main must be verified by bacteriological samples collected from points along the new main. Samples should not be collected from unsterilized hoses or fire hydrants. Upon return of an acceptable

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bacteriological report, the Owner will remove the tap (s). Contractor shall expose the tap (s) for removal by the Owner, unless otherwise shown or specified.

Repetition of Procedure. Should the initial treatment fail to yield satisfactory bacteriological results, the original chlorination and flushing procedure must be repeated and additional samples collected.

Procedure when Repairing or Cutting into Existing Mains. Whenever an old line is opened by accident or design the excavation is always wet and frequently badly contaminated. Where the main has been partially or totally dewatered that section of main must be chlorinated and flushed the same as a new main. In the event that water service cannot be disrupted to provide the full 24 hour retention period and application of 100 ppm of chlorine may be used with a retention period of one hour followed by flushing.

501.3.11 MAINLINE CHLORINATION ASSEMBLY

Construct main line chlorination assemblies as shown on the applicable Standard Plan. Provide temporary asphalt pavement restoration when chlorination tap is in paved area accessible by the traveling public. Steel plates in traffic areas not approved for durations longer than two days.

Upon receipt of negative bacteriological test, provide excavation and shoring for City crews to remove chlorination assembly. Backfill excavation and provide permanent surface restoration in accordance with other subsections of the SCS.

501.4.00 MEASUREMENT AND PAYMENT

501.4.01 PIPE

Measurement and payment for pipe will be made on a linear foot basis for the various types and sizes of pipe listed in the Proposal as actually installed. Pipe will be field measured along the centerline or the pipe in place within the limits shown with no deduction in length made for valves, fittings, and specials, except Owner installed facilities. No payment will be made on any section or reach of pipe deemed unacceptable due to excessive leakage or other defects until such leakage and defects have been corrected. The cost of all utility potholing shall be borne by the Contractor and no additional payment will be made. There will be no separate payment for deflecting water pipe to avoid conflict with another utility, it being understood that the cost, therefore, is incidental and included in the Contract unit prices for Trench Excavation and Backfill.

501.4.02 FITTINGS AND SPECIALS

Unless otherwise shown in the Proposal, fittings, and specials shall be paid for at the unit price per pound shown.

Weights of fittings will be the weight listed in the AWWA Standards book as published by the American Water Works Association (Standard ANSI/AWWA C110/A21.10). If fittings are not

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listed in that book, the weight shall be determined by physically weighing the fitting (without accessories) to the nearest pound.

501.4.03 CHLORINATION TAPS

All cost for furnishing, installing, and re-excavating (for removal of chlorination taps by the Owner) per Standard Plan 411 shall be paid for on a per each basis as shown in the Proposal.

501.4.04 MECHANICAL COUPLINGS

Unless otherwise shown in the Proposal or specified, mechanical couplings will be considered incidental to and included in the unit price for pipe and fittings.

501.4.05 JOINT RESTRAINT

Unless otherwise shown in the Proposal, joint restraint will be considered incidental to and included in the unit price bid for pipe or fittings except when joint restraint is accomplished through use of thrust blocks.

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502 Valves and Related Equipment

502.1.00 DESCRIPTION

502.1.01 GENERAL

This Section covers furnishing and installing the valves listed herein. The type and location of other special valves not listed herein will be specified and shown in the Plans and Special Specifications, when required.

502.1.02 CERTIFICATION

Furnish certification properly executed by the manufacturer showing compliance with the required Specifications and results of test performance.

502.2.00 MATERIALS

502.2.01 GATE VALVES—Deleted

502.2.01A Gate Valves

Gate valves shall be iron body, bronze mounted, double disk, non-rising stem valves with O-ring seals and shall be manufactured to open when the stem is rotated counterclockwise. Provide a 2 inch square operating nut unless otherwise specified. Valve ends and sizes shall be as shown. All gate valves shall conform to AWWA C 500.

Sealing material for flanged joints will consist of 1/8 inch thick, full face, one piece, cloth inserted, rubber gaskets conforming to Section 2.3 of AWWA C 207. Bolts and nuts shall conform to Section 2.2 of AWWA C 207.

502.2.01B Resilient-seated Gate Valves

Resilient-seated gate valves shall conform to AWWA C 509 (for cast iron body), or AWWA C 515 (for ductile iron body), nonrising stem with O-ring seals and shall be manufactured to open when the stem is rotated in a counterclockwise direction. Valves shall have a 2-inch-square operating nut. All internal cast iron or ductile iron parts shall be coated with a corrosion-resistant epoxy coating certified by the NSF for use with potable water. Valves shall have a full-size unobstructed water way and shall seal drip tight.

Resilient-seated gate valves, as specified in the Subsection are an acceptable alternate for butterfly valves.

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502.2.02 BUTTERFLY VALVES

Unless otherwise specified, butterfly valves shall conform in all respects to the physical and performance requirements of AWWA C 504, short body type having operators suitable for direct burial. Furnish Class 150 B valves unless otherwise indicated. Furnish valves having a 2 inch square operating nut which shall rotate counterclockwise to open unless otherwise shown.

502.2.03 SPECIAL VALVES

Provide special valves as specified elsewhere in the Contract Documents and as shown on the Plans.

502.2.04 COMBINATION AIR AND VACUUM RELEASE VALVES

Furnish and install combination air and vacuum release valves sized as shown. Valves shall have cast iron bodies and covers and stainless steel floats. Float guides, bushing, and lever pins shall be stainless steel or bronze. Valves shall be designed for operating service to 300 psi.

502.2.05 VALVE BOXES

502.2.05A Water Valve Box

Water valve boxes shall be cast iron "Vancouver" style, model 910 as manufactured by Kejriwal Castings, or approved equal. Dimensions are shown on applicable Standard Plan.

502.2.05B Brooks Valve Box

Brooks valve boxes shall have a minimum 8½-inch inside diameter concrete body with cast iron ring and cast iron traffic cover, model 1 RT as manufactured by Brooks Products, Inc., or approved equal.

502.2.06 VALVE BOX RISERS

When metallic valve box extension risers are shown, or specified, they shall be Brooks RT-3(new style) or an approved equal. Riser shall not restrict the valve box opening. Riser and lids shall be made of cast or ductile iron.

Extend the valve box by lifting and/or replacing the concrete barrel with a longer barrel when shown or specified.

502.3.00 CONSTRUCTION

502.3.01 VALVES

Set valves in the same manner as previously specified for installation of pipe. Clean the face of flanges thoroughly before assembling the flanged joint. Insert the gasket and tighten the nuts uniformly around the flange. Align pipe carefully on both sides of the valve before final

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tightening of the flanges to avoid stressing the valve body. After installation, operate the valve from full open to full closed to make sure that the valve does not bind during operation. Correct any malfunction in the operation of the valve. Test valve joints with the adjacent pipeline. Repair any leaks as previously specified. Backfill around valves in the same manner as specified for pipe.

502.3.02 VALVE BOXES

Center the valve boxes and set plumb over the operating nut of the valve. Set valve boxes so they do not transmit shock or stress to the valve. Set the valve box covers flush with the surface of the finished pavement or to such other level as may be directed. Cut the extensions to the proper length as required for proper installation. Backfill shall be the same as specified for the adjacent pipe. Correct any misalignment of valve boxes without additional expense to the Owner.

502.3.03 VALVE PADS

Where required, set valve pads on undisturbed earth in the trench bottom. Construct valve pads with reinforcing steel to the dimension shown on the Plans. Set the valve pads to the elevation as shown so that when the valve is installed, it will rest on proper grade in contact with the valve pad. Allow five days' cure time before placing the valve on the pad.

502.4.00 MEASUREMENT AND PAYMENT

502.4.01 VALVES

Measurement and payment for each size and type of valve will be on the unit price basis as shown in the Proposal, shall include the valve in place with valve pad and valve box as required.

502.4.02 VALVE BOXES

Measurement and payment for valve boxes and lids will be included in the payment for valves installed as specified.

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503 Fire Hydrants

503.1.00 DESCRIPTION

503.1.01 GENERAL

This Section covers the work necessary for furnishing fire hydrants and installing fire hydrant assemblies in accordance with *Section 204 Excavation, Embankment, Bedding, and Backfill* and with Standard Plan 401. Pipe and fittings are specified in Section 501 and valves in Section 502. Furnish catalog data and obtain approval of all hydrants before ordering.

503.1.02 CERTIFICATION

Furnish certification, properly executed by the manufacturer, to the Owner, showing compliance with required Specifications and results of tests performed.

503.2.00 MATERIALS

503.2.01 HYDRANTS

The depth of bury shall normally be 3 or 4 feet. Where conditions require greater depths, extensions shall be attached by the Contractor prior to installation. The Contractor shall cooperate with City forces where extensions are attached on the work site and shall maintain excavations and barricades where required.

1. Acceptable Hydrants:

    a. Mueller Centurian A423
    b. Kennedy Guardian K81A
    c. M & H Reliant 929T
    d. Clow Medallion

2. Style:

    AWWA Improved, dry barrel, compression type valve, traffic model.

3. Ports:

    All hydrants shall be equipped with two 2½ N.S.T. bronze hose ports and one 4½ N. S. T. bronze steamer port. All ports be equipped with cast iron caps.

4. Shut-off Valve:

    Underground type gate valve with Brooks valve box with cast iron lid set to grade by use of 6 inch concrete sewer tile.

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5. Drain:

   Opening(s) at bottom of hydrant, to prevent water in barrel from freezing in cold weather.

6. Inlet:

   Standard 6 inch flanged, face drilled to 125 pounds American Standard.

7. Operating Stem:

   One and one-half inch Pentagon, tapered, approximately ¾ inch wide on flats. Hydrant to open counterclockwise.

8. Hydrostatic Test:

   Shall be capable of 150 psi working pressure and 300 psi test pressure.

9. Lubrication of Operating Item:

   Shall be provided by an oil or grease reservoir which is sealed from the water chamber. Hydrant design shall be such that water will not be permitted to enter the operating thread cavity.

10. Hydrant Height:

    The center of steamer port shall be minimum of 18 inches and maximum of 24 inches above grade. Extensions, if required, to set a hydrant to proper grade shall be furnished and installed by the Contractor.

11. Facing of Hydrants:

    The steamer port shall point towards the public way.

12. Out-of-service Hydrants

    All new hydrants not yet activated and other hydrants that are out-of-service shall be completely bagged or covered in a manner that readily identifies the hydrant as inoperable. These bags will be removed by the Owner when activating the mains.

503.2.02 BASE BLOCK

Solid precast concrete pier block having nominal dimensions of 16 inches x 16 inches x 8 inches.

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503.2.03 GRAVEL FOR DRAINAGE

Three-quarter inch crushed rock, free of organic matter, sand, loam, clay, and other small particles that will tend to restrict water flow through the gravel.

503.2.04 CONCRETE FOR ANCHOR BLOCKING

A mix not leaner than 1 part cement, 2 ½ parts sand, 5 parts coarse aggregate, and just enough water to make a workable mix. Twenty-eight day compressive strength shall be a minimum of 2,500 psi. Engineer shall approve quality of materials prior to their use.

503.2.05 GATE VALVES SMALLER THAN 2 INCHES

Valves shall be 125 psi, non-rising stem, hand-wheel operator, wedge disc, all brass or bronze valves with screwed ends. Valves shall be Crane No. 438 or approved equal.

503.2.06 TIE RODS, DUCTILE IRON LUGS, VALVE BOXES, GATE VALVES, AND PIPE

As shown on the Standard Details, bound herewith, or as specified in the Specifications governing gate valves and cast iron pipe and fittings, or as directed by the Engineer.

503.2.07 GALVANIZED PIPE

Standard weight, galvanized steel, ASTM A 120, with galvanized malleable screwed fittings, Federal Specification WW-P-521.

503.3.00 CONSTRUCTION

503.3.01 GENERAL

Construction and installation of hydrants shall conform to provisions of appropriate Sections of AWWA C 600, except where otherwise specified. Installation of the hydrant shall conform to the applicable provisions of Section 501 of these Specifications.

503.3.02 LOCATION AND POSITION

Locate as shown or directed so as to provide complete accessibility to pedestrians. Improperly located hydrants or blow offs or unplumbed hydrants shall be disconnected and reset at the Contractor's expense.

503.3.03 EXCAVATION

Do not carry below subbase grade. Refill over excavated areas with gravel and hand tamp to provide firm foundation.

503.3.04 BASE BLOCKS

Place on firm, level subbase to assure uniform support.

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503.3.05 HYDRANTS

Place carefully to prevent the base blocking from breaking. After hydrant is in place and connected to the pipeline, place temporary blocks to maintain the hydrant in a plumb position during subsequent work.

503.3.06 ANCHOR BLOCKS

Bearing surfaces shall rest against undisturbed soil. Bearing area shall be sufficient to prevent movement of pipeline and shall be as specified or directed by the Engineer.

503.4.00 MEASUREMENT AND PAYMENT

503.4.01 HYDRANT ASSEMBLIES AND HYDRANT STUB ASSEMBLIES

Payment will be made for each fire hydrant assembly, fire hydrant stub assembly, and fire hydrant relocation at the unit price bid. Payment for main line tee fitting is included in Section *Ductile Iron Pipe and Fittings*. The cost of furnishing and installing the drain gravel and pier block used in installation of the fire hydrant will be included or absorbed in the unit price of the hydrant. cost to furnish and install extensions, if required, to set hydrant to proper grade shall be considered incidental to the unit price of the hydrant.

Payment shall include all costs of installation including the pipe spool, gate valve, valve box, elbows and/or fittings, and fire hydrant complete in place as shown on Standard Drawing No. 400 or 401.

Fire hydrant stub assemblies and fire hydrant assemblies differ only on whether or not the Owner supplies the fire hydrant.

No differentiation will be made for horizontal length of the installation.

503.4.02 BLOW OFF ASSEMBLIES

Payment will be made for each blow off assembly at the unit price bid. No differentiation will be made between blow off installations beginning at the plugged end of ductile iron pipe and those beginning at a mainline gate valve. In the latter case, the mainline gate valve with its valve box will be paid for at the price bid as specified in Section 502.4.00. Payment for tapped plugs is included in this Section.

Payment for each assembly shall constitute full compensation for all work specified in this Section and shall include excavation and backfill for each assembly.

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504 Water Service Installation

504.1.00 DESCRIPTION

This Section covers the work necessary for a Developer to install water services in his/her subdivision complete in place.

504.1.01 WORK PERFORMED BY THE DEVELOPER

Installation by the Developer's water contractor at the time when the water mains are installed. The Service shall be complete including a lock-wing angle meter curb stop and meter box set to top of curb grade.

504.1.02 WORK TO BE PERFORMED BY THE CITY

The City will provide and install meters in the meter boxes. Minor leveling adjustments of meter boxes will be done by the Owner when installing meters in the boxes.
Disinfecting of services will be performed by City forces at the time the water main is disinfected.

All water meters shall be installed on the City right-of-way and in a manner prescribed by the Director of Public Works.

504.2.00 MATERIALS

504.2.01 BEDDING AND BACKFILL

All backfilling under streets, parking lots, driveways, and sidewalks will be ¾ inch minus crushed aggregate material.

Backfill for all other areas may consist of native materials providing that no rocks larger than 3 inches maximum dimensions or clods of soil larger than 6 inches maximum dimensions are included. No sharp objects or any other material is acceptable.

Provide imported base material under all pipe where in the opinion of the Engineer, material satisfactory for fine grading and bedding the pipe is not available at the trench. Imported base material will be used principally where ground water or rock conditions make the use of a lesser quality base impractical.

504.2.02 SERVICE WATER PIPE AND FITTINGS

Materials for water services are shown on applicable Standard Plans and specified elsewhere in the SCS.

All water service pipelines shall be seamless copper (type K) tubing conforming to ASTM B 88 for potable water transmission. No pipe shall be smaller than 1 inch.

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Corporation Stops shall be 1-inch-minimum size, ball valve type, brass body conforming to AWWA Standard C 800 and have AWWA (CC) male inlet and flared outlet sized for seamless copper (type K) tubing. They shall have full way bore to accommodate direct tap installation. (Saddle required for4-inch mains.)

Corporation Couplings shall be 1-inch-minimum size, brass body conforming to AWWA Standard C 800 and shall have a flared inlet and copper pack joint outlet with set screw.

Curb Stops shall conform to the requirements for Corporation Stops except that the inlet shall match the outlet in size and type.

Meter Stops shall be ball valve type, lock wing style, brass body conforming to AWWA Standard C 800. Inlets shall be copper pack joint type with set screw. Outlets shall be meter swivel nut with saddle (for 1-inch services) or meter flange with flat rubber drop-in gasket (for 1½-inch and 2-inch services).

Meter Setter shall be constructed with copper tubing and two brass body ball valves conforming to AWWA Standard C 800. Meter Setter shall have high, offset bypass, minimum 1-inch-diameter. Bottom inlet and outlet shall have female iron pipe threads. Top inlet and outlet shall have meter flanges.

Meter Setter Adapter shall be brass body conforming to AWWA Standard C 800. Inlet shall be copper pack joint type with set screw. Outlet shall have male, iron pipe threads.

All compression fittings for the brass stops, discussed above, shall be designed with grooved split clamp locking device which shall be drawn down securely on the tubing by tightening of a stainless steel screw.

All fittings shall be used with the aid of Teflon tape or paste.

Meter Boxes shall be constructed of lightweight, plastic BCF series as manufactured by Mid-States Plastics, Inc., or polyethylene “Rotocast” series as manufactured by Armorcast Products Company. All meter boxes shall be capable of withstanding minimum 20,000 pound incidental traffic loading.

Meter Box Lids shall be one piece solid lid, constructed of either ductile iron or polymer concrete as manufactured by Mid-States Plastics, Inc., or Armorcast Products Company. The lids shall be capable of withstanding minimum 20,000 pound incidental traffic loading. All meter box lids shall be provided with automatic meter reading (AMR) holes as depicted on the applicable Standard Plan.

All A.C., plastic and steel pipe shall be saddle tapped. All saddles will be Mueller thread made of D.I. with stainless steel straps, nuts, and washers.

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Direct corporation taps can be made on the following cast iron and ductile iron pipe sizes. All other sizes shall be saddle tapped. Whenever possible, a direct tap shall be utilized.

			¾"x 1"	1"	1½"	2"
4"	C.I. & D.I.	Class 51	*			
6"	C.I. & D.I.	Class 50		*		
8"	C.I. & D.I.	Class 50		*		
10"	C.I. & D.I.	Class 50		*	*	
12"	C.I. & D.I.	Class 50		*	*	*
14"	C.I. & D.I.	Class 50		*	*	*
16"	C.I. & D.I.	Class 50		*	*	*
20"	C.I. & D.I.	Class 50		*	*	*

504.2.03 VALVES AND SPECIAL VALVES

Bronze ball cock valves or bronze gate valves with an iron wheel and a minimum rate working pressure of 200 psi shall be used, for 1 ½ inch and 2 inch irrigation services. All valves shall be hydro-tested to 300 psi or air tested to 100 psi under water by the manufacturer.

504.2.04 LARGE METER INSTALLATIONS (3 INCHES AND LARGER)

All vaults for meter installations of 3 inch and larger shall meet the applicable requirements of Standard Plans 503, 504, 505, and 506. Vaults shall have spring assisted doors centered over the meter. Each vault shall have a permanently installed ladder located for sage access without being a hindrance when installing, removing, or testing the meter. In some installations this may require a separate door for entry. The pipe entering the vault shall enter wit the bottom of the pipe being at a minimum of 12 inches and a maximum of 30 inches from the vault floor. Elbows, tees, and crosses shall be no closer than 10 pipe diameters of straight pipe of the same nominal diameter as the meter upstream and 5 diameters downstream. For meters 6 inches and larger, the doors shall be split into two equally sized doors (i.e., a 3' x 6' door would be two 3' x 3' doors). All joints in the vault and the opening for the pipe to enter and leave the vault shall be sealed watertight.

504.3.00 CONSTRUCTION

504.3.01 EXCAVATION, BACKFILL, AND BEDDING

Minimum allowable depth of trench within the permanent water easement shall be as shown on the applicable Standard Drawing. A greater depth may be necessary to avoid underground obstructions. A minimum of 6 inches of clearance shall be maintained between the pipe and obstructions unless otherwise permitted by the Engineer.

Compaction will be by mechanical means. Compact to a minimum of 95 percent of maximum dry density according to ASTM D 698 in all streets, sidewalks, driveways, and parking lots.

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Compaction for backfill in all other areas will be not less than 90 percent, including depths over 3 feet.

Grade the bottom of the trench to the line and grade to which the pipe is to be laid. The trench bottom shall form a continuous and uniform bearing and support for the pipe on solid undisturbed ground.

Provide and maintain ample means and devices at all times to remove and dispose of all water entering the trench excavation during the process of pipe laying. Trench water shall not be disposed of into sanitary sewers.

504.3.02 PIPE LAYING

Provide and use proper implements, tools, and facilities satisfactory to the Engineer for the safe and convenient prosecution of work. Handle pipeline materials to prevent damage. While cleaning pipe and fittings, wire brush if necessary and wipe clean, dry, and free from oil, dirt, grease, and other foreign matter before the pipe is laid.

Do not allow foreign material to enter the pipe while it is being placed in the trench.

At times when pipe laying is not in progress, close the open ends of pipe by a watertight plug or other means approved by the Engineer and allow no trench water or animals to enter the pipe. These provisions shall apply during the noon hours as well as overnight. If water is in the trench, keep the seal in place until the trench is pumped dry. do not lay pipe in water or when in the opinion of the Engineer, trench conditions are unsuitable. Dry line will have watertight plugs to prevent water and dirt from entering the pipe.

Cut pipe for inserting valves, fittings, or closure pieces in a neat and workmanlike manner without damaging the pipe, fittings, or interior coatings, and leave a smooth end at right angles to the axis of the pipe. Dress cut ends of pipe to remove sharp edges or projections which may damage fittings of valves.

Leakage on any service line shall be corrected to the satisfaction of the Engineer.

Services shall not be bored or pushed under streets unless approved by the Engineer.

The horizontal separation between a water service paralleling a sewer line shall be 6 feet and the water service shall be installed above the crown elevation of the sewer. When a water and sewer line cross, the waterline shall be higher than the sewer line and the vertical separation shall not be less than 18 inches. Also, the water service shall be installed with no joints within 7 feet of the sewer. Where there is less than 18 inches of clearance, the sewer line shall be replaced with ductile iron pipe for 9 feet on each side of the crossing. Horizontal separation of 3 feet with all other utilities is required.

Whenever it is necessary to deflect pipe direction, the amount of deflection allowed shall not exceed that approved by the Engineer.

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All taps will be made at a position of 10 o'clock or 2 o'clock. The Engineer may approve a tap on top of the main when the meter is set above the main.

In general, service connections will extend to and include the lock-wing angle meter stop unless directed otherwise by the Engineer.

Two or more service lines may be installed in the same trench when tapped with a minimum clear distance of 16 inches from any bell joint or between taps on a main line. Two or more meters may not be served by a common service line.

All service installations shall conform to Standard Plan No. 401 or 410A, as appropriate.

Replacement services shall terminate in a new lock wing angle meter stop located inside the existing meter box parallel to and 2 inches from the existing stop. Damage to existing facilities shall be repaired at Contractor's expense.

504.3.03 ELECTRICAL LOCATOR

All non-metallic water service yard piping shall have an electrically conductive tracer wire 12 gauge, insulated copper, blue in color, installed in the trench for locating the pipe in the future. The tracer wire shall run the full length of the installed pipe, with each end left above the finished grade, and shall be clearly marked. One end of the wire shall be at the building end of the pipe; the other end shall terminate at the property line in the meter box, the curb valve casing, or be spliced into the serving utilities' tracer wire, when present.

504.3.04 HYDROSTATIC TESTING

The Contractor shall provide the pressure test of the main and service installations as follows:
Fill the pipe with water and apply the specified test pressure of 150 psi. Hold the pressure in the line for one hour by shutting off the valve from the pump. After one hour, operate the pump until 150 psi is again attained. The pump suction shall be in a barrel or similar device, metered so that the amount of water required to restore the test pressure may be measured accurately. The measured quantity of water shall then be compared with the table on the following page to determine if it is within the allowable limits.

504.3.05 DISINFECTION

Pipelines carrying potable water must be disinfected before the City will accept the work and/or supply water. The Developer is referred to Subsection 504.1.02.

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504.4.00 ACCEPTANCE AND/OR PAYMENT

504.4.01 INSPECTION

If the service or meter box is found to be broken or if the service has to be adjusted up or down at the time City crews are installing the meter, the cost of repair, adjustment, or replacement will be billed to the party (Developer) taking out the permit for the meter.
All cost of replacement, if necessary, shall be borne by the Developer.
Replacement of existing street surfacing, curbs, and sidewalks damaged by service connection construction shall be in conformance with the City of Salem Standard Specifications.

504.4.02 CITY FEES

The meter installation fee will be as now specified in code for previously installed service lines. This charge for installation of ¾ inch meter is 30 percent of the existing full rate, plus any additional damage or adjustment cost.

504.4.03 ACCEPTANCE

At such time as all construction work is complete and all testing, disinfection, and inspections have been found satisfactory by the Engineer, the City of Salem will recommend that the water service installations be approved.

504.4.04 PAYMENT

Payment for water services shall be for each long or short service of the size specified, in place. All pavement, sidewalk, driveway, curb removal, and replacement, excavation, all boring, pushing r pulling work (when authorized by the Engineer), compacted backfill, pipe, restoration, top soil, seeding and placing sod as required, aggregate surfacing as required, disposal of excess material, utility protection, sheeting and shoring, dewatering, fittings, tracing wire, corporation stop, angle meter stop, meter setter, service saddle, meter box, disinfection, testing, and repair shall be incidental to and included in the Contract unit price for each long or short service.

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504.4.05 ELECTRICAL LOCATOR

Payment for installation of an electrically conductive tracer wire adjacent to the water service yard piping between the meter box and building shall be incidental to other bid items.

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Standard Water Pipe Leakage Allowance $L = \frac{NDP.5}{5500}$

Pressure Factors Water $= \frac{ND}{5500}$

Joints	2"D	4"D	6"D	8"D	10"D	12"D	14"D	16"D	18"D
1	.00038	.00073	.00109	.00145	.00182	.00218	.00255	.00291	.00327
2	.00073	.00145	.00218	.00291	.00364	.00436	.0509	.00582	.00655
3	.00109	.00218	.00327	.00436	.00545	.00655	.0764	.00873	.00982
4	.00145	.00291	.00436	.00582	.00727	.00873	.01018	.01164	.01309
5	.00182	.00364	.00545	.00727	.00909	.01091	.01273	.01455	.01636
6	.00218	.00436	.00655	.00873	.01091	.01309	.01527	.01745	.01964
7	.00255	.00509	.00764	.01018	.01273	.01527	.01782	.2036	.02291
8	.00291	.00582	.00873	.01164	.01455	.01745	.02036	.02327	.02618
9	.00327	.00655	.00982	.01309	.01636	.10964	.02291	.02618	.02945
10	.00364	.00727	.01091	.01455	.01818	.02182	.02545	.02909	.03273
20	.00727	.01455	.02182	.2909	.03636	.04364	.05091	.05818	.06545
30	.01091	.02182	.03273	.04364	.05455	.06545	.07636	.08727	.09818
40	.01455	.02909	.04364	.05818	.07273	.08727	.10182	.11636	.13091
50	.01818	.03636	.05455	.07273	.09091	.10909	.12727	.14545	.16364
60	.02182	.04364	.06545	.08727	.10909	.36091	.15273	.17455	.19636
70	.02545	.05091	.07636	.10182	.12727	.15273	.17818	.20364	.22909
80	.02909	.05818	.08727	.11636	.14545	.17455	.20364	.23273	.26182
90	.03273	.06545	.09818	.13091	.16364	.19636	.22909	.26182	.29455
100	.03636	.07273	.10909	.14545	.18182	.21818	.25454	.29091	.32727
200	.07273	.14545	.21818	.29091	.36364	.43636	.50909	.58182	.65455
300	.10909	.21818	.32727	.43636	.54545	.65455	.76364	.87273	.98182
400	.14545	.29091	.43636	.58182	.72727	.87273	1.01818	1.16364	1.30909
500	.18182	.36364	.54545	.72727	.90909	1.09091	1.27273	.145455	1.63636
600	.21818	.43636	.65455	.87273	1.09091	1.30909	1.52727	1.74545	1.96364
700	.25454	.50909	.76364	1.01818	1.27273	1.52727	1.78182	2.03636	2.29091
800	.29091	.58182	.87273	1.16364	1.45455	1.74545	20.3636	2.32727	2.61818
900	.32727	.65454	.98182	1.30909	1.63636	1.96364	2.29091	2.61818	2.94545

Example: 123 Joints 12" pipe, starting pressure 150 psi, after 1 hour P = 138 psi

$$Avg\ P = \frac{150 + 138}{2} = 144 \text{ psi}$$

P.F. for
100 Joints = .21818
20 Joints = .04364 p. 5 = 12 psi
3 Joints = .00655
123 .26837 x 12 psi = 3.22 gallons
Allowable loss in one hour

L = Allowable leakage in one hour
D = Diameter, inches
N = Number of joints
P = Average test pressure

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Division 6 – Structures

601 Piling

601.1.00 DESCRIPTION

Furnish and drive piles of kind and dimension shown, in manner and to elevation, penetration, and bearing as specified, or as designated. Cut off of build up piles when required.

601.2.00 MATERIALS

Acceptable piling types are as specified below; determine pile lengths as hereinafter provided.

601.2.01 STEEL PILING

Use steel pipe piling of nominal inside diameters as specified and minimum 3/8 inch wall thickness, conforming to ASTM A 53, with grade as specified, or ASTM A 252, Grade 2.

Use rolled steel of size and weight specified on the Plans, with steel conforming to ASTM A 36, except that Manufacturer's name, brand, or trademark may be shown by die Stamping in web at intervals not exceeding 20 feet along length of pile.

For pile caps and splice plates, use material conforming to the same requirements as steel pile section.

601.2.02 TIMBER PILING

601.2.02A General

Use timber piling as specified, either untreated, or treated with one of the preservatives provided for herein, and conforming to ASTM D 25 for round timber piles, strapped as provided herein.

601.2.02B Untreated Piling

Except where specifically provided otherwise, use untreated timber piling of Douglas fir, Western red cedar, or Larch. Use Douglas fir for foundation piling if possible. Cut piling from sound, live trees containing no unsound knots. Sound knots will be permitted if diameter of knot does not exceed 4 inches, or one-third of small diameter of stick at the point where they occur, whichever is smaller. Any defect or combination of defects which will impair strength of pile, more than the maximum allowable knot, will not be permitted.

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601.2.02C Treated Piling

For treated piling, use on e of the following types of preservatives:

Creosote
Creosote-Petroleum Solution
Ammoniacal Copper Arsenite (ACA)
Chromated Copper Arsenate (CCA), Type A and Type B
Chromated Zinc Chloride (CZC)
Copperized Chromated Zinc Arsenate (CuCZA)
Fluor Chrome Arsenate Phenol (FCAP), Type A and Type B
Pentachlorophenol
Pentachlorophenol—heavy petroleum solvent solution
Pentachlorophenol—mineral spirits solvent solution
Pentachlorophenol—volatile petroleum solvent (LPG) solution

Use a preservative treatment and amount of retention conforming to AWPA C-1 and C-2 for corresponding timber species and environmental exposure at location of installation.

601.2.02D Composite Piling

Where specified, use composite pile consisting of a pile of two timber sections, or a reinforced concrete pile and a timber pile section.

For composite piling made up of two timber sections, use untreated timber for the lower section and treated timber for upper section. For composite piling made up of reinforced concrete and timber, use untreated timber for lower section and either precast or cast-in-place, reinforced concrete for upper sections.

For both treated and untreated timber sections of composite piles, use material meeting respective requirements specified above for full length of treated and untreated timber piling.

601.2.02E Peeling

Untreated and treated piles must be peeled by removing all of rough bark and at least 80 percent of inner bark with no strip of inner bark remaining on the stick over ¾ inches wide, or over 8 inches long, and at least 1 inch of clean wood surface between any two such strips. Not less than 80 percent of the surface on any circumference will be clean wood. All knots must be trimmed close to body of pile.

601.2.02F Pile Strapping

Strap treated timber piles in three places: approximately 18 and 24 inches from butt, and approximately 24 inches from tip.

Provide additional straps at 15 foot spacing between butt and tip.

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Encircle pile once with each strap and fasten with a clip so crimped that joint will have minimum tensile strength of 80 percent tensile strength of strap.

Strap shall be 1¼ inches wide, 0.03 inches thick, cold rolled, fully heat treated, high tensile strapping, painted and waxed, with an ultimate tensile strength of 5,100 pounds. Clips shall be 2¼ inches ling, 20 gauge, crimped with a notch type sealer. Provide treated timber piles that are strapped after treatment and prior to shipping.

601.2.02G Pile Head Waterproofing

Use creosote conforming to AASHTO M 116, asphalt pitch conforming to ASTM D 312, Type 4, and waterproofing fabric of cotton conforming to ASTM D 173.

601.2.03 PRECAST CONCRETE PILING

601.2.03A General

Utilize precast concrete piles consisting of sections properly reinforced to withstand handling and driving stresses, which can either be precast concrete piles with deformed steel reinforcing bars or precast-pre-stressed concrete piles with pre-stressed steel strands.

601.2.03B Concrete

Cement Type II or Type III shall be used in all precast concrete piles, with resulting concrete having a minimum compressive strength of 5,000 psi at the transfer of pre-stress.

601.2.03C Reinforcement

Choose high tensile strength steel wire, or seven wire strand, or alloy bars for pre-stressing reinforcement.

Conform to applicable requirements of Sections 603 and 604.

601.2.04 CAST-IN-PLACE CONCRETE PILING

Cast-in-place concrete piles shall consist of steel casings or shells driven or drilled in the ground and filled with concrete.

Use steel casings for cast-in-place concrete piles conforming to ASTM A 252, Grade 2, and of adequate strength and rigidity to permit driving and prevent distortion due to soil pressure or driving of adjacent piles. Casings must be sufficiently watertight to exclude water before and during placing of concrete.

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Shells may be spirally or longitudinally welded and may be either tapered or constant in section. Fit tips with a driving plate, welded to the casing, of sufficient thickness to permit driving and prevent distortion until filled with concrete. Do not allow plate to protrude more than ⅜ inch beyond outside surface of casing.

Determine wall thickness required for steel casing or shell and submit to Engineer for approval.

601.3.00 CONSTRUCTION

601.3.01 ORDERING PILING

601.3.01A Timber and Precast-Pre-stressed Concrete Piles

Order piles in accordance with an itemized Order List, which will be furnished by Engineer, showing number and length of all piles.

Lengths given in Order List will be based on lengths assumed to remain in the completed structure plus an allowance for variation in final drive lengths. If desired, increase lengths given to provide for such additional length necessary to suit Contractor's method of operation.

601.3.01B Steel Piles and Cast-in-place Concrete Piles

No Order List will be furnished by Engineer for steel piles or steel shells. Determine pile lengths required, and order and furnish piling of sufficient length to obtain penetration and bearing value specified and to extend into cap or footing as shown.

Determine lengths of piles required by driving test piles, making borings, or such other investigation as considered necessary.

Engineer's estimated length, when shown or specified, can be used only for comparison of bids and for determining minimum pay lengths for driving as provided for herein, and does not represent final individual or total pile length required.

Piles not incorporated in the finished structure, are the property of Owner, and must be delivered to Owner immediately. Purchase of additional piles or piles of a greater length than those required is at Contractor's risk.

601.3.02 METHODS OF DRIVING

601.3.02A General

Unless otherwise provided or authorized by Engineer, drive piles with a steam, air, or diesel hammer, or combination of water jets and hammer. Use single acting hammer to drive pre-stressed concrete piling. Other types of hammers may be approved upon written authority of Engineer.

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601.3.02B Hammers

Hammers must be capable of developing consistently effective dynamic energy suitable for piles being driven and for depths and material into which they are being driven. Underwater hammers will not be permitted. All hammers shall have a power source equal to or greater than that required by the hammer manufacturer.

Unless otherwise shown or directed, use a hammer that will deliver a minimum total energy per blow in accordance with the following table:

Required Pile Bearing Value	**Minimum Hammer Energy**	
	Steam and Air Hammers	**Diesel Hammers**
50 ton and under	14,500 ft. lb.	18,000 ft. lb.
51 to 70 ton	19,000 ft. lb.	24,000 ft. lb
71 to 90 ton	26,500 ft.lb	33,000 ft. lb.
91 to 100 ton	30,000 ft. lb.	37,500 ft. lb
Over 100 ton	As called for by Special Specifications	

Weight of striking part of the hammer used shall be not less than one-third weight being driven, and in no case less than 2,750 pounds. Alternatively, minimum hammer energy may be determined by approved dynamic methods of analysis to compute internal pile forces for evaluating driving stresses.

Furnish Engineer with manufacturer's specifications and catalog for all diesel, steam or air hammers used, showing all data necessary for computing bearing value of piles driven.

Equip hammers with all appurtenances necessary for safe, efficient driving and with a suitable head which does not damage pile.

All driving equipment must be maintained and operated at all times in accordance with manufacturer's instructions. When directed, install a pressure gauge at inboard end of hose for the purpose of measuring air or stream pressure at hammer.

601.3.02C Cushion Blocks

For steel and concrete piling, use a cushion device suited to the pile an hammer employed, as determined and approved by Engineer, to prevent damage to piles. Inspect cushion blocks periodically during driving and replace them after becoming unduly worn and compacted.

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601.3.02D Leads

Use fixed lead pile drivers for driving piles. Do not use swinging leads. Leads must be of sufficient length so that use of a follower will not be necessary, except as hereinafter provided for timber piles. Use leads adapted to driving of batter piles for driving inclined piles.

601.3.02E Followers

Driving of piling with followers may be done only with written approval of Engineer. Follower, made of steel, with driving head and cap made to fit snugly over head of pile, may be used when driving timber piles. Use of wood followers will not be permitted. When followers are used, drive one long pile from each group of ten without a follower, and use it to determine average bearing value of the group.

601.2.02F Water Jets

Do not use water jets unless, in the opinion of Engineer, such use is necessary or desirable. When water jets are used, be sure number of jets and volume and pressure of water at jet nozzles is sufficient to freely erode material adjacent to pile. Before desired penetration is reached, withdraw jets and drive piles with hammer to secure final penetration and bearing value. Use two water jets and nozzles. Fix jets to pile and maintain them is a position 2 feet above pile tip. Check carefully during driving of piles to determine if piles are becoming loosened by attempting to re-drive at least one pile in every five piles.

No allowance will be made for cost to Contractor for jetting or re-driving.

601.3.03 PREPARATION FOR DRIVING

601.3.03A Excavation

Unless otherwise shown or directed, excavate completely the foundation pits, including construction of cofferdams or cribs where required before driving of foundation piles is begun. Make allowance for upheaval of pit bottom due to driving piles. Remove to correct elevation all material forced up between piles above elevation shown for base of foundation pit at no additional expense to Owner, before concrete is place.

601.3.03B Caps

Heads of all piling must be cut or cast normal to axis of pile, and a driving cap of an approved design provided to hold axis of pile in line with axis of hammer. Design cap to distribute blow hammer throughout cross-section of pile and to support a timber of other approved shock block.

Timber piles, treated and untreated, must be fresh cut on butt end just before driving. Plate approved caps, collars, or bands on butt end to avoid crushing or brooming pile

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head. Bevel butt end to ensure a tight fit with collar, cap, or band and to avoid splitting of sapwood from body of pile during driving.

For precast concrete piles, determine diameter of inside of cap before pile is cast and pile head is formed to make a loose fit inside cap.

Protect top of steel casing for cast-on-place concrete piles with a combination driving head and pilot of proper size for the hammer to insure a properly distributed blow and to prevent damage to casing during driving.

601.3.03C Shoeing

Unless otherwise shown, or directed, drive piles with square ends. In the event Engineer determines that soil conditions require shoes, fit piles carefully with steel shoes of an approved design.

601.3.03D Welding

Weld pile splices and attachments, such as pile tips and pile anchors, to steel piles and steel shells by the shielded metal arc process, submerged arc process or gas shielded metal arc process. All welds, welding procedure, welding materials, and preparation of welded surfaces for painting must conform to Standard Specifications for Welded Highway and Railway Bridges of the American Welding Society.

601.3.04 DETERMINATION OF BEARING VALUES

Determine minimum bearing values of piles preferably by loading tests, as specified hereinafter. Second order of preference is analysis of pile resistance by dynamic and/or static methods, as approved. In the absence of loading tests of substantiated pile analysis, determine minimum bearing values from the following formulas:

$P = \frac{2WH}{S+0.1}$ *For single-acting air or steam hammers*

$P = \frac{2H(W+Ap)}{S+0.1}$ *For double-acting air or steam hammers*

$P = \frac{2(0.8E)}{S+0.1}$ *For diesel hammers*

Where:

P = bearing value in pounds
W = weight, in pounds, of striking pars of hammer
H = heights of fall in feet
A = area of piston is square inches
P = air or steam pressure in pounds per square inch at the hammer
S = average penetration in inches per blow for last 10 to 20 blows
E = Energy for all open-end diesel hammers to be considered as E = WH. If hammer is equipped with a compression or bounce chamber above ram or piston, hammer energy shall be considered to be the EquivaLent Energy, E=WH+(energy, in compression chamber)

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Above formulas are applicable only when:

1. Hammer has a free fall.

2. Head of pile is not broomed or crushed.

3. Penetration is reasonable quick and uniform.

4. There is no appreciable bounce after the blow.

5. A follower is not used.

6. Hammer is in good condition and operating in a satisfactory manner. If Engineer determines that hammer being used may not be obtaining the specified bearing, when above formulas are applied, Engineer may order Contractor, at contractor's expense, to verify bearing values obtained by load tests or use of a different hammer. Unless otherwise directed, drive timber piling to bearing value shown. If bearing values are not shown, drive timber piling to a minimum value of 20 tons.

601.3.05 CASTING, PLACEMENT, AND CURING

Before casting precast piling, submit for approval design calculations and shop drawings outlining method and sequence of stressing, prestressing tendons, and steel reinforcement details, proposed anchoring devices, anchoring stresses, and any additional data pertaining to prestressing operations.

As soon as forms are removed, point concrete piles carefully with a 1:2 mortar, filling all cavities or irregularities. That portion which will be below ground or low water surface or piles in alkali soils need not be finished except by pointing. Finish piling exposed to view above ground line and cure all piling in accordance with *Section 602 Concrete Structures*.

Remove accumulations of dirt, debris, and water from casing before concrete is placed. If water cannot be removed, pull casing or fill it with sand and drive a new casing. Place concrete in a continuous operation from tip to cutoff elevation in a manner which will prevent segregation.

601.3.06 STORAGE AND HANDLING

601.3.06A Timber Piling

Store and handle timber piling carefully to avoid injury to piles. Take special care to avoid breaking of surface of treated piles; use of tools or lead equipment which dig into wood will not be permitted. Prevent crushing of corners and abrasion of surfaces. Use fiber rope slings to handle piles. Give cuts or breaks in surface of treated piles three brush coats of hot creosote oil of approved quality, and pour hot creosote oil into all bolt holes, splits, or cuts. Plug any unfilled holes, after being treated with creosote oil,

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with creosoted plugs. If treatment is damaged so that integrity of pile is in jeopardy, pile will be rejected and a replacement pile furnished at no expense to Owner. Treated piling must be close stacked and piled to prevent warping.

601.3.06B Steel Piling

Store and handle steel piles such as to avoid injury to or rusting of piles. Bent or kinked piles which, in the opinion of Engineer, cannot be straightened without injury to the metal will be rejected.

601.3.06C Precast Concrete Piling

Store and handle precast concrete piling such that piling is not subject to fracture by impact, bending stresses, or other injury in curing or transporting. Locate points of pickup on the shop drawings submitted for review. Determine maximum length of pile per number of pickup points in accordance with recommendations of the Prestressed Concrete Institute. Unless otherwise approved, lift piles only at points shown on reviewed shop drawings. Lift piles by means of approved bridle or slings attached to the pile at marked pickup points. Do not subject piles to any handling stress until a test cylinder, made from the concrete pour for the piles involved and cured with these piles, shows a strength of at least 5,000 pounds per square inch for precast-prestressed piles or 3,300 pounds per square inch for other precast piles. Method of handling shall never be such as to induce stresses in reinforcement in excess of 12,000 pounds per square inch, allowing 100 percent of calculated load for impact and shock effects. In handling piles for use in alkali soils, take special care to avoid surface abrasions or other injuries exposing interior concrete.

601.3.07 DRIVING PILING

601.3.07A General

Drive piles continuously without voluntary interruption, to a minimum penetration and/or to a minimum bearing as shown or specified.

Uniform section and uniform taper section steel casings or shells may be driven without a mandrel but must be equipped with heavy steel driving tips approved by Engineer. Drive step taper shells using a mandrel of a length equal to full length of pile.

601.3.07B Minimum Penetration

When shown or specified for piles to be driven to a minimum penetration, drive piles continuously to specified penetration, or to refusal driving resistance, as shown. IF penetration at refusal is less than minimum specified, and Engineer determines that required penetration cannot be obtained without exceeding maximum driving resistance of the pile, jetting while driving or pre-boring may be permitted, subject to approval, or Contractor may be required to remove and re-drive pile at another location.

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601.3.07C Minimum Bearing

When shown, or specified for piles to be driven to a minimum bearing, determine minimum bearing value as hereinbefore specified.

601.3.07D Driving Restrictions

Do not drive piles within 200 feet of structural concrete which has set less than seven days unless otherwise approved.

Do not drive any steel casings for cast-in-place concrete piling within 15 feet of a pile, the concrete in which has set for less than seven days when concrete is reinforced, or 48 hours when concrete does not enclose reinforcing steel bars.

601.3.07E Locations for Driving

Lay out pile locations from information shown and as furnished by Engineer. Method used to determine pile locations is subject to approval of Engineer.

601.3.07F Accuracy of Driving

In general, drive piling in true alignment at locations shown. Drive piles for trestle or dock bents so that cap may be placed in its proper location without inducing excessive stresses in pile. Use templates or other approved methods to obtain required degree of accuracy. Centers of foundation piles must not vary from vertical or batter shown, or established by Engineer, more than 6 inches at cutoff elevation, unless otherwise approved in writing. Manipulation of piles into alignment or position will not be permitted, and Contractor will be required to re-drive or use other satisfactory methods to avoid such manipulation.

601.3.07G Driving Through Embankments

Do not drive piling in embankments until embankment is in place. Drive piles completely through embankment fills to specified bearing and/or penetration in underlying material. If penetration of fill cannot be accomplished with usual driving methods, Contractor, at his/her own expense, must resort to pre-boring or other approved methods. Pre-bored or spudded holes must be of a size and depth necessary to allow frictionless penetration of fill by pile. After piles are driven to required bearing and/or penetration, fill space tightly between pile and pre-bored or spudded hole with approved granular material.

601.3.07H Minimum Age

Do not drive precast concrete piles until a test cylinder, made from the concrete pour for piles involved and cured with these piles, shows a strength of at least 6,000 pounds per square inch for precast-prestressed piles, or 4,000 pounds per square inch for other

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precast piles. Do not drive prestressed concrete piles within three days of detensioning the prestressing strands.

601.3.08 TEST PILES

When shown or directed, drive test piles to determine lengths of piling required to obtain necessary load carrying capacity and/or penetration. Drive these piles at location designated and of sufficient length to provide for any variation in soil conditions. Test piles must be the same as permanent piles which are to be driven except test piles for treated timber piles may be either treated or untreated.

Drive test piles to specified bearing and/or penetration without interruption in driving. Interruption in driving is cause for rejection of pile as a test pile and it will be replaced with a properly driven pile at no expense to Owner. Use same driving equipment and methods used to drive test piles as that to be used for driving permanent piles.

Drive test piles for foundations and trestles to a minimum bearing value of 15 tons more than bearing value specified for permanent piles. When a pile tip elevation is specified, test piles must penetrate at least to specified tip elevation. If a pile tip elevation is not specified, test piles must penetrate at least 10 feet below bottom of concrete footing and 15 feet below bottom of concrete seal.

If any test pile, which is driven in place of a permanent pile, is damaged by handling or driving to the extent that it is unfit for use, remove damaged pile and replace at no expense to Owner. If Engineer specifically directs Contractor to drive test pile to more than 15 tons over minimum bearing capacity specified for permanent piling, Contractor must overdrive test pile as directed at his/her own expense, but will not be required to remove and replace test pile at his/her own expense because of damage resulting from such overdriving.

Timber or precast concrete piles, when used as test piles, must not be used in place of permanent piles and must be driven outside of footing area.

When steel or cast-in-place piles are used for test piles, drive them in place of permanent piles and reduce number of permanent piles by number of test piles driven.

Remove test piles that are not to be incorporated in completed structure to at least 2 feet below ground surface and backfill remaining hole with earth or other acceptable material.

When specified or shown, drive test piles before permanent steel piles or steel casings for cast-in-place concrete piles are drive.

601.3.09 LOADING TESTS

When specified or approved, determine size and number of piles by actual loading tests.
Load tests shall conform to ASTM D 1143. Procedures of load application must be approved by Engineer.

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601.3.10 SPLICING

Furnish full length timber, precast and prestressed concrete piles. In exceptional circumstances, splicing of piles may be permitted.

Splice composite untreated timber and treated timber piles where shown using lengths of steel pipe securely fastened to both untreated and treated piles with spikes or bolts. Drive composite piles the same as other timber piles, except that lower or untreated pile must first be driven to approximately ground or water line before splicing the two sticks together.

Untreated piles must have butt end rounded to form a tight driving fit into pipe splice. Treated piles must have tip end rounded, prior to treatment to form a tight driving fit into pipe splice. Then, drive composite pile to required penetration and bearing value. Drive composite piles in such a manner that position of splice will be well into ground to provide lateral support for pile, and also below level of permanent ground water.

Before ordering lengths of piles for timber composite piles determine relative positions of ground line and permanent water table carefully and order piles accordingly. Splice material purchased by Contractor before receiving pile Order List will be at contractor's expense if number of composite piles is reduced.

Furnish full length steel piles and steel casing or shells for cast-n-place piles wherever practicable. Splicing may be permitted, subject to approval of Engineer as to necessity for splicing and manner in which splice is to be made. Splice by using a full penetration butt weld which will develop the section of pile, and have a full and even bearing at the joint.

Splicing of concrete piles will not be permitted, except as provided for herein.

601.3.11 CUTOFFS

601.3.11A General

Withdraw piles driven below cutoff elevation and replace by new and if necessary, longer piles.

601.3.11B Timber Piles

Make tops of all piling to a true horizontal plane at elevation shown or established by Engineer. Cut piles which support timber caps or grillage to conform to plane of bottom of superimposed structure. Cut with approved tools that will not fracture or damage area below cut surface. In general, length of pile above elevation of cut-off must be sufficient to permit complete removal of all material injured by driving, but piles driven to very nearly cut-off elevation must be carefully adzed or otherwise freed from all broomed, splintered, or otherwise injured material.

Thoroughly cover heads of all untreated piles except those encased with concrete, with hot creosote followed by two applications of a hot sealing compound mixture of

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creosote and asphalt pitch, mixed to thick consistency, and brushed thoroughly into the wood. Allow time for each application to soak in before applying next coat.

Immediately after making final cut-off on treated timber piles, give cut area same treatment as specified above for untreated piles.

Further protect timber pile heads not encased in concrete by one of the following waterproofing methods, as shown. If not otherwise specified, use second method.

1. Zinc Covering—Cover cut surface with three applications of a mixture of 60 percent creosote and 40 percent asphalt or brush coat thoroughly with three applications of hot creosote and cover with hot asphalt. Before placing cap, place a sheet of 12 gauge (.028 inch) zinc on each pile head. Use sheet zinc of sufficient size to project at least 4 inches outside of pile. Bend sheet down, neatly trimmed and securely fastened to faces of pile with large-headed, galvanized roofing nails.

2. Fabric Covering—Cover heads of all piles with alternate layers of hot asphalt pitch and waterproofing fabric, similar to membrane waterproofing, using four applications of asphalt pitch and three layers of fabric

Cover at least 6 inches more in dimension than diameter of pile, fold neatly down over pile and secure by large-headed galvanized nails or by binding with not less than seven complete turns of galvanized wire securely held in place by large-headed galvanized nails or staples. Galvanized or stainless steel straps and clips conforming to requirements specified hereinbefore may be used in lieu of galvanized wire. Trim edges of fabric projecting below wrapping to present an approved appearance.

At completion of work, all unused pile cutoffs, regardless of length, become property of contractor and must be disposed of as approved.

601.3.11C Steel Piles or Casings for Cast-in-place Piles

Cut tops of piles square at required elevation and grind smooth after cutoff. All cutoffs from steel piles and shells will remain property of Contractor and must be disposed of as approved. Undamaged cutoffs may be used as pile extensions or welded together to form full length piles, subject to approval. Welding together of steel piles, whether pile extensions or full length piles, must be done in a manner as to produce piles which do not vary from a straight line more than ¼ inch in 20 feet measured along any edge of pile.

601.3.11D Precast Concrete Piles

Cut off precast concrete piles at required elevation. Use approved equipment for cutting which will not fracture of damage area below cut surface. Repair any spalling of concrete below the area of pile covered by the footing or pile cap as approved, at no expense to Owner. All precast concrete pile cutoffs not used in extensions or buildups,

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regardless of length, will become property of and be disposed of by Contractor. Pile cutoffs designated to be used in construction of pile extensions or buildups remain property of Owner.

For cutoffs of prestressed piles, clean concrete off projecting prestressing strands thoroughly.

601.3.12 EXTENSIONS OR BUILD-UPS

Extensions, splices, or build-ups on concrete piles must have approval of Engineer and be done after driving is completed. If additional driving to obtain specified bearing is required after build-ups or extensions are made, no additional driving can be performed until concrete in build-up or extension has reached full design strength.

Splice prestressed concrete piles to prestressed concrete piles as designated. Remove spalled concrete and fresh head the pile to provide a top surface that is perpendicular to pile axis.

For other precast piles, cut away concrete at head of pile, leaving reinforcing steel exposed for a length of 40 diameters. Make final cut of concrete perpendicular to axis of pile. Fasten reinforcement similar to that used in the pile securely to projecting steel and place necessary form work, care being taken to prevent leakage along pile. Use same quality concrete as that used in pile. Just prior to placing concrete, wet top of pile thoroughly and cover with a thin coating of neat cement, re-tempered mortar, or other suitable bonding material. Keep forms in place not less than seven days and then remove carefully and finish entire surface of pile as previously specified.

Where piles with steel casings are used and a portion of the pile is exposed to view above finished ground line or low water lien in water crossings, the steel casings must not extend above an elevation 2 feet below finished ground line or 2 feet below low water line. Pile above finished ground line or low water line must be as shown for size of pile specified, except that they may be either round or octagonal. Extend reinforcing steel for section of pile above cutoff elevation for steel casing a minimum of 4 feet into lower section to tie the two sections together. Make extensions or build-ups as designated.

601.3.13 DAMAGED AND DEFECTIVE PILES

In handling and driving of piles, do not subject them to excessive and undue abuse producing crushing or spalling of concrete, injurious splitting, splintering, and brooming of wood or deforming of steel. Excessive manipulation of piles to force them into proper position will not be permitted.

Correct any pile which is split, broomed, cracked, crushed, broken, or otherwise injured so as to impair its intended purpose, due to internal defects or as some consequence of storage, handling or driving, at no expense to Owner by one of the following methods approve for the pile in question:

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1. Withdraw and replace pile.

2. Drive replacement pile adjacent to defective or low pile.

3. Splice or build up piles as otherwise provided herein or extend a sufficient portion of the footing to properly embed the pile.

601.3.14 INSPECTION

When specified, collect and record the following date:

1. Elevation of ground surface at pile location on land.

2. Elevation of mud line and water surface at pile location on water, and time water surface elevation recorded.

3. Overall pile length.

4. Depth pile is driven.

5. Number of hammer blows per foot of penetration for entire driving sequence.

6. Length of any cutoff.

7. Elevation of any splice or repair.

When directed, pull selected piles after driving for test and inspection to determine their condition. Remove from site any pile so pulled and found to be damaged to such extent as would impair its function in completed structure and drive a new pile. Re-drive piles pulled and found to be in satisfactory condition. If a pile is pulled and connate be re-driven, backfill hole with tremie-placed concrete or pea gravel.

601.4.00 MEASUREMENT AND PAYMENT

601.4.01 FURNISH PILING

601.4.01A Timber, Precast, and Prestressed Concrete Piling

Measurement will be made on a linear foot basis and will be the total footage computed from the Order List. Composite piling made with two or more timber sections spliced together or with an untreated timber lower section and a reinforced concrete upper section spliced together will be considered as one pile. For measurement of furnishing test piling, see Subsection 601.4.03.

When shown or specified, splices, steel shoes, extensions, build ups, and other incidental work are included in payment for *Furnish Piling*.

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601.4.01B Steel Piles and Steel Shells for Cast-in-place Piles

Measurement will be made on a linear foot basis for pile remaining in completed work, measured from tip of pile to plane of cutoff to nearest foot. All splices, steel shoes, extensions, build ups, and other incidental work are included in payment for *Furnish Piling*. For measurement of furnish test piling, see *Subsection 601.4.03*.

All work for splices, tip re-enforcement, and attachments is included in payment for *Furnish Piling*.

Measurement and payment for cast-in-place piling also includes full compensation for casings, furnishing, and placing concrete and re-enforcement, and re-enforcement required to extend beyond end of pile for connections.

601.4.02 DRIVE PILING

Except for dock or trestle piles, drive piling, or drive test piling will be measured on a linear foot basis for particular size and type of piling in place, measured from tip of pile to plane of cutoff to nearest foot. Measurement will not be less than 75 percent of individual pile lengths shown in Engineer's estimated length or Order List, whichever is applicable. Driving dock or trestle piles will be measured on a linear foot basis for piling in place, measured from pile tip to ground surface.

Measurement and payment for driving piles includes fill compensation for cutting off piles, treatment work necessary to obtain required penetration of bearing values of piles.

601.4.03 FURNISH TEST PILING

When specified, test piles required by Plans or Special Specifications will be measured on a linear foot basis for total footage specified or directed to be placed. Test piles remaining in completed work will be included for measurement and payment under this Subsection.

Meet other applicable requirements contained in Subsection 601.4.01.

Test piles driven by Contractor for his/her information or convenience and later incorporated into completed work will be measured in accordance with applicable provisions. Measurement and payment will not be made for test piles not shown, specified, or directed by Engineer unless Engineer approves their incorporation into completed work.

601.4.04 DRIVE TEST PILES

Drive test piles will be measured in accordance with provisions of ***Subsection 601.4.02 Drive Piling***.

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601.4.05 LOAD TESTS

Measurement will be made on a unit price each basis for actual number of load tests performed.

601.4.06 PAYMENT

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract.

Pay Item		Unit of Measure
1.	Furnish Piling (specify type, size, and unit length)	L.F.
2.	Drive Piling or Test Piling (specify type and size)	L.F.
3.	Furnish Test Piles (specify type, size, and unit length)	L.F.
4.	Load Tests	EA.

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602 Concrete Structures

602.1.00 DESCRIPTION

This Section covers Portland Cement concrete, plain or reinforced, precast or cast-in-place, in bridges, box culverts, retaining walls, catch basins, abutments, piers, footings, foundations, and similar structures.

602.2.00 MATERIALS

602.2.01 PORTLAND CEMENT

Conform to *Section 205 Materials*.

602.2.02 AGGREGATES

602.2.02A General

Use aggregates which conform to requirements of *Section 205 Materials*, and the additional requirements contained herein.

If Contractor desires to furnish aggregates which deviate from gradations contained herein, obtain written approval from Engineer prior to incorporation of any materials in any part of the work.

602.2.02B Fine Aggregate

Fine aggregate must be graded from coarse to fine within the following limits:

All fine aggregate shall meet the requirements of ASTM C 33.

Grading Requirements Fine Aggregate Portland Cement Concrete	
Sieve Size Passing	**Percentages (by weight)**
3/8”	100
No. 4	90 – 100
No. 16	45 – 75
No. 30	25 – 55
No. 50	5 – 30
No. 100	0 – 8

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Use fine aggregate which has a sand equivalent of not less than 68, and which develops in the mortar strength test taken at seven days, a compressive strength of at least 95 percent of mortar using Ottowa sand.

Sand for mortar shall conform to the requirements of AASHTO M 45; testing shall conform to the OSHD standard test for mortar strength.

602.2.02C Coarse Aggregate

Coarse aggregate must conform to the specified maximum size, and when each maximum size is separated into designated sizes, the separated designated sizes shall be as follows:

Maximum Size of Aggregates	Separated Sizes
2 inch	(2”—1”), (1”—No. 4)
1½ inch	(1½ “—¾”), (3/4”—No.4)
1 inch	(1”—No. 4)
¾ inch	(3/4”—No.4)

Do not allow oversized and undersized materials to exceed a combined 15 percent of any separated size, nor allow any pieces to have any dimension greater than twice the minimum square screen size for the specified grading.

Grading of each of specified separated sizes of coarse aggregate shall conform with the following:

Grading Requirements
Coarse Aggregate—Portland Cement Concrete

Sieve Size Passing	Separated Sizes			
	2”—1”	1½”—¾”	1”—No. 4	¾”—No. 4
	Percentages (by weight)			
2½”	100			
2”	90 – 100	100		
1½”	35 – 70	90 – 100	100	
1”	0 – 15	30 – 65	90 – 100	100
¾”		0 – 15	50 – 80	90 – 100
⅜”			15 – 40	20 – 50
No. 4			0 – 10	0 - 10

When a tolerance range is set forth in the above grading requirements, it shall be understood that the midpoint of the tolerance range is the target value and the product

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shall conform as closely as realistically possible to this target value. The purpose of the tolerance range is only to permit occasional minor variations from the target value that are, for practical reasons, unavoidable.

When coarse aggregate is to be separated into two sizes as set forth hereinabove, control grading of material in each separated size within the applicable range of percentages given in grading requirements for coarse aggregate hereinabove so that the quantity of each separated size measured into the batch shall be not less than 35 percent nor more than 65 percent of total quantity of coarse aggregate measured into the batch.

602.2.03 WATER

Conform to *Section 205 Materials*.

602.2.04 ADMIXTURES

602.2.04A Air-entraining Admixtures

Air-entraining admixtures shall conform to AASHTO M 154 (ASTM C 260) using one or another of several tests as directed by the Engineer. Chloride content of admixture must not exceed 0.5 percent by weight.

602.2.04B Water reducing, Retarding, and Accelerating Admixtures

Water reducing, retarding, and accelerating admixtures shall conform to AASHTO M 194 (ASTM C494) using one or more of several tests as Engineer may direct. Chloride content of admixtures must not exceed 0.5 percent by weight.

602.2.05 CURING MATERIALS

Use curing material (s) conforming to one or more of the following requirements or as specified:

White Burlap-Polyethylene Sheets for Curing Concrete .....AASHTO M 171
Waterproof Paper for Curing Concrete .....AASHTO M 171
Liquid Membrane-Forming Compounds for Curing Concrete*
(white-pigmented) .....AASHTO M 148
White Polyethylene (Film) for Curing Concrete Burlap Cloth (Jute or Kenaf) .....AASHTO M 182

*Not permitted on bridges, reservoirs, and box culverts.

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602.2.06 JOINT MATERIALS

602.2.06A Pre-formed Expansion Joint Fillers

Use pre-formed expansion joint fillers for concrete conforming to AASHTO M 153 or AASHTO M 213 except that those furnished under AASHTO M 213 shall be tested in conformance to ASTM D 1751. Fillers conforming to AASHTO M 213, except that the binder, if other than bituminous material, may also be used provided that they otherwise meet these Specifications and provided further that they have been demonstrated to be rot and vermin proof for a period of at least five years.

602.2.06B Preformed Elastomeric Joint Seals

Utilize preformed elastomeric joint seals conforming to AASHTO M 220.

602.2.06C Poured Filler

Utilize poured filler for concrete joints conforming to AASHTO M 173.

602.2.07 WATER STOP

602.2.07A Plastic

Plastic water stops shall be fabricated with a uniform cross section, free from porosity or other defects, to the nominal dimensions shown on the Plans. An equivalent standard shape may be furnished, if approved by the Engineer.

The material from which the water stop is fabricated shall be a homogeneous, elastomeric, plastic compound of basic polyvinyl chloride and other material which, after fabrication, will meet the requirements tabulated herein. No reclaimed material shall be used. The contractor shall furnish a certificate from the producer, showing values for the designated properties. The Contractor shall furnish samples, in lengths adequate for making designated tests, as ordered by the Engineer.

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Required Properties and Test Methods Plastic Water Stop			
Property	**No. 406 Method Standard Federal Test**	**ASTM Equivalent**	**Requirement**
Tensile strength	1011	D638	Minimum 1,400 psi (9.65MPa)
Elongation at breaking	1011	D638	Minimum 250 percent
Hardness (shore)	1082	D2240	60 to 75
Specific gravity	5011		Maximum + or – 0.02 from Manufacturer's value
Resistance to alkali (7 days using 10 percent NaOH)	7011	D543	Maximum weight change 0.10 percent to + 0.25 percent Maximum hardness change + or – (shore); maximum tensile strength decrease: 15 percent
Water absorption (48 hours)	7031	D570	Maximum 0.5 percent
Cold bending	(1)	(1)	No cracking
Volatile loss	6081	D1203	Not more than manufacturer's value

(1) The cold bend test will be made by subjecting a 1-inch by 6-inch by ⅛-inch strip of plastic water stop to a temperature of minus 20 degrees Fahrenheit for two hours. The strip will immediately thereafter be bent 180 degrees around a rod of ¼-inch diameter by applying sufficient force to hold the sample in intimate contact with the rod. The sample will then be examined for evidence of cracking. At least three individual samples from each lot will be tested and the result reported.

602.2.07B Rubber

Rubber water stops may be molded or extruded and shall have a uniform cross section, free from porosity or other defects, conforming to the nominal dimensions shown on the Plans. An equivalent standard shape may be furnished, if approved by the Engineer.

The water stop may be compounded from natural rubber, synthetic rubber, or a blend of the two, together with other compatible materials which will produce a finished water stop meeting the requirements tabulated herein. No reclaimed material shall be used. The Contractor shall furnish a certificate from the producer to show the general composition of the material and values for the designated properties. The Contractor shall furnish samples, in lengths adequate for making designated tests, as ordered by the Engineer.

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Required Properties and Test Methods Rubber Water Stop		
Property	**Federal Test Method Standard No. 601**	**Requirement**
Hardness (by shore durometer)	3021	60 to 70
Compression set	3311	Maximum 30 percent
Tensile strength	4111	Minimum 2,500 psi (17.24 MPa)
Elongation at breaking	4121	Minimum 450 percent
Tensile stress at 300 percent elongation	4131	Minimum 900 psi (6.21 MPa)
Water absorption by weight	6631	Maximum 85 percent
Tensile strength after aging	7111	Minimum 80 percent original

602.2.07C Copper

Sheet copper for water stops or flashings shall meet the requirements of AASHTO M138 (ASTM B 152) for type ETP light cold-rolled, soft anneal, unless otherwise specified.

602.3.00 CONSTRUCTION

602.3.01 GENERAL

When purchasing concrete from others during performance of the Contract, be fully responsible for such concrete conforming to all requirements contained herein.

602.3.02 MIX DESIGN

602.3.02A Classes of Concrete

Classes of concrete shall designate design field strength of concrete in 28 days (psi) followed by maximum size of aggregates to be used in the concrete, i.e., Class 3000-1 ½ shall indicate a compressive strength of 3,000 psi in 28 days with 1 ½-inch maximum size aggregate used in that concrete.

Use the class of concrete as specified or shown for each component part of the project, and if not so specified or shown, use class 3000-1 ½ concrete.
In all precast-prestressed concrete members, in the stems of post-tensioned box girders, and in all other members where the spacing of reinforcement is less than 2 inches, use 1-inch maximum size aggregate, unless specified otherwise.

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602.3.02B Classification and Proportioning of Concrete Mixtures

Before beginning any concrete work, the contractor shall have the concrete mix designed by an approved independent testing laboratory, at no expense to the Owner. Certified copies of all laboratory trial mix reports shall be sent to the Engineer from the testing laboratory. The contractor shall not place concrete prior to approval of the concrete mixes and laboratory test results.

During progress of work, if concrete strength and quality as determined by cylinders and test taken by Engineer fail to attain the requirements specified, suspend all concrete work and make necessary adjustments to obtain required results.

A mix using different proportions or aggregate sizes of any of the concrete materials in the mix, may be requested to satisfy a particular production schedule or for other reasons. Any requested and authorized alteration to proportions of any of the concrete materials in the mix shall be made at no expense to Owner.

The Contractor shall design mix to meet the following requirements unless otherwise specified:

1. Entrained air range 3 percent to 6 percent (percent by volume). AASHTO T 152

2. Slump range—2 inches to 4 inches. AASHTO T 119

3. Maximum water-cement ratio (gallons of water per 94-pound sack of cement) shall be determined by the Engineer in accordance with the required compressive strength.

4. When using ¾-inch maximum size aggregate, the fine aggregate shall be between 40 percent and 48 percent of the total aggregate used.

5. When using 1½-inch maximum size aggregate, the fine aggregate shall be between 35 percent and 45 percent of the total aggregate used.

6. When specified, use a water-reducing admixture in conformance with manufacturer's recommendations.

7. Conform to the following minimum cement content per cubic yard for class specified:

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Class (Compressive strength f'c')	Minimum Cement Content
2500	518 Pounds (5.5 sacks)
3000	564 Pounds (6.0 sacks)
3300	592 Pounds (6.3 sacks)
4000	658 Pounds (7.0 sacks)
4500	677 Pounds (7.2 sacks)
5000	705 Pounds (7.5 sacks)
5500	733 Pounds (7.8 sacks)
6000	752 Pounds (8.0 sacks)

Tests for strength shall be made in accordance with the following:

Molding Concrete Specimens in the Field ..... AASHTO T 23
Compressive Strength of Molded Cylinders ..... AASHTO T 22

Curing of cylinders shall conform to AASHTO T 23 except as modified herein.

602.3.03 CONSISTENCY

In general, use a mixture which contains the minimum amount of water consistent with required workability. Consistency of concrete shall be gauged by ability of equipment to properly place it without segregating or honeycombing, and not by the difficulty in mixing or transporting.

602.3.04 MEASUREMENT OF MATERIALS

Provide facilities for weighing and accurately measure all materials by weight, except water, when batching concrete; weigh fie and coarse aggregates separately. Take representative samples and determine moisture content for each kind of aggregate. Store or handle aggregates so that their water content remains reasonably constant during any day's run. Equipment for weighing materials shall provide convenient and positive means of determining quantities in the batch of concrete and means shall be provided for addition or removal of small quantities of materials to obtain exact weight per batch. Device for measuring water shall show accurately quantity in gallons and be so designed that the water supply will be automatically cut off while water is being discharged into the mixer. Water shall be assumed to weigh 8.34 pounds per gallon.

602.3.05 MIXING

602.3.05A General

Machine mix all concrete. Ready-mixed concrete may be used if approved by the Engineer. Approval will be given if investigation of the plant's delivery system indicates

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that concrete delivered to the project will conform in all respects to the requirements of ASTM C 94.

602.3.05B Mixing at Site

Mix concrete thoroughly in a batch mixer of an approved size and type which will insure a uniform distribution of materials throughout the mass.

Equip mixer with adequate water storage and a device for accurately measuring and automatically controlling amount of water used in each batch. Preferably provide mechanical means for recording the number of revolutions for each batch and automatically preventing discharge of mixer until materials have been mixed the specified minimum time.

Remove entire contents of the mixer from drum before materials for a succeeding batch are placed therein. Deposit materials composing a batch simultaneously in the mixer. Do not use any mixer having a rate capacity of less than one-sack batch. Do not charge a mixer in excess of its rated capacity.

Mix all concrete for a period of not less than 1 ½ minutes after all materials, including water, are in mixer. During the period of mixing, operate mixer at a design speed of not less than 14 nor more than 20 revolutions per minute.

The first batch of concrete materials placed in mixer shall contain a sufficient excess of cement, sand, and water to coat inside of drum without reducing required mortar content of mix. Upon cessation of mixing for a considerable period, cleans the mixer thoroughly.

The above Specification contemplates the use of conventional revolving drum type mixers. Other types may be used with written permission of Engineer.

602.3.05C Truck Mixing

Unless otherwise authorized by Engineer, use only revolving drum type truck mixers that are watertight and so constructed that concrete can be mixed to insure a uniform distribution of materials throughout the mass.

Accurately measure all solid materials for concrete in accordance with Subsection 602.304 and charge into drum at proportioning plant. Except as subsequently provided, equip truck mixer with a tanks for carrying mixing water. Place only the prescribed amount of water in tank unless tank is equipped with a device by which quantity of water added can be readily verified. Mixing water may be added directly to the batch in which case a tank will not be required. Truck mixers may be required to be provided with means by which the mixing time can be readily verified by Engineer.

Do not allow any batch in a truck mixer to exceed the maximum rated capacity of mixer as stated by manufacturer and stamped in metal on the mixer. Continue truck mixing

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for not less than 70 revolutions nor more than 100 revolutions of drum at the rate of rotation designated by manufacturer and stamped in metal on mixer. Commence mixing after all ingredients, including water, are in drum. Additional mixing, if any, shall be of the rate of rotation as designated by manufacturer as agitating speed. Begin mixing within 30 minutes after cement has been added to either the water or aggregate. When cement is charged into a mixer drum containing water or surface-wet aggregate and when the temperature is above 90 degrees Fahrenheit, or when high-early strength Portland Cement is used, reduce this limit to 15 minutes.

The limitation on time between introduction of cement to aggregates and the beginning of mixing may be waived when, in the judgment of Engineer, aggregates are sufficiently free from moisture so that there will be no harmful effects on the cement.

602.3.05D Partial Mixing at Central Plant

When a stationary mixer is used for partial mixing of concrete (shrink-mixing), mixing time in stationary mixer may be no more than is required to intermingle the ingredients. After transfer to a truck mixer, further mixing at a designated mixing speed will be required only as necessary to meet requirements for uniformity of concrete as specified for truck mixing.

602.3.05E Plant Mix

Conform mixing at a central plant to requirements for mixing at a site.

602.3.05F Time of Hauling and Placing Mixed Concrete

Completely discharge and place in the forms all concrete transported to project in a truck mixer or truck agitator within 9- minutes after the introduction of mixing water to cement and aggregate, or cement to aggregate, or before 250 revolutions of the truck drum or blades, whichever comes first.

As directed by Engineer, reduce this time during conditions which contribute to accelerated setting of concrete, or when temperature of concrete is 85 degrees Fahrenheit, or above.

Add no water to concrete during hauling or before discharge, unless ordered by Engineer. Engineer will not approve any water addition which increases the slump by more than 1 inch or exceeds the design water-cement ratio.

602.3.05G Delivery

Utilize a plant capacity and transportation equipment which are adequate to insure continuous delivery of concrete during concreting operations and which will provide for proper handling, placing and finishing of concrete. Use a rate of delivery such that interval between batches does not exceed 20 minutes. Methods of delivery and handling concrete shall allow placing with a minimum of re-handling and without

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damage to the structure or concrete. Time interval may be reduced when deck concrete is being placed. Control delivery of concrete for decks so that deck pour will progress at a rate of not less than 20 feet per hour unless some other rate of pour is approved.

602.3.05H Re-tempering

Mix concrete only in such quantities as are required for immediate use and do not use any which has developed initial set. Concrete which has partially hardened shall not be re-tempered or re-mixed.

602.3.06 FALSEWORK

For structures requiring poured-in-place concrete superstructures, working drawings and calculation for falsework prepared by an Engineer registered to practice in the State of Oregon may be required to be submitted for approval.

For designing falsework, assume a weight of 150 pounds per cubic foot for green concrete. Design and construct all falsework to support the total applied loads with a deflection/span ratio not to exceed 1/500 in any falsework span. Employ screw jacks or hardwood wedges to take up any settlement in formwork either before or during placing of concrete. Set falsework to give finished structure the camber specified or shown. Design falsework for post-tensioned structures to carry full dead load and any additional vertical or horizontal loads caused by the pre-stressing operation.

Contractor is directed to the fact that post-tensioned structures are not self-supporting until post-tensioning is complete and Contractor shall consider this fact in the design, maintenance, and protection of falsework.

602.3.07 FORMS

Make all forms mortar-tight, set them so finished concrete will conform to proper dimensions and contours, and make them sufficiently rigid to prevent distortion due to pressure of the concrete and other loads incident to construction operations. Construct and maintain forms to prevent warping and opening of joints.

Design forms to withstand effect of vibration of concrete as it is placed.

Support deck forms for concrete box girder spans by girder stems. Posts or other supports for deck forms will not be permitted to come in contact with bottom slab of box girder.

Make wood forms for concrete surfaces not subject to backfill of dressed lumber of uniform thickness with a form liner of an approved type. Wood forms for interior cells of box girders may be made with or without a form liner. Shiplap or S4S boards are acceptable provided forms are mortar-tight. Plywood will be acceptable as a form liner if supported in an approved manner. Insure that all formwork for exposed concrete surfaces is smooth with grain running in the same direction to give a good finished appearance. Construct metal ties or anchorages

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within forms to permit their removal to a depth of a least 1 inch from face without injury to concrete. Where wire ties are permitted, all wires, upon removal of forms, shall be cut back at least ¼ -inch from face of concrete with chisels or nippers; for green concrete, nippers are necessary. Design all fittings for metal ties so that, upon their removal, cavities which are left will be of smallest possible size. Fill cavities with cement mortar and leave surface sound, smooth, even, and uniform in color.

Fillet forms at all sharp corners and bevel or draft in the case of all projections, such as girders and copings, to insure easy removal. For narrow walls and columns, where bottom of form is inaccessible, leave lower from boards loose so that they may be removed for cleaning out extraneous material immediately before placing of concrete.

Keep forms in place for periods, which shall be determined as hereinafter specified. When forms appear to be unsatisfactory in any way, either before or during placing of concrete, work may be ordered stopped until defects have been corrected.

Maintain shape, strength, rigidity, water tightness, and surface smoothness of re-used forms at all times. Do not re-use warped or bulged lumber, and do not re-use any forms which, in the opinion of Engineer, are unsatisfactory in any respect. Thoroughly clean re-used forms of all dirt, mortar, and foreign matter.

Treat all forms with an approved form oil or wax or saturate with water immediately before placing concrete. Do not use material which will adhere to or discolor concrete.

602.3.08 REMOVAL OF FALSEWORK AND FORMS

Assume full responsibility for all damage resulting from premature removal of forms. Do not place earth backfill against walls below grade, and do not remove forms and shoring from structural slabs or beams until concrete has reached and actual field strength equal to 75 percent of the specified 28-day design field strength. Actual field strength shall be determined from field cured test cylinders which shall be cured under conditions equivalent to the most unfavorable conditions for the portions of concrete which the cylinders represent.

Do not use methods of form removal likely to cause over-stressing of concrete. Do not remove forms and their supports without approval. Remove supports in such a manner as to permit concrete to uniformly and gradually take the stresses due to its own weight.

Remove all formwork from cells of concrete box girders to which access is provided, and all formwork except that necessary to support deck slab, from remaining cells of box girder.

602.3.09 WEATHER LIMITATIONS

602.3.09A General

Assume full responsibility for the concrete work during any unusual weather conditions including, but not limited to, hot and cold weather. Any work not in conformance to the

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Plans and Specifications may be rejected by Engineer and replaced or repaired at Contractor's expense.

602.3.09B Hot Weather

Take special precautions for hot weather in placing, finishing, and curing concrete when the ambient temperature reaches 85 degrees Fahrenheit or higher or whenever relative humidity, wind velocity, or exposure to sun at lower air temperatures are expected to cause hot weather conditions for the concrete. Specify cool materials for the mix, add additional water to forms, subgrades, and other areas to be in contact with concrete but allow no standing water when concrete is placed; schedule work carefully to place and finish concrete as rapidly as possible, reduce evaporation from concrete with windbreaks, covers, and fog nozzles and begin curing as soon as possible.

602.3.09C Cold Weather

Do not place concrete when ambient temperature is below 35 degrees Fahrenheit without written permission of Engineer. When directed by Engineer, enclose structure in such a way that concrete and air within enclosure can be kept above 60 degrees Fahrenheit for a period of seven days after placing concrete. If high-early strength cement is used, this period may be reduced by Engineer. When enclosures are used to maintain specified temperatures, furnish a 24-houre temperature recording thermometer to record all temperature within enclosure.

Supply heating apparatus such as stoves, salamanders, or steam equipment and the necessary fuel. When dry heat is used, provide means of maintaining atmospheric moisture. Heat all aggregates and mixing water to a tempera rue of at least 70 degrees Fahrenheit, but not more than 150 degrees Fahrenheit; aggregates may be heated by either steam or dry heat.

Where practicable, forms insulated with at least 2-inch thick blankets, made of fiberglass, rock wool, balsam wool, or similar commercial material capable of maintaining surface of concrete at no less than 50 degrees Fahrenheit may be used in lieu of other protection of concrete involving housing and heating. When forms are insulated, protect exposed horizontal surfaces with a similar layer of the insulating materials securely fastened in place. If insulated forms do not maintain proper temperature at surface of concrete, use auxiliary protection and heat.

602.3.10 HANDLING AND PLACING

602.3.10A General

Do not place any concrete without the approval of Engineer. Concrete placed without Engineer's approval may be rejected and removal required. Provisions of this Subsection shall apply to precast piling and other precast members, except that manufacturers' methods of vibrating may be used if approved.

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In preparation for placing of concrete, remove all sawdust, chips, and other construction debris and extraneous matter from interior of forms. Remove struts, stays, and braces, serving temporarily to hold forms in correct shape and alignment prior to placing of concrete, when the concrete placing has reached a position rendering their service unnecessary. Remove these temporary members entirely from the forms and do not leave buried in the concrete.

Do not use concrete which does not reach its final position is forms within time stipulated in Subsection 602.3.05F.

Place concrete so as to avoid segregation of material and displacement of reinforcement. Do not use long troughs, chutes, and pipes for conveying concrete from mixer to forms except with written authorization of Engineer. In case an inferior quality of concrete results from the use of such conveyors, Engineer may order discontinuance of their use and substitution of a satisfactory method of placing material.

For open troughs and chutes, use steel or steel lined material. Where steep slopes are required, equip chutes with baffles, or make in short lengths that reverse direction of movement. Keep all chutes, troughs, and pipes clean and free from coatings of hardened concrete by thoroughly flushing with water after each run; discharge water used for flushing clear of structure and do not discharge into any sewer or culvert or appurtenances thereto.

When placing operations would involve dropping concrete more than 3 feet, deposit through an approved ***elephant trunk***. Aluminum pipe will not be allowed.

After initial set of concrete, do not jar forms, nor place strain on ends of reinforcing bars which project.

Thoroughly compact concrete during and immediately after depositing.

Provide compaction by mechanical vibration subject to the following provisions:

1. Use internal vibration unless special authorization of other methods is given by Engineer or as provided herein.

2. Use vibrators of an approved type and design, capable of transmitting vibration to concrete at frequencies of not less than 4,500 impulses per minute.

3. Provide intensity of vibration such as to visibly affect mass of concrete of 1-inch slump over a radius of at least 18 inches.

4. Provide a sufficient number of vibrators to properly compact each batch, immediately after it is placed in forms.

5. Manipulate vibrators so as to thoroughly work concrete around reinforcement and embedded fixtures and into corners and angles of forms.

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6. Apply vibration at point of deposit and in area of freshly deposited concrete. Insert vibrators and with draw from concrete slowly. Use vibration of sufficient duration and intensity to thoroughly compact concrete but do not continue so as to cause segregation. Do not continue vibration at any one point to the extent that localized areas of grout are formed.

7. Make application of vibrators at points uniformly spaced and not farther apart than twice the radius over which vibration is visibly effective.

8. Do not apply vibration directly or through reinforcement to sections or layers of concrete which have hardened to the degree that concrete ceases to be plastic under vibration. Do not use vibration to make concrete flow in forms over distances so great as to cause segregation, nor to transport concrete in forms.

9. Supplement vibration by such spading as is necessary to insure smooth surfaces and dense concrete, along form surfaces and in corners and locations impossible to reach with vibrators.

Place concrete in horizontal layers not more than 12 inches thick except as hereinafter provided. When less than a complete layer is placed in one operation, terminate in a vertical bulkhead. Place each layer and compact before preceding layer has taken initial set to avoid surfaces of separation between layers. Compact each layer so as to avoid formation of a surface of separation with a preceding layer.

When placing of concrete is temporarily discontinued, and after concrete has become firm enough to retain its form, clean off laitance and other objectionable material to a sufficient depth to expose sound concrete. Smooth top surface of concrete adjacent to forms with a trowel. Where a ***feather edge*** might be produced at a construction joint, as in the sloped top surface of a wing wall, use inset formwork to produce a blocked out portion in the preceding layer which produces an edge thickness of not less than 6 inches in succeeding layer. Do not discontinue work within 18 inches of top of any face, unless provision has been made for a coping, in which case, a construction joint shall be made at underside of coping.

602.3.10B Footings, Base Slabs, Walls, and Columns

Place base slab or footings and allow to set before walls are constructed. Make provision for bonding walls to base by means of a construction joint. Use a construction joint conforming to the requirements for construction joints as hereinafter specified.

Stop concrete pours in columns and walls at bottoms of caps, cross-beams, girders, or any widened portion of the column or wall, and allow concrete to obtain shrinkage and settlement before pour is continued. Delay a minimum of two hours for pours less than 4 feet in height and a minimum of 12 hours for pours over 4 feet in height. At horizontal construction joints in walls and columns, provide a rough concrete surface or form shear keys, as shown.

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602.3.10C Girders and Elevated Slabs

Deposit concrete by beginning at center of span and working from center toward ends unless otherwise permitted. For concrete in girders, deposit uniformly for full length of girder and bring up evenly in horizontal layers.

Stop concrete pours in T-beams and box girders over 4 feet in depth at bottom of deck or deck fillet and allow concrete to obtain shrinkage and settlement before pour is continued. Delay a minimum of 12 hours. Incorporate similar delays into concrete pours at intersection of any structural members where concrete settlement could cause cracking at intersection. Form mechanical shear keys between girder stems and slabs, and in vertical construction joints where permitted. In general, suitable keys may be formed by of timber blocks approximately 2 inches by 4 inches in cross-section and having a length of 4 inches less than width of girder stem. Place keys along girder stem as required, but do not exceed 1 foot center to center. Bevel key blocks and oil to insure their ready removal. Remove as soon as concrete has set sufficiently to retain its shape.

For concrete in bottom slab of box girder structures, pour to bottoms of beam stems or stem fillets. Before stems are poured, allow bottom slab concrete to cure a minimum of three days at ambient temperatures of 40 degrees Fahrenheit or above, or for at least five days at ambient temperatures below 40 degrees Fahrenheit. In box girder spans, place construction joints at locations designated.

602.3.10D Pumping

Placement of concrete by pumping will be permitted provided approved clean equipment is used which is of sufficient size and capacity to satisfactorily handle the concrete mix specified. For discharge line of pump, use steel or rubber pipe. Provide additional cement or additives required to obtain a pumpable mix at no expense to Owner.

Furnish evidence of backup means of placing structural concrete in the event of failure of equipment during placement.

602.3.10E Depositing Concrete Under Water

Approval of Engineer is required for depositing concrete under water. Deposit concrete carefully in water by means of a tremie in a compact mass, in its final position, and do not disturb after depositing. Maintain still water at point of deposit.

Place concrete seals continuously from start to finish; keep surface of concrete as nearly horizontal as practicable at all times. To insure thorough bonding, place each succeeding layer of a seal before preceding layer has take initial set.

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A tremie shall consist of a tube having a minimum diameter of 10 inches, of sufficient length to reach from bottom of excavation up to concrete placing elevation above water line with an attached receptacle or hopper for receiving concrete. A jointed tremie will be permitted, provided joints are of flanged and gasketed type and waterproof. Support tremies to permit free movement of discharge end over entire top surface of work and to permit rapid lowering when necessary to retard or stop flow of concrete. At start of work and on any withdrawal of pipe for moving to a new location, close discharge end to prevent water from entering pipe. During progress of work, seal pipe entirely at all times and keep full of concrete to bottom of hopper. When a batch is dumped into hopper, induce flow of concrete by slightly raising discharge end, always keeping it in deposited concrete. Place concrete continuously until work is completed.

Dewatering may proceed when concrete seal is of sufficient strength as determined by test. Remove all laitance or other unsatisfactory material from exposed surface by scraping, chipping, or other means which will not injure surface of the concrete.

602.3.11 CONSTRUCTION JOINTS

602.3.11A General

Use construction joints only were shown or designated on the Plans, unless otherwise approved. Taper wooden key forms and pre-soak or teat to prevent swelling. When placing operation is interrupted for any reason, place construction joints as approved by Engineer and provide with keys to resist shear and dowels to develop bond as directed by Engineer.

602.3.11B Bonding

Before depositing new concrete on or against concrete which has hardened, the forms shall be re-tightened. The surface of the hardened concrete shall be roughened as required by the Engineer, in a manner that will not leave loosened particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned foreign matter and laitance and saturated with water. At the juncture of the hardened and the newly deposited concrete, the cleaned and saturated surfaces, including vertical and inclined surfaces, shall first be thoroughly covered with a coating of mortar or neat cement grout against which the new concrete shall be placed before the grout has attained its initial set.

The placing of concrete shall be continuous from joint to joint. The face edges of all joints which are exposed to view shall be carefully finished true to line and elevation.

602.3.12 EXPANSION AND FIXED JOINTS

Construct all joints according to details shown or as approved.

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602.3.12A Open Joints

Place open joints in locations shown. Construct by insertion and subsequent removal of a template of approved material without chipping or breaking corners of the concrete. Do not extend reinforcement across an open joint unless so shown.

602.3.12B Filled Joints

Construct poured expansion joints similar to open joints. When pre-molded types are specified, drive nails at about 1 foot on centers through filler to provided anchors into concrete when it is placed. Place pre-molded joint filler in forms improper rigid position before concrete is poured. Install pre-molded joint filler in all walks to provide expansion and contraction joints at maximum 18-foor intervals and at all changes in direction, at intersections and at each side of driveway entrances.

602.3.12C Steel Joints

Shape plates, angles, or other structural shapes accurately at the shop to conform to the section of concrete. Fabricate and paint to conform to requirements of these Specifications. Take care to insure that surface in finished plane is true and free of warping. Employ positive methods in placing joints to keep them in correct position during placing of concrete. Opening at expansion joints at normal temperature shall be as shown. Avoid impairment of clearance of any manner.

602.3.12D Preformed Elastomeric Joint Seals

Use compression joint seals in the longest practicable lengths for longitudinal joints. In transverse joints, one factory splice will be permitted in joint seals where required length of material in any one joint exceeds manufacturers' standard stock lengths. Make such splices true and smooth on outside surfaces with no offsets of abutting sections and with complete bond on all abutting surfaces. Make joints clean and dry and free of spalls and irregularities which would impair a tight seal in service. Place seals in the joint under compression, as recommended by manufacturer, using a lubricant-adhesive as a covering film applied to both sides of the seal just prior to its installation.

For lubricant-adhesive material, use a compound of same base polymer as the joint seal with which it is used, blended with a suitable volatile solvent. Lubricant-adhesive must be compatible with joint seal and concrete and be relatively unaffected by normal moisture in the concrete. It shall maintain a suitable consistency at the temperature at which joint seal is installed.

Set seal as shown and make sure it contacts walls of joint throughout its length. Longitudinal elongation of an installed seal by 3 percent or more of its original length will be cause for its removal and re-installation.

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Remove all lubricant-adhesive which comes upon the exposed top of an installed seal before it dries, and remove all seals which show twist, curl, nicks, or other malformation, as installed. Seal all ends of pre-formed elastomeric joint seals with a watertight plug prior to installation of joint seal. Use a foam rubber plug or other acceptable closed cell cellular material which is compressible to 15 percent of its uncompressed thickness. Plug shall be a minimum of 2 inches in length and be secured in elastomeric joint seal with an adhesive which will insure a watertight plug.

602.3.13 SURFACE FINISHING

602.3.13A General

After forms have been removed, carefully point all depressions resulting from removal of form ties or from other causes with mortar conforming to Section 205. Maintain thorough saturation of concrete surface during pointing and patching. Type of finish to be used shall be as specified or as shown.

602.3.13B Wall Finishes

1. **Unexposed Wall Finish**. Patch all rock pockets, form tie holes, and other irregularities as specified above. No further finishing will be required.

2. **Ordinary Wall Finish**. Immediately after removal of forms, patch or point up all defects and cure patches. After pointings have set sufficiently, grind or fill all form marks and pointings to give a smooth surface even with the flat wall surface.

3. **Class 1 Surface Finish**. After pointing has set sufficiently, wet entire surface thoroughly and grind with a carborundum stone or an abrasive of suitable quality to remove all form marks and to remove surface film resulting from form treatment or laitance. Then, finish surface by floating with a canvas, carpet faced or cork float, using paste formed by grinding or additional paste of fine sand and cement, to fill all air holes and voids and bring surface to a smooth and uniform texture. Keep surface damp until finish has set so that dusting will not occur when surface is rubbed. Complete the finish work within six days following placement of concrete except for those areas where it is structurally impossible to remove forms. Finish these areas as soon as forms are removed.

4. **Class 2 Surface Finish**. Prepare surface as for a Class 1 Surface finish. After paste has been allowed to set for at least 24 hours, saturate surface thoroughly with water and paint, while damp, with a latex emulsion paint as specified. Clean surface thoroughly before painting. Apply a minimum of two coats of paint, with additional coats as necessary to provide uniformity in coverage and appearance, Second coat may be applied when previous coat is sufficiently dry so that it does not adhere to backs of fingers when touched lightly, Do not apply latex emulsion point until concrete being finished has reached a minimum age of seven days.

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5. **Brush Finish**. Finish upper horizontal surfaces such as tops of parapets, copings, and bridge seats by placing an excess of concrete in forms and removing or striking off such excess with a wooden template and forcing coarse aggregate below mortar surface. The use of mortar topping for surfaces falling under this classification will not per permitted.

6. **Float Finish**. In lieu of a brush finish, finish surface with a rough carpet or wood float, leaving surface even and free of voids, but distinctly sandy or pebbled in texture.

602.3.13C Slab Finishes

1. **General**. Refrain from excessive use of "Jitterbugs" or other special tools designed for the purpose of forcing coarse aggregate away from slab surface. Dusting of surfaces with dry materials will not be permitted. Compact slabs and floors thoroughly by vibration. Round off edges of slabs and tops of walls with a ½-inch radius steel edging tool, unless specified otherwise.

2. **Monolithic Finish**. Finish by screeding and floating with straightedges to bring surfaces to the required finish elevation shown. While concrete is still green, but sufficiently hardened to bear man's weight without deep imprint, wood float to a true, even plane with no coarse aggregate visible. Apply sufficient pressure on wood floats to bring moisture to surface. After surface moisture has disappeared, steel trowel concrete to produce a smooth, impervious surface, free form trowel marks. Give an additional troweling to surface for the purpose of burnishing. Final troweling shall produce a ringing sound from the trowel. Do not use dry cement or additional water in troweling. Do not use excessive troweling.

3. **Rough Slab Finish**. Finish slabs to receive fill and mortar settings beds by screeding with straightedges to bring surface to required finish plane. Remove all laitance and leave surface clean. Subject to approval, an acceptable aggregate revealing material may be used and laitance washed off when concrete has set.

4. **Wood Float Finish**. Finish by screeding with straightedges to bring surface to required line shown. While concrete is still green, but hardened sufficiently to bear cement finisher's weight, work float surface to a true and uniform plane with no coarse aggregate visible.

5. **Broomed Floor Finish.** Finish concrete as specified for monolithic floor finish above, except omit final troweling and finish surface by drawing a fine-hair broom lightly across surface. Do all brooming in same direction and parallel to expansion joints or in cases of inclined slabs, perpendicular to slope, except for reservoir roof slab, broom surface in radial direction.

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6. **Power Machine Finish**. In lieu of hand finishing, an approved power machine may be used for finishing concrete floors and slabs in conformance with directions of machine manufacturer and as approved.

7. **Bridge Roadway Finish**. After concrete is placed and compacted, strike it true to lines, grades, and cross section shown. Then, float to a smooth, even texture. Quality of workmanship shall be such that the finished work, when tested with a 10–foot straightedge, shows no deviation greater than 1/8-inch from required grade and cross section. After concrete has struck and floated to grade and cross section and hardened sufficiently, give it a broom finish. Use a broom, with a stiff fiber or a steel-tined broom that will mark finished concrete to a depth of not to exceed 1/8-inch. Make markings of corrugations transverse to roadway center line and full roadway width, except for strips 16 inches wide along curb faces; mark these parallel to curb faces.

8. **Bridge Sidewalk Finish**. Strike off surface true to line and grade by means of a strike board and float with a wooden or cork float. Use and edging tool on all edges and at all expansion joints. Do not allow surface to vary more than 1/8-inch under a 10-foot straightedge, Broom surface at right angles to direction of traffic. Lay out sidewalk surfaces in blocks with an approved grooving tool shown or as directed.

602.3.14 CURING

Cure concrete surfaces by covering with material conforming to Subsection 602.2.05. Place covering as soon as concrete has hardened sufficiently to support covering without damage. Use a covering which is best suited to existing conditions. If such coverings are not required, keep surfaces moist by flushing or sprinkling. Arrange sprinkling system so outside of all forms can be kept damp for a period of seven days after placing of concrete so that no moisture is taken away from concrete by forms. Coordinate curing and finishing when both requirements are to be met at same time.

Protect slab concrete exposed to conditions causing premature drying during placing operations by providing wind breaks, fog spray, or by other approved methods.

602.3.15 PNEUMATICALLY APPLIED MORTAR

602.3.15A General

This Subsection refers to a dry mix method of pre-mixed sand and cement pneumatically applied by suitable mechanism and competent operators, and to which mixture water is added immediately previous to its expulsion from the nozzle.

602.3.15B Proportion and Application

Use the following proportions of cement to sand based on dry and loose volumes: 1 to 4 or encasement of steel members, 1 to 3 for concrete repair, and unless specified

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otherwise, 1 to 4½ for special linings. Apply a mortar with a minimum test cylinder strength of 3500 psi, unless otherwise specified.

Maintain water content at a minimum for proper placement, and do not exceed 3 gallons per sack of cement as placed.

Use sand containing not less than 3 nor more than 6 percent moisture by weight. Mix cement and sand thoroughly before charging into the machine. Maintain a uniform velocity of material as it leaves the nozzle at a rate determined by job conditions to produce minimum rebound. Hold nozzle in such a position and at such distance that stream of flowing material will impinge at approximately right angles to surface being covered without excessive impact. Remove rebound or accumulated loose sand from surface to be covered prior to placing original or succeeding layers of mortar.

602.3.15C Joints

Slope off pneumatically applied mortar to a thin edge at the end of any day's work or at similar stopping periods. Before placing an adjacent section, clean and wet this sloped portion thoroughly.

602.3.15D Bond

For surfaces to which pneumatically applied mortar is to be bonded, clean thoroughly of dirt, paint, grease, organic matter, and loose particles. Wet absorptive surfaces before application of mortar.

602.3.15E Curing

For pneumatically applied mortar, apply, protect, and cure to prevent its temperature from falling below 50 degrees Fahrenheit, or a loss of moisture from the surface for periods of seven days where normal Portland Cement is used, or three days where high early-strength Portland Cement is used. Conform to requirements for curing hereinbefore or as specified.

602.4.00 MEASUREMENT AND PAYMENT

602.4.01 CONCRETE

Concrete will be measured on a lump sum basis or on a cubic yard basis for payment as shown in the Proposal. In all cases the part or parts of work to be measured on each basis shall be as shown and as specified.

When reinforcing steel, metal expansion plates, or miscellaneous metal items are not specified or shown as a separate pay item in the Proposal, payment for said item is considered to be incidental to the related item of work and no separate payment will be made.

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602.4.01A Lump Sum Basis

Measurement and payment will be made on a lump sum basis as shown in the Proposal.

602.4.01B Cubic Yard Basis

Measurement and payment will be made on a cubic yard basis for each class of concrete as shown in the Proposal.

602.4.02 PNEUMATICALLY APPLIED MORTAR

Measurement and payment for pneumatically applied mortar will be made on a square foot basis for the actual number of square feet placed and accepted.

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603 Reinforcement

603.1.00 DESCRIPTION

This Section covers work necessary for reinforcing steel, welded wire fabric, dowels, and accessories, for concrete structures, complete.

603.2.00 MATERIALS

603.2.01 BAR REINFORCEMENT

Use steel deformed bars conforming to ASTM A 615, Grade 40, unless otherwise shown, except that longitudinal bars in continuously reinforced concrete pavement and high strength bar reinforcement shall be Grade 60.

603.2.02 DOWELS

For concrete pavement, slab, or wall load transfer devices at joints and other elements, use dowels conforming to ASTM A 306, Grade 70 unless otherwise specified. Coat with plastic or other approved material for bond prevention where specified.

603.2.03 BAR MATS

For bar and rod mats, use the clipped type, conforming to ASTM A 184.

603.2.04 SPIRAL REINFORCEMENT

Use plain wire for spiral reinforcement conforming to ASTM A 82, except that f^y shall be the stress corresponding to a strain of 0.35 percent if design yield strength exceeds 60,000 psi.

603.2.05 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185.

603.2.06 TIES AND SUPPORTS

Use ties of 16-gauge, black, soft-annealed wire and bar supports approved by Engineer for intended use. Bar supports in beams and slabs exposed to view after stripping must be galvanized or plastic coated. Use concrete supports for reinforcing in concrete placed on grade. Galvanizing shall conform to ASTM A 153 Class D. Plastic shall not chemically react with concrete, shall be impervious and a minimum thickness of 3/32 inches at point of contact with form.

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603.2.07 CERTIFICATION AND IDENTIFICATION

Furnish certification that reinforcing bars identified and delivered to project site are as specified. For identification and tagging, include copies of heat numbers, chemical compositions, and physical test performed on that heat.

603.3.00 CONSTRUCTION

603.3.01 SHOP DRAWINGS

Prior to fabrication and before ordering material, submit all Order Lists and bending diagrams for approval. Such approval by Engineer in no way relieves Contractor of responsibility for correctness of lists and bending diagrams. Any expense incident to the revision of material furnished in accordance with such lists and bending diagrams in compliance with Plans, shall be borne by Contractor.

603.3.02 FABRICATION

Fabricate, ship, tag, and mark bar reinforcement in conformance with Manual of Standard Practice for Reinforced Concrete Construction of the Western Concrete Reinforcing Steel Institute.

Bend all bars cold.

603.3.03 DELIVERY AND STORAGE

Deliver steel reinforcement with suitable hauling and handling equipment. Protect at all times from injury. Keep free from dirt, detrimental rust or scale, paint, oil, or other foreign substance.

603.3.04 PLACING

Place all steel reinforcement accurately in positions shown on Plans and hold firmly during placing and setting of concrete. For bars in top mats of footings and deck slabs, tie at all intersections. For all other bars, tie at all intersections except where spacing is less than 1 foot in each direction, tie alternate intersections.

Maintain distance from forms by means of stays, block, ties, hangers, or other approved supports. For blocks for holding reinforcement from contact with the forms, use precast mortar of approved shape and dimensions and with same compressive strength as concrete in which they are placed. For metal chairs in contact with exterior surface of concrete, fabricate from stainless steel conforming to ASTM A 493, Type 430. Turn legs of chairs up a minimum of ⅛-inch. Separate layers of bars by precast mortar blocks or by other equally suitable devices. The use of pebbles, pieces of broken stone or brick, metal pipe, and wooden block will not be permitted. Reinforcement in any member shall be placed and then inspected and approved by

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Engineer before placing of concrete begins. Concrete placed in violation of this provision may be rejected and removal required.

If fabric reinforcement is shipped in rolls, straighten it into flat sheets before placing it. For fabric reinforcement, extend fabric to within 2 inches of edges of slab, and lap splices at least 1 ½ courses of fabric with a minimum of 6 inches. Tie laps and splices in fabric securely at ends and at least every 24 inches.

603.3.05 SPLICING

Furnish all reinforcement in the full lengths indicated on Plans. Splicing of bars, except when shown on Plans, will not be permitted without written approval of Engineer. Stagger splices as far as possible.

For No. 11 bars and smaller, lap splice as shown on Plans. In lapped splices, place bars in contact and wire together in such a manner as to maintain not less than the minimum clearance to the surface of concrete as shown on Plans.

Lap splicing of No. 14 and No. 18 bars will not be permitted. Splice these sizes in conformance with the following:

(a) Splice shall develop at least the specified minimum ultimate strength of reinforcing bars in compression and in tension. Where bars of different sizes or strengths are connected, the governing strength shall be the strength of the smaller or weaker bar.

(b) Make splices by an approved mechanical butt splicing method utilizing a ferrous filler metal and an enclosing steel sleeve. Submit method to Engineer for approval prior to making splices. Completed splices will be subject to testing at no expense to Owner.

603.4.00 MEASUREMENT AND PAYMENT

603.4.01 INCIDENTAL BASIS

When not specified or shown as a separate pay item in the Proposal, payment for reinforcement is considered to be incidental to related item of concrete work and no separate payment will be made.

Reinforcement in precast or prestressed beams, slabs, piles, and other items, where reinforcement is specified and included in the Contract price for other pay items, will not be included in the pay item for reinforcement.

603.4.02 LUMP SUM BASIS

Measurement and payment for reinforcement will be made on a lump sum basis as shown in Proposal.

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603.4.03 UNIT PRICE BASIS

Measurement and payment for reinforcement will be made on a unit price per pound basis as shown in the Proposal.

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604 Prestressed Concrete Members

604.1.00 DESCRIPTION

This Section covers the work necessary for manufacture, transportation, and storage of beams, slabs, or other structural concrete members, prestressed by either pre-tensioning or post-tensioning methods and installation of all precast-prestressed members.

604.2.00 MATERIALS

604.2.01 SEVEN-WIRE STRAND

Seven-wire strand (bright wire) shall conform to ASTM A 416, Grade 270, minimum ultimate strength of 270,000 psi.

604.2.02 HIGH-TENSILE-STRENGTH WIRE

High-tensile-strength wire shall conform to ASTM A 421, minimum ultimate strength of 240,000 psi.

604.2.03 ALLOY STEEL BARS

Alloy steel bars shall conform to ASTM A 322.

During their manufacture, bars shall be proof stressed to their minimum yield strength and then stress-relived to meet the following requirements:

1. Minimum ultimate tensile strength—145,000 psi for smooth and 160,000 psi for deformed;

2. Minimum yield strength of 0.7 percent extension—130,000 psi for smooth and 136,000 psi for deformed;

3. Minimum elongation in 20 diameters after rupture—4.0 percent;

4. Minimum reduction of are after rupture—20 percent (for smooth bars only).

604.3.00 CONSTRUCTION

604.3.01 SHOP DRAWINGS

Before casting any member to be prestressed, submit for approval all design calculations and shop drawings outlining method and sequence of stressing, prestressing steel and anchoring devices, working stresses, anchoring stresses, type of ducts, pressure grouting, and any additional data retaining to the prestressing operation.

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604.3.02 SUPERVISION

Unless specifically excused by the Engineer, provide a technician, skilled in the use of the system of prestressing to be used, who shall supervise the work and give Engineer such assistance as he/she may desire.

604.3.03 EQUIPMENT

Do prestressing with approved jacking equipment. If hydraulic jacks are used, equip them with accurately reading pressure gauges. Combination of jack and gauge shall be calibrated and a graph or table showing calibration shall be furnished. Should other types of jacks be used, furnish calibration proving rings or other devices so that jacking forces may be accurately know. Recalibration will be required annually or at time it appears equipment is producing erratic results.

604.3.04 CONCRETE

Control, mix, and handle concrete as follows:

1. Proportion concrete mix to obtain the strength specified. Use aggregate of a maximum size consistent to making concrete with good placing qualities. In general, ¼-inch to 1-inch aggregate will be required.

2. Do not deposit concrete in forms until placing of reinforcement, conduits, anchorages, and prestressing steel has been inspected and approved.

3. Vibrate concrete internally or externally, or both, as directed. Vibrate with care and in such a manner as to avoid displacement of reinforcing, conduits or wires.

604.3.05 STEEL PROTECTION

Protect prestressing steel against physical damage and corrosion at all times. Prestressing steel that has sustained physical damage at any time will be rejected. An approved corrosion inhibitor may be used. Clean all ducts free from accumulated water at time of placing prestressing steel. In the event of a delay of seven calendar days or more between time of placing and time of grouting prestressing steel, Engineer may require Contractor to withdraw prestressing steel for inspection and all prestressing steel that has sustained corrosion damage shall be replaced at no expense to Owner.

Do not make any welds or grounds for welding equipment on the forms or on the steel in the member after prestressing steel has been installed.

604.3.06 PRETENSIONING

Hold prestressing elements accurately in position and stress them by jacks. Keep a record of jacking force and elongations produced thereby. Do not transfer bond stress to concrete, nor

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release end anchors, until concrete has attained a compressive strength of at least the minimum designated for such transfer of load. Cut or release elements in such an order that lateral eccentricity of pre-stress will be a minimum. Cut back pre-stress strands at least ½-inch from face of concrete and point up resultant holes flush with beam end with mortar, except that strand ends that are to be covered by cast-in-place concrete in completed structure need not be cut back.

Determine compressive strength of the concrete to establish time for detensioning by testing standard cylinders cast and cured identically with beam or unit. Cast and test cylinders in conformance with AASHTO T 23 and T 22, respectively. Do not detension until so authorized.

604.3.07 POST-TENSIONING

604.3.07A Anchorages

Secure all post-tensioned pre-stressing steel at ends by means of approved permanent type anchoring devices. All anchoring devices for post-tensioning must hold pre-stressing steel at a load producing a stress of not less than 95 percent of guaranteed minimum tensile strength of pre-stressing steel.

Anchoring devices shall conform to the following:

1. Final unit compressive stress on concrete directly underneath plate or assembly shall not exceed 3,000 psi.

2. Bending stresses in plates or assemblies induced by applied force shall not exceed yield point of material or cause visible distortion in anchorage plate, as determined by Engineer, when 100 percent of ultimate load is applied.

Recess anchorage assemblies so that upon completion of structure, all parts have at least2 inches of concrete cover, unless a greater embedment is shown.

604.3.07B Ducts

All ducts for post-tensioned structures must consist of rigid galvanized ferrous metal, be mortar-tight and be accurately placed. Transition couplings connecting said rigid ducts to anchoring devices need not be galvanized.

Fabricate rigid ducts with either welded or interlocking seams. Galvanizing of welded seam will not be required. Rigid ducts shall have sufficient strength to maintain their correct alignment during placing of concrete. Joints between sections of rigid duct must be positive metallic connections which are mortar-tight and do not result in angle changes at joints. Use waterproof tape at connections.

All ducts must have vents with ±3 feet of high points, and at any additional locations shown. Make vents ½-inch minimum diameter standard pipe. Connect to ducts with metallic structural fasteners. Make vents mortar-tight, taped as necessary, and provide

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means for injecting grout through vents and for sealing vents. Remove ends of vents after grouting to provide 1 inch of cover to nearest concrete surface. Fasten ducts and vents securely in place t prevent movement

Repair all holes or openings in ducts large enough to let grout out, or concrete in, prior to placing concrete. Repair holes less than ¼-inch with waterproof tape and holes large than ¼ inch with a split metal sleeve which overlaps itself by 3 inches, extends at least 3 inches on either side of hole, is sealed with waterproof tape, and secured to duct. Cut out indentions which cannot be repaired and repair as above for holes larger than ¼-inch.

After installation in forms, cover ends of ducts at all times as necessary to prevent entry of moisture or debris.

Prior to placing forms for closing slabs of box girder cells, demonstrate to satisfaction of Engineer that all ducts are unobstructed.

604.3.07C Prestressing

Tension prestressing steel by means of hydraulic jacks so that force in prestressing steel is not less than value shown.

Do not prestress members until at least 14 days (exclusive of days on which temperature drops below 40 degrees Fahrenheit for a total period of eight hours or more) after the last concrete has been placed in member and not until compressive strength of said concrete has reached strength specified.

Equip each tendon stressing jack with either a pressure gauge or a load cell for determining jacking stress, at option of Contractor. Pressure gauge, if used, shall have an accurate reading dial at least 6 inches in diameter and a capacity such that final pressure reading is in upper half of its range. Each jack and its gauge shall be calibrated as a unit with cylinder extension in the approximate position that it will be at final jacking force, and be accompanied by a certified calibration chart, Load cell, if used, shall be calibrated and provided with an indicator by means of which prestressing force in tendon may be determined, Range of load cell must be such that lower 10 percent of manufacturer's rated capacity will not be used in determining jacking stress, Adjustment or repair of jacks or gauges subsequent to certification is cause for rejection.

Conduct tensioning process so that tension being applied and elongation of prestressing steel may be measured at all times. Keep a record of gauge pressures and elongations.

Tension prestressing tendons in continuous post-tensioned members may be tensioned by jacking from one end only. When tensioning is done from one end only, tension half of prestressing steel in each member from one end of span and the other half from opposite end unless otherwise permitted in writing.

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604.3.07D Bonding and Grouting

Bond prestressing steel to concrete by filling void space between duct and tendon with grout. Commence grouting prior to a maximum of seven calendar days after a tendon has been stressed.

Grout shall consist of Type II Portland Cement and water. An approved expansive admixture may be required at option of Engineer. Admixture must contain an expansive agent which will provide between 5 and 10 percent unrestrained expansion when used in quantity recommended by manufacturer, and shall not contain chlorides as C1 in excess of 0.25 percent by weight of admixture.

Use potable water in grout which is clean and free of injurious quantities of substances known to be harmful to Portland Cement or prestressing steel. Batch all materials with accessory equipment which will provide for accurate solid and liquid measures. Use mechanical mixing equipment of a type that will produce uniform and thoroughly mixed grout. Do not use more than 5 gallons of water per sack of cement. Re-tempering of grout will not be permitted. Agitate grout continuously until it is pumped.

Employ grouting equipment capable of grouting at a pressure of 150 psig and furnished with a pressure gauge having a full scale reading of not more than 300 psi. It shall contain a relief valve which will limit grouting pressures to safe values.

If actual grouting pressure exceeds maximum recommended pumping pressure, grout may be injected at any vent which has been, or is ready to be capped as long as a one-way flow of grout is maintained. If this procedure is used, fit the vent which is to be used for injection with a mechanical shut-off valve.

Whenever grout pumping pressure exceeds 150 psig and one-way flow of grout cannot be maintained as outlined above, flush grout out of duct with water immediately. Under no circumstances shall the pumping pressure at duct inlet exceed 250 psig.

Pump grout through duct and waste continuously at outlet pipe until: (1) no visible slugs of water or air are ejected and (2) efflux time of ejected grout is not less than 11 seconds. The, cap outlet pipe (or close valve) and maintain the pumping pressure of 60 psig, whichever is greater, for at least 30 seconds. Then, close valve at injection pipe (or vent being used for injection) while maintaining this pressure. Do not remove valves and caps or open until grout has set.

In temperatures below 32 degrees Fahrenheit, keep ducts free of water to avoid damage due to freezing. Temperature of concrete must be 35 degrees Fahrenheit or higher from time of grouting until job cured 2-inch cubes of grout reach a minimum compressive strength of 800 psi.

Do not allow grout to be above 90 degrees Fahrenheit during mixing or pumping. If necessary, cool mixing water. Following grouting, fill all grouting and anchorage recesses with concrete and finish flush.

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604.3.08 STEAM CURING

Steam cure under an approved enclosure to contain live steam in order to minimize moisture and heat loss. Maintain steam at 100 percent relative humidity to prevent loss of moisture and to provide excess moisture for proper hydration of cement. Do not apply steam directly on the concrete.

Make initial application of steam from two to four hours after final placement of concrete to allow initial set of concrete to take place. During application of steam, insure that ambient temperature within enclosure increases at a rate not to exceed 40 degrees Fahrenheit per hour until a maximum temperature of from 140 degrees Fahrenheit to 160 degrees Fahrenheit is reached. Hold maximum temperature until concrete has reached desired strength. In discontinuing the steam, do not decrease temperature within the enclosure more than 40 degrees Fahrenheit per hour until a temperature has been reached about 20 degrees Fahrenheit above temperature of air to which concrete will be exposed. Do not expose concrete to temperatures below freezing for six days after casting.

Equip steam supply line to enclosure with a motor-operated modulating steam control valve operated by a temperature-sensing element located in the enclosure such that it will measure temperature within enclosure. Distribute steam within not less than 30-foot centers, or closer if necessary to keep units being cured completely and uniformly surrounded with live steam. Equip enclosure with a recording thermometer.

604.3.09 TRANSPORTATION AND STORAGE

Transport precast girders in an upright position, and maintain points of support and directions of reactions with respect to girder approximately the same during transportation and storage as when girder is in its final position.

604.4.00 MEASUREMENT AND PAYMENT

604.4.01 INCIDENTAL BASIS

When prestressed concrete members are specified as a component of a structure and payment therefor is not specified to be made as otherwise provided for herein, prestressed concrete components will be considered as incidental to and payment included in payment for such structure as specified and provided for in the Proposal.

604.4.02 UNIT PRICE BASIS

Measurement and payment for prestressed concrete members will be made on a unit price per member basis as shown in the Proposal for precast prestressed concrete member of the specified types and sizes installed and accepted.

604.4.03 LUMP SUM BASIS

Measurement and payment for prestressed concrete member will be made on a lump sum basis as shown in the Proposal.

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605 Steel Structures

605.1.00 DESCRIPTION

This Section covers work necessary for structural steel, complete, and includes all metal parts required for permanent connection of component parts of structural steel.

605.2.00 MATERIALS

605.2.01 CARBON STEEL

Structural carbon steel shall conform to ASTM A 36. Class of carbon steel must, if required, be marked at the mill.

605.2.02 OTHER STEEL

For structural steel other than ASTM A 36, conform to Special Specifications.

605.2.03 BOLTS, NUTS, AND WASHERS

605.2.03A Unfinished

Unfinished bolts (ordinary machine bolts), nuts, and washers shall conform to ASTM A 307, Grade A unless otherwise specified.

605.2.03B High-strength

High-strength bolts, nuts, and washers shall conform to ASTM A 325.

605.2.04 RIVETS

Structural rivet steel shall conform to ASTM A 502, Grade 1. High-strength structural rivet steel shall conform to ASTM A 502, Grade 2.

605.2.05 MILL TEST REPORTS

Provide three certified copies of mill test reports of all steel to be used in the work for approval before any fabrication is started on material to be used on the work.

605.3.00 CONSTRUCTION

605.3.01 SHOP DRAWINGS

Submit shop drawings to Engineer for approval prior to fabrication.

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605.3.02 WORKMANSHIP AND FINISH

Provide workmanship and finish equal to the best general practice in modern fabrication shops. Use materials that are new and free from defects and of best commercial quality for purposes intended. Do not make or enlarge holes for rivets or bolts by flame cutting. Provide openings in members to permit connecting work of other trades who will furnish the necessary templates or such information as may be required. Fabricate framing to exact dimensions. The practice of flame cutting by hand to make incorrect framing fit together will not be acceptable.

605.3.03 STRAIGHTENING BENT MATERIAL

Straighten bent or distorted plates, angles, and other shapes or built up members by approved methods that will not produce fracture or other physical or metallurgical damage. Obtain Engineer's approval for each straightening application. Make parts to be heat straightened substantially free of stress and from external forces, except stresses resulting from mechanical means used in conjunction with application of heat. Following straightening of a bend or buckle, inspect metal carefully. Any evidence of fracture is cause for rejection.

605.3.04 OXYGEN CUTTING

Steel may be flame-cut, provided a smooth surface free from cracks and notches is secured, and provided that an accurate profile is secured by use of a mechanical guide. Do not flame cut by hand unless approved by Engineer. When flame cutting is approved, make surface smooth by planning, chipping, or grinding and adjust and manipulate cutting flame so as to avoid cutting beyond prescribed lines. Fillet re-entrant cuts to a radius of not less than ¾ inch. Flame-cut surfaces shall meet the ANSI surface roughness rating value of 800. Remove notches less than ¼-inch deep by planning, chipping, or grinding when permitted by Engineer. Engineer's specific approval must be obtained for correction of each type of member. Flare corrections from notches on a bevel of 1 to 24 or less with surface of cut.

Preheat members to be cut to a minimum temperature of 200 degrees Fahrenheit to prevent edge cracks. Allow sufficient additional width to permit planning, chipping, or grinding to remove rough, burned, cracked, or otherwise defective edges. Grind corners at flame-cut edges to a radius of at least 1/16-inch and remove any evidence of edge cracking by planning, chipping, or grinding to a depth not exceeding ¼-inch.

605.3.05 EDGE FINISHING

Plane sheared edges of material more than 5/8-inch in thickness to a depth of not less than 1/8-inch when so required. Make all sheared and flame-cut edges true to line and free from rough corners or projections. When required, grind all such edges to remove objectionable defects. Fillet re-entrant cuts as large as practicable, but never less than ¾-inch radius, except when otherwise shown. Cut gusset plates with curved edges to exact radius shown and grind to remove any rough corners.

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605.3.06 PLANING BEARING SURFACES

Mill or saw column ends bearing upon base and cap plates to true surfaces and correct bevels. Assemble caps and baseplates of columns for full contact. For warped or deformed plates, hot-straighten, plane or otherwise treat to secure an accurate and uniform contact. Correspondingly, surfaces of baseplates which are to come in contact with masonry must be rough-finished and free from warp or other deformations.

605.3.07 ABUTTING JOINTS

Face abutting ends of compression members accurately to secure an even bearing when assembled in the structure. Face or mill ends of built-up members after they have been fabricated. Rough-finish ends of tension members at splices to secure close and neat but not necessarily to contact fitting joints.

605.3.08 END CONNECTION ANGLES

Make end connection angles flush with each other and set accurately as to position and length of member. In general, do not finish end connection angles unless required. Faulty assembling, however, may be cause for requiring surfaces to be milled, in which case their thickness must be reduced not to exceed 1/16-inch.

605.3.09 RIVET AND BOLT HOLES

605.3.09A General

For all connections of main members and nay other members indicated on the Plans, subpunch and ream or drill holes. This requirement does not apply to holes in lateral bracing, portals, sway bracing, and other secondary members, nor to their connections to main members. For holes where reaming is not required, material ¾-inch or less in thickness may be punched full size. Subpunch and ream, or drill all holes in steel more than ¾-inch in thickness. Unless shown otherwise, make holes 1/16-inch larger than nominal bolt diameter, except holes for anchor bolts must be 1/8-inch larger.

605.3.09B Punched Holes

Diameter of die must not exceed diameter of punch by more than 3/32-inch. Clean-cut holes without torn or ragged edges. Ream any holes which must be enlarged to admit bolts.

Punch holes so accurately that, after assembling component parts of a member, a cylindrical pin ⅛-inch smaller than the nominal diameter of punched holes may be passed through at least 75 of any group of 100 contiguous holes in the same surface, or in like proportion for any group of holes. If this requirement is not fulfilled, badly punched pieces will be rejected. If any holes will not pass a pin 3/16-inch smaller than nominal diameter of the punched hole, it will be cause for rejection.

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605.3.09D Drilled and Reamed Holes

Ream bolt holes with twist drills or with short taper reamers. Do not direct reamers by hand. Do not use oil or grease as lubricant.

Remove burrs with a tool producing a 1/16-inch fillet around edge of hole.

Drill or ream holes in a completed member only after its component parts are assembled and firmly bolted together. No interchange or reamed parts will be permitted. Holes through assembled material shall not consist of both subpunched or subdrilled holes, and holes punched or drilled full-size.

Ream or drill holes cylindrical and perpendicular to member. Accuracy shall be the same as specified for punched holes except that, after reaming or drilling, 85 percent of any group of contiguous holes shall not show an offset greater than 1/32-inch between adjacent thicknesses of metal.

605.3.10 ASSEMBLING

Assemble parts accurately as shown and follow any matchmarks. Handle material carefully so than no parts will be bent, broken, or otherwise damaged. Do no hammering which will injure or distort the members. During assembly, drift holes only to bring parts into position. Do not drift to enlarge holes or distort metal. Ream any holes to be enlarged to admit rivets or bolts. For end connection angles, stiffeners, and similar parts, hold firmly in place until welded, bolted, or riveted. For bearing surfaces and surfaces to be in permanent contact, clean off rust, loose mill scale, oil, and all other foreign substances before members are assembled. Surfaces that will be in contact when shop assembled need not be painted, unless specified otherwise.

Assemble field connections of main members, such as trusses, plate girders, or rigid frames, in shop with milled ends of compression members in full bearing. Then ream their subsize holes to specified size while connections are assembled.

605.3.11 BOLTED CONNECTIONS

605.3.11A General

Use bolted connections only as shown. Use standard nuts for bolts and insure that washers under nut, or bolt head, are turned in tightening. Use beveled washers where bearing faces have a slope of more than 1:20 with respect to a plane normal to bolt axis.

605.3.11B High-strength Bolts

For all high-strength bolts, conform installation and inspection to ASTM A 325.

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605.3.12 WELDING

605.3.12A General

Insure that all shop and field welding conforms to American Welding Society standards for the type of welding being done, except for bridge structures which shall conform to AASHTO Standard Specifications for Highway Bridges. Use welders certified by the Owner under AWS standards for the type of welding being done. All shop and field welding including technique of welding employed, appearance and quality of welds made, and methods of correcting defective work shall conform to Structural Welding Code, AWS D1.1.

605.3.12B Workmanship

Remove all loose scale, rust, grease, paint, and other foreign material from surfaces to be welded, except that mill scale which will withstand vigorous wire brushing may remain. Do not weld when temperature of base metal is lower than zero degrees Fahrenheit. Make finished members true to line and free from twists.

For edges and ends of pieces to be joined by other than field welding, bevel, groove, or otherwise prepare by grinding or gas-cutting method, as shown.

Take every effort and precaution and use methods in making continuous welds to avoid distortion of member due to welding operation.

Unless otherwise approved on basis of results obtained through use of automatic equipment, make continuous welds of intermittent welds spaced to prevent excessive heating of metal and joined into a continuous weld by filling in between intermittent welds with short welds.

Make welds solid and homogeneously a part of metals joined and free from pits or incorporated slag or scale. Remove weld spatter from adjacent areas. Make surfaces of welds uniform and regular and the full area indicated or required to develop necessary strength of joint.

605.3.12C Inspection

Welds that are required to be corrected must be corrected or redone as directed at no expense to Owner.

605.3.13 ERECTING STEEL

605.3.13A General

Erect metal work, provide all tools, machinery, falsework, and appliances necessary for expeditious handling of work, remove temporary construction, and do all work required to complete erection.

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605.3.13B Falsework

Design falsework properly and construct and maintain for the loads which will come upon it. If required, prepare and submit for approval Plans for falsework or for changes in an existing structure necessary for maintaining it in use.

605.3.13C Misfits

Do not correct any misfit without the approval of Engineer. Be fully responsible for all misfits resulting from errors in shop fabrication or deformation resulting from handling and transportation, and make all necessary corrections in presence of Engineer. In the opinion of Engineer, when adequate corrections cannot be made, then supply replacement members when ordered by Engineer, and at no expense to Owner.

605.3.14 SURFACE PREPARATION AND PAINTING

605.3.14A General

Surface preparation and painting shall conform to ***Section 609 Painting, Galvanizing, and Surface Treatment***, except as modified herein.

605.3.14B Sandblasting

After fabrication has been completed and immediately before first or shop coat of paint is applied, clean all structural steel by sandblasting. Perform sandblast cleaning by commercial methods in strict accordance with Steel Structures Painting Council Surface Preparation Specification No. 6 for Commercial Blast Cleaning.

Remove all rust, mill scale, dirt, oil, grease, and other foreign substance. Resultant steel surface shall be free from all red or yellow iron rust. Small stained areas may, with approval be left in place. After cleaning, remove all loose dust and dirt remaining on the steel before paint is applied.

605.3.14C Shop Priming

After cleaning thoroughly by sand blasting as provided for above, paint all structural steel within eight hours of sandblasting with one shop coat of primer as specified. After erection is completed, clean all holidays and damaged areas of the prime coat thoroughly and re-prime with paint similar to shop coat, and give a minimum of one field coat, unless otherwise specified.

For surfaces not in contact but inaccessible after assembly or erection, paint with two coats of primer. Do not paint shop contact surfaces. Paint field contact surfaces with a shop coat of paint, except for material where a shop coat of paint would make erection difficult. Give field contact surfaces not painted with shop coat a temporary coat of approved lacquer or other protective coating if it is expected that there will be a

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prolonged period of exposure before erection. Remove temporary lacquer coat prior to assembly when directed.

Do not paint surfaces which will be in contact with concrete or structural steel which is to be welded before welding is complete. If structural steel is to be welded only in fabricating shop and subsequently erected by bolting, paint with one coat of paint after shop welding is finished and all slag and flux is removed. Give surfaces of iron and steel castings either milled or finished, one coat of paint.

With the exception of abutting joints and baseplates, coat machine-finished surfaces as soon as practicable after being accepted, with a hot mixture of white lead and tallow or other approved coating before removal from shop.

Paint erection marks for field identification of members and weight marks upon surface areas previously painted with shop coat. Do not load material for shipment until it has thoroughly dried, and in any case not less than 24 hours after paint has been applied.

605.4.00 MEASUREMENT AND PAYMENT

605.4.01 LUMP SUM BASIS

Measurement and payment for structural steel will be made on a lump sum basis as shown in the Proposal.

605.4.02 UNIT PRICE BASIS

Measurement and payment for structural steel will be made on a unit price basis as shown in the Proposal.

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606 Timber Structures

606.1.00 DESCRIPTION

This Section covers work necessary for furnishing and placing timber in structures including all castings, hardware, fastenings of all types, preservative treatment, and all other items necessary for completed work. When preservative treatment of timber is required, type and kind of treatment will be shown or specified.

606.2.00 MATERIALS

606.2.01 LUMBER

Unless otherwise shown or specified, use S4S Douglas Fir with grading requirements as specified. Moisture content of lumber shall not exceed 19 percent unless otherwise specified. All lumber must be grade stamped by an American Lumber Standards certified inspection agency.

606.2.02 GLUED LAMINATED TIMBER MEMBERS

Use Douglas Fir or Western Larch, unless otherwise specified, and off stress grade shown.

Manufacture of structural glued laminated work shall conform to American Institute of Timber Construction (AITC) Timber Construction Standards. Quality control must be provided in accordance with AITC Inspection Manual for Structural Glued Laminated Lumber. Adhesives shall meet glued laminated lumber standards and be waterproof. Appearance grade of members shall be defined in AITC Timber Construction Standards and be as specified. A coat of end sealer shall be applied to ends of all members as soon as practicable after end trimming in accordance with AITC Protection Standards. Materials used as sealer must be clear and render beam compatible to creosote stain. Members must be bundle wrapped in accordance with AITC Protection Standards. Shop details must be furnished by fabricator and approved before fabrication is commenced. Details shall conform to current AITC Timber Construction Standards.

606.2.03 CONNECTORS AND FASTENERS

Use connectors conforming to AITC Timber Construction Manual, with types and sizes as shown except bolts, nuts, nails, and miscellaneous hardware must conform to National Design Specification for Stress Grade Lumber it its fastenings by National Forest Products, with sizes as shown.

Galvanize all connectors for treated timber structures, except those of malleable iron, in accordance with ASTM A 123. Galvanize all rough hardware, drive pins, expansion bolts, clamps, washers, anchors, joist hangers, bolts and nuts, lag screws, and miscellaneous connectors in accordance with ASTM A 153.

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606.2.04 WOOD PRESERVATIVES

Conform to current Architect's and Engineer's Guide Specifications to pressure treatment of western woods prepared by Western Wood Preservers Institute, Portland, Oregon. Type of preservative, method, retention, and use is as specified or shown on the Plans.

606.3.00 CONSTRUCTION

606.3.01 TIMBER CONNECTORS

Install in conformance with AITC Timber Construction Manual. Fabricate all structures prior to application of preservatives and pressure treatment. After fabrication, store timber in a manner which will prevent changes in dimensions of members before assembly.

606.3.02 STORAGE OF MATERIAL

Keep lumber and timber stored on site in orderly piles or stacks. Open-stack untreated material on supports at least 12 inches above ground surface to avoid absorption of ground moisture and permit air circulation. Stack and sticker to permit free circulation of air between tiers and courses. Provide protection from weather by a suitable covering when directed.

606.3.04 WORKMANSHIP

Insure that workmanship is first-class throughout. Employ competent carpenters and make all framing plumb and true to line. Drive nails and spikes with just sufficient force to set heads flush with surface of wood.

606.3.04 TREATED TIMBER

606.3.04A Handling

Handle treated timber carefully without dropping, breaking of outer fibers, bruising or penetrating surface with tools. Make slings out of robe to handle treated timber; do not use cant hooks, peaveys, pikes, or hooks.

606.3.04B Framing and Boring

Do all cutting, framing, and boring of treated timber before treatment in so far as is practicable. When treated timbers are to be placed in water, untreated cuts, borings, and other joint framings between high and low water elevation will not be permitted.

606.3.04C Cuts and Abrasions

After trimming carefully, cover all cuts in treated timbers, and all abrasions, with two applications of a mixture of 60 percent creosote oil and 40 percent asphalt pitch or

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brush coated with at least two applications of hot creosote oil and covered with hot asphalt pitch.

606.3.04D Bolt Holes

Pour hot creosote oil into all bolt holes bored after treatment or treat such holes with creosote oil by means of an approved pressure bolt hole treater. Plug any unfilled holes, after being treated with creosote oil, with approved creosote plugs.

606.3.04E Temporary Attachment

Whenever forms or temporary braces are attached to treated timber with nails or spikes, fill holes by driving galvanized nails or spikes flush with surface or plugging holes as required for bolt holes.

606.3.05 UNTREATED TIMBER

Surfaces of untreated timber which after assembly or construction are inaccessible, shall be thoroughly coated with wood preservatives in accordance with Subsection 606.2.04.

Use a method of application which prevents preservative from discoloring adjacent painted surfaces. Devote particular attention to necessity for avoidance of stains on handrails. Where handrail posts are to be treated with a creosote treatment for a portion of their length and then painted over the remainder, apply preservative first and thoroughly dry before paint is applied.

606.3.06 HOLES FOR BOLTS, DOWELS, RODS, AND LAG SCREWS

Conform to National Design Specification for Stress Grade Lumber and Its Fastenings by National Forest Products Association. Bore holes for drift pins with a bit 1/16-inch less in diameter than pin or dowel. Bore holes for truss rods or bolts with a bit 1/16-inch larger than rod or bolt. Bore holes for lag screws in two parts: lead hole for shank shall have same diameter as shank and same depth as length of unthreaded shank; lead hole for threaded portion shall have a diameter equal to approximately two-thirds of shank diameter.

606.3.07 BOLTS AND WASHERS

Use a washer of size and type designated under all bolt heads and nuts which would otherwise come in contact with wood. Lock nuts of all bots after they have been finally tightened.

606.3.08 COUNTERSINKING

Paint with hot creosote oil, all horizontal recesses formed for countersinking in treated lumber after completion of treatment: after bolt or screw is in place, fill with hot asphalt pitch.

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606.3.09 FRAMING

Cut and frame all lumber accurately to a close fit in such manner that joints will have even bearing over entire contact surfaces. Mortises shall be true to size for the full depth and tenons shall fit snugly. No shimming will be permitted in making joints, nor will open joints be acceptable.

606.3.10 FRAMED BENTS

For untreated timber mud sills, use heartwood only of cedar, cypress, redwood, or other approved timber. Bed all mud sills firmly and evenly to solid bearing and tamp in place.

Finish concrete pedestals for support of framed bents carefully so that sills or posts will bear evenly on them.

Insure that sills have true and even bearing on foundations. When possible, remove all earth from contact with sills so that there will be free air circulation around them.

606.3.11 CAPS

Place timber caps with ends aligned to secure an even and uniform bearing over tops of supporting posts or piles.

606.3.12 BRACING

Bolt or spike intermediate intersections with wire or boat spikes, as shown.

606.3.13 STRINGERS

Size stringers at bearings and place in position so that nay knots near midspan are in top portions of stringers and any knots near supports are in bottom portions of stringers. Outside stringers may have butt joints with ends cut on a taper. Lap interior stringers to take bearing over full width of floor beam or cap at each end. Separate lapped ends of untreated stringers at least ½-inch for circulation of air and fasten securely by drift bolting where specified. When stringers are two panels in length, stagger joints. Cross-bridging between stringers must be neatly and accurately framed and securely toe-nailed with at least two nails in each end. Insure that cross-bridging members have full bearing at each end against sides of stringers.

606.3.14 PLANK FLOORS

Unless otherwise specified all plank shall be surfaced one side (S15). Single plank floors shall consist of a single thickness of plank supported by stringers or joints. Lay planks heart side down, with ½-inch opening between them for seasoned material and with tight joints for unseasoned material. Spike each plank securely to each joist. Grade planks carefully as to thickness and lay so that no two adjacent planks vary in thickness by more than 1/16-inch.

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606.3.15 WHEEL GUARDS AND RAILINGS

Frame wheel guards and railings accurately in accordance with the Plans and erect true to line and grade. Unless otherwise specified, wheel guards and rails and rail posts shall be surfaced on four sides (S4S). lay wheel guards in sections not less than 12 feet long.

Carpentry for hand railings must be equal to first-class stair work and finished work in perfect alignment, both horizontally and vertically, for its entire length. Select material for use specifically with reference to freedom from knots and straightness of grain. No defective lumber of any description will be permitted and all joints must be exactly true to line and tight fitting.

606.3.16 TRUSSES

Complete trusses to show no irregularities of line. Insure that chords are straight and true from end to end in horizontal projection and, in vertical projection, show a smooth curve through panel joints conforming to the correct camber. Uneven or rough cuts at points of bearing are cause for rejection of piece containing defect.

Where a manufacturer's design for trusses is required, submit shop drawings and calculations for approval which have been stamped by an Engineer registered in the State of Oregon.

606.3.17 ERECTION OF RAILINGS

Build railings after removal of falsework and adjust trusses to correct alignment and camber.

606.3.18 PRESERVATIVE TREATMENT

Conform workmanship to AWPI and AWPA Specifications. Provide certification that treated lumber meets all requirements for type shown or specified.

606.3.19 PAINTING

Paint untreated timber or timber treated with preservative salts, as specified.

Give metal parts, except hardware, one coat of shop paint and, after erection, two coats of field paint.

606.4.00 MEASUREMENT AND PAYMENT

606.4.01 UNIT PRICE BASIS

Measurement and payment for lumber and timber, treated or untreated, will be made on a unit price per thousand board feet measure basis as shown in the Proposal and will include all incidental work and material necessary to complete the structures as specified.

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Measurement will be made using nominal dimensions based upon all lumber and timber in the finished structure. Payment will include all allowances for waste since this will not be measured for payment.

606.4.02 LUMP SUM BASIS

Measurement and payment for lumbar and timber, treated or untreated, will be made on a lump sum basis as shown in the Proposal.

Payment will include full compensation for all work and materials necessary for timber structures complete within limits shown and as specified.

NEWER VERSION PUBLISHED

607 Metal, Bin-type Retaining Walls

607.1.00 DESCRIPTION

This Section covers work necessary for the construction of metal, bin-type retaining walls at locations shown.

607.2.00 MATERIALS

607.2.01 METAL

Insure that various members are fabricated from specified metal of respective gauges as shown. In absence of given gauges or dimensions for any member, fitting or appurtenance, gauge of metal or dimensions thereof is as required to fully develop strength of members whose gauges and dimensions are given and which are used in structural combination. Do not form units from sheets lighter than 16-gauge. Use specified members, bolts, nuts, washers, and all other hardware that have been galvanized after fabrication in conformance with ***Section 609 Painting, Galvanizing and Surface Treatment***.

Insure that all members are so fabricated that members of same nominal size are fully interchangeable. Members must also be so fabricated and punched that no drilling, punching, or drifting to correct defects in manufacture will be required during field assembling.

607.2.02 PERFORATED UNDERDRAIN PIPE

Conform to requirements contained in ***Division 4—Sewers***.

607.2.03 UNDERDRAIN FILTER

Conform to requirements of Special Filter Material contained in ***Division 4—Sewers***.

607.2.04 BIN WALL BACKFILL

Use materials for backfilling bins of wall and around outer sides thereof predominantly of a granular nature with sand, gravel, or rock fragments containing not over 25 percent of soil, free of sod, cinders, frozen material, and gravel or rock fragments having any dimension greater than 4 inches.

607.3.00 CONSTRUCTION

607.3.01 EXCAVATION AND BACKFILL

Perform excavation and backfill in accordance with requirements contained in Section 204. Excavate with least amount of disturbance to natural ground as is practicable.

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Fill within bins of assembled wall concurrently with assembly of bins, and around outer sides thereof at approximately same level with inside fills. Place materials in layers not exceeding 6 inches in thickness and compact with mechanical tampers to at least 90 percent of maximum density, as determined by AASHTO T 99, Method A. Exercise care to completely fill depressions of stringers and spacers without tamping to the point of displacing them from established line and batter.

607.3.02 UNDERDRAINS

Construction of underdrains shall conform to requirements of ***Division 4—Sewers***.

607.3.03 ASSEMBLY AND ERECTION

07.3.03A Shop Drawings

Submit materials list for review and approval before beginning any construction work.

607.3.03B Metal Bin-type Retaining Walls

Obtain assembly instructions and recommendations from fabricator or manufacturer of all materials and make provisions for a qualified representative or fabricator or manufacturer to be present at job site to act as consultant on matters of installation and procedure, when his/her presence is requested by Engineer. Assemble and construct in conformance to fabricator's or manufacturer's recommendations and instructions and with skills workmanship in all respects.

607.4.00 MEASUREMENT AND PAYMENT

607.4.01 LUMP SUM BASIS

Measurement and payment for bin type retaining wall will be made on a lump sum basis for each bin type retaining wall completed and accepted, including all backfill, underdrains, sewer connections, and all other required work, at each separate location stated in the Proposal.

607.4.02 SQUARE FOOT OF WALL AREA BASIS

When so shown in the Proposal, bin wall will be measured and payment made on a square foot of wall area basis for each separate design shown in the Proposal, fully completed, and accepted. Determination of respective square foot pay items, in each instance, shall be by measurement to nearest 0.01 foot of out-of-out height and by measurement to nearest 0.01 foot of width between centers of column. Payment for bin wall includes full compensation for all backfill, underdrains, sewer connections, and all other required work.

NEWER VERSION PUBLISHED

608 Chain Link Fence and Street Guardrail

608.1.00 DESCRIPTION

This Section covers work necessary for installation of chain link fence and street guardrail.

608.2.00 MATERIALS

608.2.01 CHAIN LINK FENCE

608.2.01A General

Insure that chain link fence and gates conform to AASHTO M 181. Use new materials and products of recognized, reputable manufacturers or producers. Materials must carry a tag identifying manufacturer and, in case of steel fabric and barbed wire, class of zinc coating. Used, rerolled, regalvanized finish, or open-seam posts are not acceptable. All steel materials must be hot-dip galvanized after fabrication. Insure that posts and other appurtenances have a minimum zinc coating of 2.0 ounces per square foot of surface except that weight of galvanizing on all hardware must conform to ASTM A 153. Contractor may use zinc-coated steel, aluminum-coated steel, or aluminum alloy at his/her option provided only one material is used throughout any one project.

608.2.01B Tension Wire and Wire Ties

For all wire fabric ties, hot rings, and tension wire furnished for use in conjunction with zinc-coated steel fabric or with aluminum-coated steel fabric, use zinc-coated wire or aluminum-coated steel wire. For those in conjunction with aluminum alloy fabric, use aluminum alloy wire.

Use tension wire having the same strength required for the fabric of the same material. Zinc-coated wire shall be coated with prime western spelter or equal (AASHTO M120) applied at a rate of not less than 0.8 oz. per square foot of uncoated wire surface. Aluminum-coated wire shall be coated will aluminum alloy applied at a rate not less than 0.4 oz. per square foot of uncoated wire surface.

For wire used for zinc-coated or aluminum-coated wire fabric ties, wire ties, and hot rings, use ductile steel coated with prime western spelter or equal (AASHTO M120) applied at a rate of not less than 0.7 oz. per square foot of uncoated wire surface. For wire ties and hot rings for use with aluminum alloy fabric, use the same alloy.

608.2.01C Barbed Wire

Use barbed wire, if specified, conforming to ASTM A 121, and consisting of 2-strand 12½-gauge wire with 4-point barbs spaced evenly at 5-inch intervals, with Class 3 galvanizing.

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608.2.01C Top Rail

When top rail is specified, use couplings of outside-sleeve type, minimum of seven inches long. Provide springs to permit expansion movement as recommended by manufacturer. Construct top rail to extend through line post tops to form continuous brace from end to end of each stretch of fence.

608.2.01E Fittings

Include extension arms with fittings for all specified barbed wire, bracket supports, stretcher bars and clamps, clips, tension rods, brace rods, hardware, fabric bands, fastenings, and all accessories. Provide 45-degree bracket type supports for barbed wire where shown.

608.2.01F Gates

Provide gates with all fittings, braces, sag rods, ball-and-socket type hinges, and single or plunger bar type latches or semiautomatic outer latches to secure gates in opened position, as specified. Arrange latches and plunger bars for locking with padlocks. Brace gates diagonally with adjustable rods to prevent sagging in conformance with manufacturer's standard practice as approved.

608.2.02 STREET GUARD RAILS

608.2.02A Metal Beam Rail

Insure that metal beam rail is formed from either galvanized steel or aluminum alloy sheets. Conform galvanized steel to AASHTO M 180, for Class a rail. Conform zinc coating to Type 2, AASHTO M 180, applied after fabrication and subject to the single spot test. Backup plates will be accepted with ungalvanized edges and bolt holes, provided these areas are field coated with an approved galvanizing substitute. Form aluminum alloy from sheets of a minimum thickness of 0.100 inch and, except for galvanizing, meeting mechanical properties, configuration, and other pertinent requirements as set forth in AASHTO M 180 for steel rail members.

608.2.02B Posts

Use Portland Cement concrete conforming to Section 602 or steel conforming to Section 605 as specified. Insure that each post is true in form and free from fractures, cracks, surface roughness, and other defects. Steel posts must be galvanized to conform to AASHTO M 111.

608.2.02C Hardware

Provide steel bolts, nuts, washers, and other fittings which are interchangeable with similar parts and galvanized to conform to ASTM A 153. Insulate galvanized hardware

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used with aluminum alloy rail members from physical contact with aluminum in a manner approved by Engineer.

608.3.00 CONSTRUCTION

608.3.01 GENERAL

Construct fence and guard rail true to line, grade, and dimensions specified; do not follow any surface unevenness.

608.3.02 CHAIN LINK FENCE

Dig post holes as specified, place post and fill remainder with concrete extending around posts to a point 2 inches above finished grade. Crown top surface with a watershed finish. Fasten chain link fabric to end posts with stretcher bars and clamps and to line posts and top rail or top tension wire with wire or bands at approximately 15-inch and 24-inch centers, respectively. Brace gate posts diagonally to adjacent line posts to insure stability. Hang gates and adjust all hardware so that gates operate from open or closed positions as approved.

608.3.03 STREET GUARD RAIL

Excavate to lines and grades established by Engineer and to depths shown on Plans. For pavement cuts, use mechanical means, such as knife-edge cutters or rotary drills. For cuts below pavement, use auger or other means which will prevent undue disturbance of abutting areas. Avoid fouling of existing bases and pavements. Repair any materials which do become fouled or replace as directed, at Contractor's expense.

Keep areas to be backfilled free from water or deleterious material which would impair stability of backfill.

In areas occupied by aggregates, bituminous material, and pavements, backfill with like materials placed to same thickness and density as adjacent materials. In other areas, backfill with granular material. Place backfill in layers not exceeding 6 inches and compact each layer to a firm, dense condition.

For adjoining areas which become misshapen or disturbed during excavating and backfilling operations, remove, replace, repair, or restore, as directed, at Contractor's expense. Dispose of excess materials in an approved manner.

Posts may be set in prior excavations or they may be driven in place, as the Contractor may elect. Remove posts, anchors, or other components which are damaged during installation and replace with sound components. Set all posts firm and at proper line, grade, and spacing within a tolerance of ½-inch.

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608.4.00 MEASUREMENT AND PAYMENT

608.4.01 INCIDENTAL BASIS

When not specified or shown as a separate pay item in the Proposal, payment for chain link fence, gates, or street guard rail is considered to be incidental to related items of work and no separate payment will be made.

608.4.02 LUMP SUM BASIS

When so specified and shown in the Proposal, measurement and payment for chain link fence, gates, or street guard rail will be made on a lump sum basis, which will include full compensation for all fence, gates, or guard rail within limits shown or specified.

608.4.03 UNIT PRICE BASIS

When so specified and shown in the Proposal, measurement and payment for chain link fence and/or guard rail will be made on a unit price basis, which will include full compensation for all chain link fence and/or guard rail work within limits shown or specified.

608.4.03A Chain Link Fence

Measurement and payment for chain link fence will be made on a linear foot basis for closed fence and on a per each basis for each width of single and double gate. Measurement will be along line and grade of each continuous run of fence as constructed.

608.4.03B Guard Rail

Measurement and payment for street guard rail will be made on a linear foot basis. Measurement will be between post centerlines along top of guard rail.

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609 Painting, Galvanizing, and Surface Treatment

609.1.00 DESCRIPTION

This Section covers work necessary for painting which includes surface preparation, application, protection, and drying of paint coatings, and supplying of all tools, scaffolding, labor, and materials necessary for entire work. Paint systems and areas to be painted for architectural work will be shown. Galvanizing is also included in this Section.

609.2.00 MATERIALS

609.2.01 GENERAL

The term ***Paint*** as used herein includes all protective coatings and incidental materials as required. In all cases the material used as a prime coat shall be a product recommended or approved by the manufacturer of paint to be used as a finish coat.

Do not bring any paints, other than those specified or approved, to jobsite. Oils, thinners, and driers delivered to jobsite must be only those approved for use by paint manufacturer. Do not reduce paint or induce faster drying by addition of any product designed for such purposes, except as recommended by paint manufacturer and approved by Engineer.

609.2.02 ARCHITECTURAL PAINTING

609.2.02A Painting Materials

Manufacturers' names are stated to indicate type and quality of products. Products of other manufacturers of equal quality may be substituted upon approval. Formulate all paint products for architectural work with nonlead-containing pigments.

609.2.02B Colors for Architectural Painting

Colors to be used on project are shown for architectural painting. Right is reserved to deviate from any colors indicated, and, prior to commencement of painting operation, to have sample panels made. When requested, prepare color panels approximately 18 inches or more square on surfaces similar to those to be painted or stained. Do not apply finish coats until sample panels, if required, are approved. Individual rooms or areas may have two or more colors or finishes on walls in one room.

609.2.03 PAINT FOR METAL WORK

Formulas for paint for use on metal work shall conform to those specified.

Use factory mixed paint except those paints specified to be furnished as two or more components. Field mix all paint before applying in order to keep pigments in uniform

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suspension. Fix and grind ingredient material for each formula to produce a homogeneous paint, free of grit, which will not thicken, liver, gel, curdle, or settle badly nor cake in container. Amount of thinner may be modified to produce specified viscosity. Add antiskinning agents. Wetting agents and antidrier absorption agents may be added.

609.2.04 GALVANIZING

Materials used for galvanizing and methods of application shall conform to ASTM A 123, A 153, A 384, A 385, and A 386.

609.2.05 ANODIZING

Anodizing shall conform to ASTM B580.

609.3.00 CONSTRUCTION

609.3.01 INTENT

All trades employed on the jobsite must leave surfaces of their work in such a condition that only minor cleaning, sanding, and filling is required by the painting trade. Prepare metals as specified. Prepare all surfaces in accordance with printed directions and recommendations of paint manufacturer whose product is to be applied to a given surface.

609.3.02 PAINT DELIVERY AND STORAGE

Deliver all materials to jobsite in unopened containers that plainly show, at time of use, designated name, formula, color, state of manufacture, manufacturer's directions, and name of manufacturer. Store paints in a suitable protected area that is maintained between 40 degrees Fahrenheit and 100 degrees Fahrenheit, except for epoxy materials which must be stored at 70 degrees Fahrenheit to 90 degrees Fahrenheit. Keep paint material seals or covered when not in use.

609.3.03 PROTECTION OF MATERIALS NOT TO BE PAINTED

Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring any adjacent surfaces. Protect working parts of all mechanical and electrical equipment from damage during surface preparation and painting process.

609.3.04 SURFACE PREPARATION FOR ARCHITECTURAL PAINTING

Prepare surfaces for architectural painting in conformance with best practice of trade and in strict conformance with paint manufacturer's printed directions and recommendations, and these Specifications. Surfaces must be dry and thoroughly cleaned of foreign materials. Before applying any coating, inspect surface for defects which would cause paint failure or result in an unsightly surface. Fill defects or remove so that surfaces are in proper condition for painting.

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Bring any remaining defects to attention of Engineer in writing. If Contractor elects to ignore any unsuitable surface condition and applies his/her coating(s), he/she will be held responsible for any resulting unsatisfactory surface finish, and will be required to refinish work at no expense to Owner.

Remove all loose paint, mortar, dirt, and other foreign material from existing masonry walls to be painted. Repair cracks, checks, or other imperfections with approved filler.

Etch concrete floors to be painted with a 10 percent muriatic acid solution until an open faced granular texture is obtained. Thoroughly rinse with fresh water and dry for 72 hours in good drying weather.

609.3.05 PREPARATION OF METAL SURFACES

Clean surfaces of metal to be painted thoroughly, removing rust, old loose paint, loose mill scale, dirt, oil or grease, and other foreign substances. Unless cleaning is to be done by sandblasting, neutralize all weld areas before cleaning with a proper chemical and thoroughly rinse with water. Methods of cleaning are provided herein. Any of these methods may be used unless otherwise specified.

609.3.05A Hand Cleaning

Remove rust, loose paint, loose mill scale, and dirt by use of metal brushes, scrapers, chisels, hammers, or other approved means. Remove oil and grease by use of an approved solvent or benzene. Wipe excess solvent from work before proceeding with subsequent operations. Use bristle or wood fiber brushes for removing loose dust.

609.3.05B Sandblasting

Remove all loose mill scale and other substances down to bare metal. Give special attention to cleaning of corners and re-entrant angles. Before painting, remove sand adhering to steel in corners and elsewhere. Obtain Engineer's approval of cleaning prior to painting.

609.3.05C Flame Cleaning

Clean all metal except exposed inside of boxed members or surfaces inaccessible to flame-cleaning, in accordance with the following operations.

Clean and dehydrate surfaces to be painted, free of occluded moisture, by passage of approved oxyacetylene flames. Apply oxyacetylene flames over surfaces of steel in such manner and at such speed that surfaces are dehydrated. Free dirt, rust, loose scale, blisters or scabs, and similar foreign matter by rapid, intense heating of flames. Do not traverse flames so slowly that loose scale or other foreign matter is fused to surface of steel.

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Promptly after application of flames, wire brush surfaces of steel. Hand scrape wherever necessary, and then sweep and dust to remove all free material and foreign particles. Use of compressed air for this operation will not be permitted.

609.3.05D Preparing Galvanized Surfaces

For galvanized and nonferrous metal surfaces which are required to be painted, apply one primer coat of specified formula.

609.3.06 DRY FILM THICKNESS AND NUMBER OF COATS

Dry film thickness and number of coats of paint for all areas of construction shall be as specified.

Where two successive coats of the same color paint are to be applied, make first coat of a slightly different shade to differentiate it from second coat. Tint undercoats to approximate final color.

furnish at the project at least one properly calibrated and approved dry film thickness gauge during entire painting process.

609.3.07 WEATHER LIMITATIONS

Do not apply paint in temperatures below 40 degrees Fahrenheit, nor in dust or smoke-laden air, nor in damp or humid weather, unless approved. Do not apply paint upon damp or frosted surfaces, nor upon surfaces hot enough to cause paint to blister. For material painted under cover in damp or cold weather, keep under cover until dry or until weather conditions permit its exposure in the open.

609.3.08 APPLICATION

Accomplish painting in a neat and workmanlike manner and in strict conformance with manufacturer's recommendations. Apply paint with hand brushes, pads, rollers, or by spraying. Regardless of method used, apply coating of paint smoothly and spread uniformly so that no excess paint will collect at any point. Follow paint applied with spray equipment immediately by brushing when necessary to secure uniform coverage and to eliminate wrinkling, blistering, and air holes. When painting indoors, provide indoor illumination of a minimum of 100 foot candles on surfaces being painted.

Insure that work is free from runs, bridges, shiners, laps, or other imperfections. Prevent settling of dust or any other improper condition while paint is setting and repair any damaged coats at no additional expense to Owner.

609.3.09 INACCESSIBLE SURFACES

For surfaces of steel that will be inaccessible to convenient cleaning and painting after complete assembly, such as inside surfaces of boxed members, clean prior to assembly. In

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welded work, schedule fabrication, cleaning, painting, and assembly resulting in a paint system that is not damaged in any way by welding. Clean, prime, and paint structural steel members in conformance to Subsection 605.3.14.

609.3.10 DRYING TIME

Allow sufficient time between coats to assure thorough drying of previously applied paint. For materials painted in shop or on ground at jobsite, do not load for shipment nor move until paint is thoroughly dry, and in any case not less than 24 hours after paint has been applied. Touch up material which has been delivered to job with a shop prime coat as required to recoat all abraded areas prior to receiving any additional coatings.

609.3.11 PAINT COMPATIBILITY

Exact nature of existing coatings is not known in all cases, and, while it is assumed that they have oxidized sufficiently to prevent lifting or peeling when over coated with paints specified, check compatibility by application to a small area prior to starting painting. If lifting or other problems occur, notify Engineer.

609.3.12 REPAIRS TO FACTORY-FINISHED COATINGS

Repair abraded areas on factory-finished material in strict accordance with manufacturer's directions. Insure that repaired areas are equal to original finish and not visible.

609.3.13 GALVANIZING

Vent all closed or blind pipe sections properly to permit escape of gases or vent as otherwise required by galvanizer. Galvanize all bolts, nuts, washers, and similar fastenings. Hot-dip galvanize all items indicated to be galvanized after fabrication, except that parts bolted together must be galvanized before final assembly. Coat damaged areas with galvanizing repair material as directed.

609.3.14 ELECTROLYTIC PROTECTION

Where aluminum is in contact with dissimilar metals or to be embedded in masonry or concrete, apply one coat of coal-tar coating as approved to contact surfaces. Allow paint to dry before installation of material. Protect painted surfaces during installation

609.3.15 PAINTING ALUMINUM

Paint or coat all aluminum surfaces to be in contact with dissimilar materials as specified.

609.3.16 CLEANUP OF WORK AREA

Place all cloths and waste that might constitute a fire or other hard in closed metal containers or destroy at end of each day. Upon completion of work, remove all staging, scaffolding, and

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containers from site or destroy in an approved manner. Remove paint spots, oil, or stains upon adjacent surfaces and floors completely and leave entire job clean and acceptable.

609.4.00 MEASUREMENT AND PAYMENT

609.4.01 INCIDENTAL BASIS

When not specified or shown as a separate pay item in the Proposal, payment for painting, anodizing, or galvanizing is considered as incidental to related items of work, and no separate payment will be made.

609.4.02 LUMP SUM BASIS

When so specified and shown in the Proposal, measurement and payment for painting, anodizing, or galvanizing will be made on a lump sum basis.

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610 Slope Protection

610.1.00 DESCRIPTION

This Section covers work necessary for slope paving or riprap as slope protection. Slope paving shall consist of precast cement concrete blocks, poured Portland Cement concrete, pneumatically placed Portland Cement concrete, and asphalt concrete paving, constructed on prepared slopes.

Riprap shall consist of broken stone, wire enclosed stone, grouted stone, or sacked concrete, constructed on prepared slopes or filter blanket or other places.

610.2.00 MATERIALS

610.2.01 PAVING BLOCKS

Precast cement concrete blocks must conform to ASTM C 90 for hollow block and C 145 for solid block, Grade N II. Blocks may be manufactured with integral spacer devices that will provide required ½-inch mortar joint.

610.2.02 WIRE MESH

Wire mesh shall conform to ASTM A 185.

610.2.03 ASPHALTIC MATERIALS

Use asphaltic materials conforming to requirements of ***Subsection 205.2.13 Asphalt Materials***.

610.2.04 BROKEN STONE

For loose riprap, use stone that is hard, durable, angular in shape, resistant to weathering, and meets gradation requirements for class specified. Neither breadth nor thickness of a single stone must be less than one-third its length. Rounded stone or boulders will not be accepted unless authorized. Broken concrete may be substituted for stone. Shale or stone with shale seams is not acceptable.

Select sources from which stone is obtained well in advance of time when material will be required in work. Acceptability of stone will be determined by previous use records or by tests as determined to be appropriate. If testing is required, furnish suitable samples of stone taken in presence of Engineer at least 25 days in advance of time when placing of riprap is expected to begin.

In absence of satisfactory previous use records, insure that stone conforms to the following requirements:

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Apparent Specific Gravity (AASHTO T 85)	2.5 Minimum
Percent Absorption (AASHTO T 85)	6 Maximum
Degradation Passing No. 20 Sieve Sediment Height	 35 Percent Maximum 8-inch Maximum
Soundness (AASHTO T 104) Average Loss for 2 ½" – 1 ½" and 1 ½" – ¾" fraction	16 Percent

Use riprap free from overburden, spoil, shale, and organic material.

Grading of loose riprap by class and size of stone shall conform to the following:

Class 50	**Class 100**	**Class 700**	**Class 2000**	**Percent (by weight)**
Size of Stone (lb)				
50-30	100-60	700-500	2,000-1,400	20
30-15	60-25	500-200	1,400-700	30
15-2	25-2	200-20	700-40	40
Less than 2	Less than 2	Less than 20	Less than 40	10

Grade each load of riprap reasonably well from smallest to maximum size specified.

Control of gradation will be by visual inspection as herein set forth. Provide, at a location satisfactory to Engineer and in close proximity to project, a mass of rock sample of at least 5 tons meeting gradation for class specified. This sample will be used as a frequent reference for judging gradation of riprap supplied. Any difference of opinion between Engineer and Contractor will be resolved by dumping, checking, and estimating the gradation of two random truck loads of stone. Provide mechanical equipment, assorting site, and labor needed to assist in checking gradation at no additional expense to Owner.

610.2.05 FILTER BLANKET

For a filter blanket, provide one or more layers of gravel or rock of thickness and gradation designated. All material comprising filter blanket must be composed of tough, durable particles, reasonable free from thin, flat, and elongated pieces, and containing no organic matter nor soft, friable particles in quantities in excess of those approved.

610.2.06 WIRE ENCLOSED STONE

610.2.06A Stone

Provide hard, durable, crushed, quarried, or natural stone, or broken concrete having an apparent specific gravity of not less than 2.4 for stone aggregate. Do not allow absorption to exceed 4 percent, unless otherwise approved. Insure that stone is free of

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weak laminations and cleavages, and of a quality that will not disintegrate o exposure to water or weathering. For wire-enclosed stone aggregate, use round or angular stones. Not less than 95 percent of stone must be retained on a screen or wire having 2-inch square openings.

610.2.06B Wire

Provide chain link fabric for wire enclosure meeting AASHTO M 181 for steel fabric, 11-gauge, 2-inch mesh with Class I coating in accordance with ASTM A 392, knuckled selvage both edges or, welded wire fabric meeting AASHTO M 55 for 11-gauge, 2-inch spacing of horizontal and vertical, with Class I coating in accordance with ASTM A 116.

Use galvanized 12 ½-gauge, smooth steel wire for lacing, and tie wire. In lieu of lacing, 9-gauge, galvanized hog rings at 4-inch spacing may be used for fastening ends, sides, and top panels.

610.2.07 SACKED CONCRETE

Provide Portland Cement concrete in loosely woven burlap sacks of roughly 19.5 by 26 inch dimensions. Control slump of cement concrete between 3 and 5 inches. Use concrete with a minimum 28 day compressive strength of 2,200 psi.

610.3.00 CONSTRUCTION

610.3.01 SLOPE PREPARATION

Insure that slopes to be protected are free of brush, trees, stumps, and other organic material and dressed to a smooth surface. Remove all soft or spongy material to depth shown or as directed, replace with approved material and compact to density as specified. Dig toe trench when and as shown, and maintain until riprap is placed.

Provide protection for structural foundations as early as foundation construction permits. Clean area to be protected of waste materials and prepare surfaces to be protected as shown.

Shape slopes to allow full thickness of specified riprap and any bedding or filter gravel. Do not make slopes steeper than natural and of repose of slope as shown or directed. Wherever possible, excavate to undisturbed material, or where this is not possible, compact underlying material to at least 90 percent of maximum at optimum moisture content as determined by AASHTO T 99.

610.3.02 PAVING BLOCKS

Place specified paving blocks in a uniform plane and in such a manner that they rest firmly and evenly against slope with no rocking. Place blocks in horizontal parallel courses and break joints in successive courses with preceding course to form a running bond. Grout joints between blocks to provide neat appearing, dense, and impervious joints, using a grout which has a thick, creamy consistency.

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610.3.03 POURED PORTLAND CEMENT CONCRETE

Place cement concrete upon slope in such a manner as to form a compact, dense and impervious concrete with a uniform plane surface. Make thickness 4 inches unless otherwise shown or specified.

Lap wire mesh a minimum of one mesh spacing. Fasten laps securely at ends. During placement of concrete, place wire mesh reinforcement, and hold so as to provide a minimum of 1 ¼ inches of cover.

Cure where applicable in conformance with requirements contained in Section 602.

Make two test cylinders for each full day's operation. Furnish cylinders 6 inches in diameter and 12 inches high, in conformance with AASHTO T 23.

Cylinders must develop a minimum compressive strength of 3,000 pounds per square inch at age of 28 days.

610.3.04 PNEUMATICALLY PLACED PORTLAND CEMENT CONCRETE

Obtain Engineer's approval of type of equipment and method of operation before placement of any portion of slope protection.

Lap wire mesh a minimum of one mesh spacing. Fasten laps securely at ends. During placement of concrete, hold reinforcement so as to provide a minimum of 1 ¼ inches of cover.

Protect all retaining walls, columns, and structures from concrete splash or overspray. Provide suitable covering if such protection is deemed necessary.

610.3.05 ASPHALT CONCRETE SLOPE PAVING

Appl a prime coat as herein specified to the prepared slope surface before paving with asphalt mix. Deposit and compact asphalt concrete mix on slope in such a manner so as to form a compact, dense, and impervious asphalt pavement with a uniform plane surface. Provide a total thickness of 4 inches, compacted in two layers. After each lift of asphalt bituminous mixture has been spread, struck off, and surface irregularities and other defects remedied, compact thoroughly and uniformly to a minimum of 95 percent of relative maximum density as determined by AASHTO T 230. Maximum density shall be determined by AASHTO T 245 or AASHTO T 246.

As specified, place wire mesh between two layers of asphalt concrete.

Apply a tack coat as specified between each lift.

If specified, apply an asphalt seal coat to compacted finished surface of the asphalt concrete pavement.

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610.3.06 BROKEN STONE RIPRAP

Place broken stone riprap on the prepared are in a manner which will produce a reasonably well graded uniform mass of stone. Place to full course thickness in one operation in such a manner as to avoid displacing underlying material.

Distribute larger stones well and conform entire mass of stone approximately to gradation specified.

Place and distribute all material going into riprap protection so that there will be no large accumulations of either larger or smaller sizes of stone.

Place all sizes of riprap in proper proportions to produce a fairly compact stone protection. Hand placing or rearranging of individual stones by mechanical equipment may be required to the extent necessary to secure results specified.

Unless otherwise approved, place riprap in conjunction with construction of embankment with only sufficient lag in construction of stone protection as may be necessary to allow for proper construction of the portion of embankment protected and to prevent mixture of embankment and stone. Maintain broken stone slope protection until accepted and replace any material displaced by any cause at no additional expense to Owner.

Where riprap and filter material are placed under water, increase thicknesses as shown or as directed, and use methods that will minimize segregation and insure that minimum required thickness of well graded material will be obtained in both stone and filter.

610.3.07 GROUTED STONE RIPRAP

Place stones on the prepared slope substantially to dimensions shown. Moisten stones thoroughly and sluice any excess of fines to underside of riprap before grouting.

Deliver grout which has a thick, creamy consistency to the place of final deposit by any means that will insure uniformity and prevent segregation of the grout. Spade or rod grout into interstices to completely fill voids in the riprap. During pressure grouting, don not unseat stones. Penetrate with grout to depth shown on Plans. When a rough surface is specified, brush stone until from one-quarter to one-half of depth of surface stone is exposed. For a smooth surface, fill interstices with grout to within a half-inch of the surface.

Provide weep holes through riprap if shown or directed. Where depth specified for grouting is in excess of 12 inches, place riprap in lifts of 12 inches or less and grout each lift prior to placing next lift. Construct and grout succeeding lifts before grout in previous lift has hardened.

Do not place grout in freezing weather or when there is frost on riprap. Protect grout from freezing after placement.

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610.3.08 FILTER BLANKET

When specified, place a filter blanket on prepared area to full thickness of each layer in one operation, using methods which will not cause segregation of particle sizes within the layer. Make surface of finished layer reasonably even and free from mounds or irregularities. Place additional layer of filter material, when required, in same manner, using methods which will not cause mixture of material in different layers.

610.3.09 WIRE ENCLOSED STONE

Hand or machine form wire enclosure segments to dimensions shown. Place, lace, and fill them to provide uniform, dense, protective coat, shaped and located as approved.

Tie each wire cage to all adjoining cages along all contacting edges at intervals of 6 inches. Install wire cages and riprap according to manufacturer's instructions, or as approved.

610.3.10 SACKED CONCRETE

Use approved burlap sacks as herein specified and fill with concrete, allowing only enough space in sack for folding at top. Place bags on prepared slope as soon after mixing as possible. Place bags by staggering joints of each successive tier. Place bags as shown or as directed.

610.3.11 FINISHING SLOPE PAVING

Finish newly constructed cement concrete surfaces by means of a wood float and score as shown.

Roll or compact newly constructed asphalt surfaces to a smooth surface free from irregularities. Finished surface of both cement concrete and asphalt surfaces must not vary more than 0.03 foot from planned grades, dimensions, or elevations at any point.

610.3.12 RIPRAP FINISHING

Install riprap so surfaces present a reasonably neat and regular appearance and generally conform to within 0.2 foot of planned grades, dimensions, or elevations, as approved.

610.4.00 MEASUREMENT AND PAYMENT

610.4.01 MEASUREMENT BY SQUARE OR CUBIC YARD

Measurement of quantities of slope protection to be paid for on a square yard basis or a cubic yard basis will be determined from dimensions shown or limits established by Engineer for type of slope protection placed and accepted. Slope protection placed outside of these dimensions or limits will be considered to have been constructed for Contractor's convenience and no payment will be made therefor.

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610.4.02 MEASUREMENT BY TON

610.4.02A Asphalt Concrete, Stone

Measurement will be based on number of tons of slope protection material, as weighed on approved and tested scales. Present trip tickets to Engineer for his/her signature as material is delivered.

On each trip ticket, show date and time of deliver, truck number, or driver's name, net weight of material, and consider delivery receipts as valid only when signed by Engineer.

610.4.02B Asphalt Prime, Tack, Seal Coats

Quantities of bituminous cements normally shipped in tank cars or tank trucks, when they are to be paid for by the ton, will be determined from volume computations of materials when at a temperature of 60 degrees Fahrenheit, with standard recognized correction factors applied when materials are measured at any temperature other than 60 degrees Fahrenheit. When bituminous materials are shipped by truck or transport, net certified weights or volume, subject to correction for loss or foaming, may be used for computing quantities. Water added to emulsion will not be paid for as emulsified asphalt. Pay quantity shall be amount of undiluted emulsion used.

610.4.03 PAYMENT ON LUMP SUM BASIS

When shown in the proposal, payment will be made on a lump sum basis and this payment will include full compensation for all work and materials necessary for the slope protection within limits shown and as specified.

610.4.04 PAYMENT ON UNIT PRICE BASIS

Payment will be made for any or all of the following items as are listed as pay items in Proposal for any particular Contract:

Payment Item	**Unit of Measure**
1. Preparation of Slopes	Per S.Y.
2. Paving Block Slope	Per S.Y.
3. Poured Cement Concrete Slope Paving	Per S.Y.
4. Pneumatically Placed Cement Concrete Slope Paving	Per S.Y.
5. Asphalt Concrete Slope Paving (with or without wire mesh specified)	Per S.Y. or Ton
6. Asphalt Prime Coat	Per Ton
7. Asphalt Seal Coat	Per Ton
8. Broken Stone Riprap (class of stone specified)	Per C. Y. or Ton
9. Grouted Stone Riprap (class of stone specified)	Per C. Y. or Ton
10. Filter Blanket (gradation specified)	Per C. Y. or Ton
11. Wire Enclosed Stone	Per C. Y.
12. Sacked Concrete	Per C. Y.

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