Department of Public Works

City of Salem, Oregon

Standard Construction Specifications

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These Specifications are not maintained in printed form.

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DIVISION 1—GENERAL REQUIREMENTS

Section 101—Applicability, Reference Standards

101.00 Applicability—These standards apply to the following:

(a) City of Salem Department of Public Works publicly financed public improvement projects.

(b) Privately financed, public improvements that will be accepted for ownership and operation by the City of Salem, Oregon.

(c) Certain private improvements that are required to be constructed to City of Salem Public Works standards.

(d) Work in the public right-of-way by private utility companies and other private entities.

101.05 Reference Standards—Reference is made throughout the Standard Construction Specifications (SCS) to construction and material standards and testing procedures published by other jurisdictions and authorities. Those reference standards and procedures apply to the extent that they are referenced within the context of this SCS. References are made by using an Abbreviation (listed in SCS 110.05) followed by a number. The following also apply:

(a) The 2015 edition of the Oregon Standard Specifications for Construction, Volume 2, will be referenced with the abbreviation "ODOT" as depicted in the following example:

> **610.21 Materials—**Furnish Materials meeting the following requirements:
>
> Concrete Pipe Joint Material ..... ODOT 02440.40
>
> Concrete Pipe ..... ODOT 02410.10

(b) ODOT Construction Publications are referenced as shown below:

Manual of Field Test Procedures ..... MFTP
Qualified Products List ..... QPL

— END OF SECTION —

Section 110—Organization, Conventions, Abbreviations, and Definitions

Organization

110.00 Organization of Specifications

(a) The SCS are comprised of the following divisions:

Division 1—General Requirements

Division 2—General Technical Requirements

Division 3—Streets

Division 4—Sanitary Sewers and Storm Drains

Division 5—Water

Division 6—Structures

Division 7—Right-of-Way Development

Division 8—Traffic Safety and Guidance Devices

Division 9—Traffic Control and Illumination Systems

(b) Each *(1)* Division is divided into *(2)* Sections and *(3)* Subsections as shown in the following example:

(1) **DIVISION 2—GENERAL TECHNICAL REQUIREMENTS**

(2) **Section 240—Trench Excavation and Backfill**

(3) **Description**

240.00 Scope—This work consists of excavating trenches and placing bedding, pipe zone, Material, and backfill. Trench excavation does not include earthwork covered under any other section, or any earthwork that may be specifically included and provided for other pay items of the Contract.

(3) **Materials**

240.20 Pipe Bedding—Furnish either 1”–0 or ¾”–0 base aggregate conforming to SCS 250.

(3) **Construction**

240.40 General—Excavate all formations and Materials, natural or man—made, backfill and dispose of excess excavated Materials in connection with minor structures and conduits.

Conventions

110.05 Conventions Used—Conventions used throughout the Standard Construction Specifications include:

(a) **Grammar—**The SCS are generally written in the imperative mood, in which the subject is implied. Therefore, throughout the SCS, and on the Plans:

- The subject, "the Contractor", is implied.
- "Shall" refers to action required of the Contractor, and is implied.
- "Will" refers to decisions or actions of the City (Owner) and/or the Engineer.
- The following words, or words of equivalent meaning, refer5 to the actions of the City (Owner) and/or the Engineer, unless otherwise stated: "allowed", "directed", "established", "permitted", "ordered", "designated", "prescribed", "required", "determined".
- The words "approved", "acceptable", "authorized", "satisfactory", "suitable", "considered", "rejected", "denied", "disapproved", or words of equivalent meaning, mean by or to the City (Owner) and/or the Engineer.
- The words "as shown", "shown", "as indicated", or "indicated" mean "as indicated on the Plans".

(a) **Capitalization of Terms—**Capitalized terms, other than titles, abbreviations, and grammatical usage, indicate that they have been given a defined meaning in the SCS. Refer to SCS 110.20—Definitions.

(b) **References to Laws, Acts, Regulations, Rules, Codes and Ordinances, Statutes, Orders, and Permits—**References are made in the Specifications to "laws", "acts", "rules", "statutes", "regulations", "ordinances", etc., (collectively referred to for purposes of this Subsection as "Law"), and to "orders" and "permits" (issued by a governmental authority, whether local, state, or federal, and collectively referred to for purposes of this Subsection as "Permits"). Reference is also made to "applicable laws and regulations". The following conventions apply in interpreting these terms, as used in the Specifications.

- **Statutes and Rules—**Oregon Revised Statutes (ORS) and Oregon Administrative Rules (OAR).
- **Code and Ordinances—**Salem Revised Code.
- **Permits—**Orders and permits issued by a government agency may be modified during the course of performing the Work. Therefore, wherever the term "order" or "permit" is used in the Specifications, it is intended to refer to the then—current version.
- **Applicable Laws and Regulations—**Where the phrase "applicable laws and regulations" appears, it is to be understood as including all applicable laws, acts, regulations, administrative rules, ordinances, statutes, orders, and permits issued by a governmental or regulatory authority.

Abbreviations

110.10 Abbreviations—Following are meanings of abbreviations used in the Standard Construction Specifications, in the Special Provisions, on the Plans, and in other Contract Documents. Other abbreviations and meanings of abbreviations may be in the individual Sections of the Standard Construction Specifications to which they apply, in the Special Provisions, and in Salem Revised Code.

AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
AC	Asphalt Concrete
ACP	Asphalt Concrete Pavement
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADAAG	ADA Accessibilities Guidelines
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
DSL	Division of State Lands
EPA	Environmental Protection Agency
FFA	Federal Aviation Administration
FHWA	Federal Highway Administration
ISO	International Standards Organization
ITE	Institute of Traffic Engineers
MFTP	Manual of Field Test Procedures (ODOT)
MUTCD	Manual of Uniform Traffic Control Devices
NEC	National Electrical Code
NESC	National Electric Safety Code
NEMA	National Electrical Manufacturer's Association
NLMA	National Lumber Manufacturer's Association

NPDES	National Pollutant Discharge Elimination System
OAR	Oregon Administrative Rules
OPSC	Oregon Plumbing Specialty Code
ORS	Oregon Revised Statutes
OR—OSHA	Oregon Occupational Safety and Health Division of the Department of Consumer and Business Services
OSHA	Occupational Safety and Health Administration
OSSC	Oregon Standard Specifications for Construction
ODOT	Oregon Department of Transportation
PCA	Portland Cement Association
PCP	Pollution Control Plan
QA	Quality Assurance
QC	Quality Control
QPL	Qualified Products List
SAE	Society of Automotive Engineers
SI	International System of Units (Système Internationale)
SRC	Salem Revised Code
TM	Test Method (ODOT)
UBC	Uniform Building Code
UL	Underwriters' Laboratories, Inc.
UPC	Uniform Plumbing Code
USC	United States Code
USACE	Corps of Engineers, US Army
USASI	United States of America Standards Institute
WAQTC	Western Alliance for Quality Transportation Construction
WWPA	Western Wood Products Association

Definitions

110.20 Definitions—Below are definitions of words and phrases used in the Standard Construction Specifications, in the Special Provisions, and on the Plans. Other definitions are located in the General Conditions of construction Contracts, and also in the individual Sections of the SCS to which they apply, in the Special Provisions, and in Salem Revised Code.

Base — A Course of specified Material of specified thickness placed below the Pavement.

Bike Lane — A lane in the Traveled Way, designated by striping and Pavement markings for the preferential or exclusive use of bicyclists.

Borrow — Material lying outside of planned or required Roadbed excavation used to complete Project earthwork.

Boulders — Particles of rock that will not pass a 12-inch square opening.

Bridge — A single or multiple span Structure, including supports, that carries motorized and non-motorized vehicles, pedestrians, or utilities on a Roadway, walk, or track over a watercourse, highway, railroad, or other feature.

Clay — Soil passing a No. 200 sieve that can be made to exhibit plasticity (putty-like properties) within a range of water contents.

Clear Zone — Roadside border area, starting at the edge of the Traveled Way that is available for safe use by errant vehicles. Establishing a minimum width Clear Zone implies that rigid objects and certain other hazards within the Clear Zone should be relocated outside the Clear Zone, or shielded, or remodeled to make them break away on impact or be safely traversable.

Close Conformance — Where working tolerances are given on the Plans or in the Specifications, Close Conformance means compliance with those tolerances. Where working tolerances are not given, Close Conformance means compliance, in the Engineer's judgment, with reasonable and customary manufacturing and construction tolerances.

Coarse Aggregate — Crushed Rock or crushed Gravel retained on ¼-inch sieve, with allowable undersize.

Cobbles — Particles of Rock, rounded or not, that will pass a 12-inch square opening and be retained on a 3-inch sieve.

Commercial Grade Concrete — Concrete furnished according to Contractor proportioning, placed in minor Structures and finished as specified.

Course — A specified Surfacing Material placed in one or more Lifts to a specified thickness.

Coverage — One Pass by a piece of Equipment over an entire designated area.

Cross Section — The exact image formed by a plane cutting through an object, usually at right angles to a central axis, to determine area.

Drawings — That portion of the Contract Documents which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

Durable Rock — Rock that has a slake durability index of at least 90% based on a two-cycle slake durability test, according to ASTM D 4644.

DWV — Drain, Waste, and Vent piping. Items identified by this acronym shall comply with the Uniform Plumbing Code and Salem Revised Code.

Easement — The right to use a defined area of property for a specific purpose or purposes as set forth in the document.

Entity — A natural person capable of being legally bound, sole proprietorship, limited liability company, corporation, partnership, limited liability partnership, limited partnership, profit or nonprofit unincorporated association, business trust, two or more persons having a joint or common economic interest, or any other person with legal capacity to Contract, or a government or governmental subdivision.

Equipment — All machinery, tools, manufactured products, and fabricated items needed to complete the Contract or specified for incorporation into the Work.

Establishment Period — The time specified to assure satisfactory establishment and growth of planted Materials.

Existing Surfacing — Pavements, slabs, curbs, gutters, walks, driveways, and similar constructions of bricks, blocks, portland cement concrete, bituminous treated Materials, and granular surfacing Materials on existing Highways.

Final Acceptance — Written confirmation by the City that the Work has been completed according to the Contract (or Permit as applicable), with the exception of latent defects and Warranty obligations, if any, and has been accepted.

Final Inspection — The inspection conducted by the Engineer to determine that the Project has been completed according to the Contract.

Fine Aggregate — Crushed Rock, crushed Gravel, or Sand that passes a ¼ inch sieve, with allowable oversize.

Granular Material — Graded and selected free-draining Material composed of particles of Rock, Sand, and Gravel.

Gravel — Particles of Rock, rounded or not, that will pass a 3 inch sieve and be retained on a No. 4 sieve.

Incidental — A term identifying those acts, services, transactions, property, Equipment, labor, Materials, or other items for which the Agency will make no separate or additional payment.

Inspector — The representative of the Engineer authorized to inspect and report on Contract performance.

Leveling — Placing a variable thickness Course of Materials to restore horizontal and vertical uniformity to existing Pavements, normally continuous throughout the Project.

Lift — The compacted thickness of Material placed by Equipment in a single Pass.

Materials — Any natural or manmade substance specified for use in the construction of the Project or for incorporation into the Work.

Median — The portion of a divided Highway separating traffic traveling in opposite directions.

Multi-Use Path — That portion of the Highway Right-of-Way or a separate Right-of-Way, physically separated from motor vehicle traffic and designated for use by pedestrians, bicyclists and other non-motorized users.

Neat Line — Theoretical lines specified or indicated on the Plans for measurement of quantities.

Organic Soil — A Soil with sufficient organic content to influence the Soil properties.

ODOT Standard Specification — The latest edition of the Specification Document published by the State of Oregon entitled Standard Specifications for Construction, Oregon

Department of Transportation. This document is available from the Oregon Department of Transportation, Salem, Oregon.

OWNER — The public body, authority, or municipal corporation with whom Contractor has either: (1) Entered into the Agreement; or (2) To whom Contractor is obligated under conditions of a public construction permit.

Panel — The width of specified Material being placed by Equipment in a single Pass.

Pass — One movement of a piece of Equipment over a particular location.

Patching — Placing a variable thickness Course of Materials to correct sags, dips, and/or bumps to the existing grade and Cross Section, normally intermittent throughout the Project.

Pavement — Asphalt concrete or portland cement concrete placed for the use of motor vehicles, bicycles, or pedestrians on Roadways, Shoulders, Multi-Use Paths, and parking areas.

Peat — A Soil composed primarily of vegetative matter in various stages of decomposition, usually with an organic odor, dark brown to black color, and a spongy consistency.

Plans — Standard and Supplemental Drawings, and approved unstamped and reviewed stamped Working Drawings.

Project Site — The geographical dimensions of the real property on which the Work is to be performed, including designated contiguous staging areas.

Public Traffic — Vehicular or pedestrian movement not associated with the Contract Work, on a public way.

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.

Roadbed — Completed excavations and embankments for the Subgrade, including ditches, side slopes, and slope rounding, if any.

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

Sand — Particles of Rock that will pass a No. 4 sieve and be retained on a No. 200 sieve.

Shoulder — The part of a Roadbed contiguous to the Traveled Way or Roadway, whether paved or unpaved, for accommodating stopped vehicles, for emergency use and for lateral support of Base and surface Courses.

Silt — Soil passing a No. 200 sieve that is non-plastic or exhibits very low plasticity.

Single Course Construction — A wearing Course only, not including patching or Leveling Courses or partial width Base Course.

Slope — Vertical distance to horizontal distance, unless otherwise specified.

Soil — Accumulations of particles produced by the disintegration of Rock, which sometimes contains organic matter. Particles may vary in size from Clay to Boulders.

Special Provisions — Requirements that are peculiar to the project and that modify the Standard Construction Specifications.

Standard Drawings — The City-prepared detailed drawings for Work or methods of construction that normally do not change from project to project.

Standard Construction 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.

Subbase — A Course of specified Material of specified thickness between the Subgrade and a Base.

Subgrade — The top surface of completed earthwork on which Subbase, Base, Surfacing, Pavement, or a Course of other Material is to be placed.

Substructure — Those parts of a Structure which support the Superstructure, including bents, piers, abutments, and integrally built wingwalls, up to the surfaces on which bearing devices rest. Substructure also includes portions above bearing surfaces when those portions are built integrally with a Substructure unit (e.g., backwalls of abutments). When Substructure and Superstructure elements are built integrally, the division between Substructure and Superstructure is considered to be at the bottom soffit of the longitudinal or transverse beam, whichever is lower. Culverts and rigid frames are considered to be entirely Substructure.

Superstructure — Those parts of a Structure above the Substructure, including bearing devices.

Surfacing — The Course or Courses of Material on the Traveled Way, auxiliary lanes, Shoulders, or parking areas for vehicle use.

Ton — One short ton of 2,000 pounds (Ton, ton, Tn, or T).

Topsoil — Soil ready for use in a planting bed.

Traffic Lane — That part of the Traveled Way marked for moving a single line of vehicles.

Traveled Way — That part of the Highway for moving vehicles, exclusive of auxiliary lanes, berms, and shoulders.

Typical Section — That Cross Section established by the Plans which represents in general the lines to which the Contractor shall work in the performance of the Contract.

Unsuitable Material — Frozen Material, or Material that contains organic matter, muck, humus, peat, sticks, debris, chemicals, toxic matter, or other deleterious Materials not normally suitable for use in earthwork.

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.

Wetlands — Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, vegetation typically adapted for life in saturated Soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Working Drawings — Supplemental Plans, not furnished by the City, that the Contractor is required to submit to the Engineer.

— END OF SECTION —

Section 130—Submittals

Description

130.00 Scope—This work consists of all activities necessary to prepare, review, submit, and manage required submittals.

Requirements

130.40 General—Comply with the following general requirements for submittals:

(a) **Transmittal—**Transmit submittals under transmittal form, which identifies pertinent drawing sheet, detail number, or specification section, as applicable.

(b) **Sequence—**Comply with submittal sequences shown in the progress schedule or schedule of submittals.

(c) **Professional Certification—**When required by Laws and Regulations, affix licensed professional's stamp to submittal documents.

(d) **Shop Drawings**

(1) Present drawings in a clear and thorough manner, drawn accurately to scale. Title each drawing with project name and number. Identify each element of drawings by reference to sheet number and detail or equipment schedule.

(2) Identify field dimensions. Show relation to adjacent or critical features or work or products.

(3) Provide shop drawings on sheet size no larger than 11-inch by 17-inch.

(e) **Product Data**

(1) Submit only pages which are pertinent. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number. Show reference standards; performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.

(2) Modify product data by deleting information that is not applicable to the Work or by marking each copy to identify pertinent data.

(3) Supplement standard information, if necessary, to provide additional information applicable to the Work.

(4) Provide manufacturer's preparation, assembly, and installation instructions.

(f) **Samples—**Submit one of each sample unless otherwise specified elsewhere in the Contract Documents. Samples shall show the quality, type, range of color, finish, and texture of the Material.

(g) **Certificates—**Submit two copies of certificates, signed by an officer or other individual authorized to sign documents on behalf of the company or certifying organization, in accordance with requirements of each specification section and as follows:

(1) For Product Certificates, prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

(2) For Welding Certificates, prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

(3) For Installer Certificates, prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

(4) Manufacturer Certificates, prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

(5) For Material Certificates, prepare written statements on manufacturer's letterhead certifying that Material complies with requirements.

130.41 Project Specific Requirements—Project specific requirements set forth in the Special Provisions.

Measurement

130.80 Measurement—There will be no measurement of Work performed under this Section.

Payment

130.90 Lump Sum Basis—When listed as a separate item in the Schedule of Pay Items, payment for the item "Submittals" will be the lump sum amount. The amounts paid in progress payments will be as stipulated in the Special Provisions.

130.91 Incidental Basis—When not listed in the Schedule of Pay Items, payment for Submittals will be considered incidental to the Work for which no separate payment will be made.

— END OF SECTION —

Section 140—Construction Stakes, Lines, and Grades

Description

140.00 Scope—This work consists of all activities necessary to establish and maintain horizontal and vertical position for facilities to be constructed.

Requirements

140.40 General—The Contractor shall perform no Work until the Engineer establishes field controls. Work performed without field controls will be subject to removal at the Contractor's expense.

(a) **Responsibility for Field Control—**For City Contract Projects, the party responsible for providing field controls is set forth in Article 4.05 of the General Conditions.

(b) **Contractor Responsibilities—**The Contractor shall:

(1) Provide required advance notice of staking requirements as set forth in General Conditions Article 4.05.

(2) Coordinate construction to provide sufficient area for the Engineer to perform surveying work efficiently and safely.

(3) Accurately measure detailed dimensions, elevations, and slopes from the Engineer's stakes and marks.

(4) Set any reference lines for automatic control from the control stakes provided by the Engineer.

140.41 Project Specific Requirements—Project specific requirements are set forth in the Special Provisions.

Maintenance

140.70 Preservation—Contractor shall perform the Work in such a manner as to preserve stakes and mark and shall be financially responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

Measurement

140.80 Measurement—There will be no measurement of Work performed under this Section.

Payment

140.90 Payment—No separate or additional payment will be made for Work performed under this section. However, Owner may deduct from payments due the Contractor all Owner costs incurred to replace stakes and marks negligently or intentionally damaged, removed, or destroyed by the Contractor.

— END OF SECTION —

Section 160—Product Requirements

Description

160.00 Scope—This work consists of activities necessary to store, protect, and handle products to be incorporated into the Work.

Requirements

160.40 Storage and Protection—Store Materials in accordance with manufacturer's instructions to assure preservation of quality and fitness for the work.

(a) **Location—**Stored Materials shall be located so as to facilitate their prompt inspection. Approved portions of the Right-of-Way or other designated areas may be used for storage purposes, including Contractor's Equipment. Any additional space required shall be provided at Contractor's 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 Owner.

(b) **Inspection—**Maintain periodic system of inspection of stored products on scheduled basis to assure that storage facilities are adequate to provide required environmental conditions and that surfaces of products exposed to elements are not adversely affected.

160.41 Owner Furnished Products

(b) **Owner Responsibilities—**When Specifications provide for Owner furnished products, Owner is responsible to do the following:

(1) Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.

(2) Delivery supplier's bill of Materials to Contractor.

(3) Arrange and pay for delivery to site in accordance with Contractor's progress schedule.

(4) Inspect deliveries jointly with Contractor.

(5) Submit claims for transportation damage.

(6) Arrange for replacement of damaged, defective, or missing items.

(7) Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.

(c) **Contractor Responsibilities—**When Specifications provide for Owner furnished products, Contractor is responsible to do the following:

(1) Designate submittal and delivery dates for each product in a schedule of Owner furnished items. Submit this schedule concurrently with the first submission of the progress schedule.

(2) Review shop drawings, product data, samples, and other submittals.

(3) Inspect deliveries jointly with Owner, record shortages, and damaged or defective items.

(4) Handle products at site, including unpacking and storage.

(5) Protect products from damage and from exposure to the elements.

(6) Assemble, install, connect, and adjust products.

(7) Arrange for installation inspections.

(8) Repair or replace items damaged or lost.

Measurement

160.80 Measurement—There will be no measurement of Work performed under this Section.

Payment

160.90 Payment—No separate or additional payment will be made for Work performed under this Section.

— END OF SECTION —

Section 165—Quality of Materials and Workmanship

Description

165.00 Scope—This work consists of general activities necessary to control quality of the finished Work. Additional quality control activities are specified in technical Specifications.

Requirements

165.40 General—Contractor shall be fully responsible for work quality. Passing inspections performed by Owner shall not be deemed to represent that all work is acceptable.

165.41 Materials—Contractor shall incorporate into the Work only Materials conforming to the Specifications and approved by the Engineer. The Contractor shall incorporate into the Work only manufactured products made of new Materials unless otherwise specified. Materials or manufactured products not meeting the Specifications at the time they are to be used are unacceptable and must be removed immediately from the Project Site, unless otherwise directed by the Engineer.

165.42 Labor—Contractor shall employ workers, subcontractors, suppliers and manufacturers who can produce the specified quality; shall supervise and manage the workmanship and site conditions to produce work that complies with the Plans and Specifications; shall comply with industry standards except where more restrictive tolerances, specified requirements, or precise workmanship is specified.

165.43 Inspections—Contractor shall make arrangement for, and ensure that all required or necessary inspections are completed by authorized Inspectors prior to proceeding with subsequent work that either covers or is dependent upon the work to be inspected. Failure to secure inspection(s) and approval(s) shall result in the Contractor being fully responsible to uncover work to the extent necessary for adequate inspection and observation.

165.44 Sampling and Testing—Contractor shall 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 been made and Materials found equal to requirements of the Specifications or to approved samples. In all cases, furnish the required samples in ample time to permit testing of Materials prior to use. Contractor shall provide safety measures and devices to protect those who take the samples.

Measurement

165.80 Measurement—No measurement of quantities will be made for Work performed under this Section.

Payment

165.90 Payment—No separate or additional payment will be made for Work performed under this Section.

— END OF SECTION —

Section 170—Execution Requirements

Description

170.00 Scope—This work consists of planning and executing the Work in the manner consistent with the requirements of this Section.

Requirements

170.40 General—Comply with any project specific requirements set forth on the Plans, in the Special Provisions, and these Specifications.

170.41 Public Safety and Convenience

(a) Conduct work at all times so that there is the least possible interference with or hazard to the traveling public and the affected community.

(b) Provide and maintain safe temporary access to business and residence driveways, and temporary connections with streets, bicycle, and pedestrian facilities.

(c) Locate stockpile Materials and park vehicles and Equipment off the traveled way. If this is not possible, protect the stockpile Materials, Equipment, and vehicles with a barrier as directed.

(d) Use Equipment that is equipped with noise attenuating devices. Prevent construction noise, idling engines, and back-up alarms on motor vehicles in residential areas between 10 p.m. and 7 a.m. of the following day.

170.42 Examination of Existing Conditions—Verify by pothole excavation the location and depth of all known buried facilities where new facilities cross. Identify potential utility conflicts far enough ahead of construction schedule for Engineer to make necessary grade modifications without delaying the Work. Give notice to the Engineer if grade conflicts are found.

170.43 Protecting and Restoring Existing Improvements

(a) Unless designated on Plans to be removed, protect from damage all existing improvements, trees, planted areas, utilities, and other facilities at or near the work site.

(b) Utilities not designated to be relocated or altered by others shall be maintained and protected in place. Maintain utilities which are relocated by others in their relocated positions in order to avoid interference with structures which cross the project work.

(c) Restore or repair any public or private improvement, facility, or structure that is damaged directly or indirectly by or on account of any act, omission, or neglect in the execution of the work. Restore to a condition substantially equivalent to that which existed 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.

(d) Repair or replace all existing improvements that are not designated for removal but which are damaged or removed as a result of Contractor's operations. Repairs and replacements shall be equal to or better than existing improvements, and shall match them in finish and dimension.

170.44 Salvage—Salvage all cover sets, gratings, and other steel components (except reinforcing bars) of removed or abandoned structures. When directed by City Inspector, deliver salvaged Material to City of Salem Public Works Operations Division located at 1410 20th Street SE, otherwise Material will become property of the Contractor.

170.45 Protecting Private Property

(a) Take every reasonable precaution necessary to protect property endangered by construction operations. Unless arrangements are made with the Owner(s) of adjacent private property, confine construction activities to within limits of work areas, Easements, and permitted boundaries.

(b) Do not unreasonably encumber the work areas with Materials and Equipment. Obtain permits for special occupancy and use of the specified work areas from the proper agencies.

(c) Give reasonable notice to residents and businesses on property adjacent to the work to permit the occupants to remove vehicles, trailers, and other possessions as well as to 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.

(d) Protect trees, lawns, and shrubbery (that are not designated to be removed) from damage or injury. Restore or replace trees, lawns, and shrubbery in as nearly the original condition and location as is reasonably possible, if damaged or injured due to construction operations.

170.46 Waste Sites

(a) Waste Materials become the property of the Contractor at point of origin. Unless specifically allowed and subject to the Erosion and Sediment Control Plan, dispose of waste Materials outside and beyond the limits of the Project. Do not dispose of Materials on wetlands, either public or private, or within 300 feet of rivers or streams.

(b) Operate waste sites in such a manner meeting all safety and health requirements of State and local agencies. Sites, operations, or the result of such operations, which create a nuisance problem, or which result in damage to public or private properties will not be permitted.

170.47 Notification and Coordination—Notify all affected Utilities and Government Agencies prior to start of construction. Coordinate necessary relocation work and detours. The following is a partial contact list:

Northwest Natural	Natural Gas
Portland General Electric	Electric Power, Street Lighting
Salem Electric	Electric Power, Street Lighting
CenturyLink	Voice, Data
Comcast	Voice, Data, Television
City of Salem Public Works	Connections to City Utilities
Salem-Keizer Public Schools Transportation Department	School Bus
Cherriots	Salem-Keizer Transit

170.48 Sanitary Facilities—Provide enclosed toilets for employee use, maintain in a neat and sanitary condition. Comply with all applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

170.49 Project Specific Requirements—Project specific requirements are set forth in Special Provisions.

Measurement

170.80 Measurement—No measurement of quantities will be made for Work performed under this Section.

Payment

170.90 Payment—No separate or additional payment will be made for Work performed under this Section.

— END OF SECTION —

Section 171—Work Site Access Encumbrances and Restrictions

Description

171.00 Scope—This work consists of planning and executing the Work in keeping with general and specific work site access encumbrances and restrictions identified on the Plans and also in this Section.

Requirements

171.40 General—Comply with any project specific requirements set forth on the Plans, and in Special Provisions, and the following:

(a) **Downtown Holiday Work Restrictions—**Construction activities that will block streets, parking, or sidewalks in the downtown core shopping area are not permitted between 9 a.m. and 9 p.m. starting on Monday of Thanksgiving week and ending January 5th of every calendar year.

(b) **State Fair Work Restrictions—**Construction activities that disrupt traffic on any of the major routes into Salem, and certain local collector and residential streets within the Fair Exclusion Zone, are not permitted starting on Monday of the week the Fair commences and ending one day after the Fair closes.

171.41 Project Specific Requirements—Project specific requirements are set forth in the Special Provisions.

Measurement

171.80 Measurement—No measurement of quantities will be made for Work performed under this Section.

Payment

171.90 Payment—No separate or additional payment will be made for Work performed under this Section.

— END OF SECTION —

Section 173—Sequence of Construction

Description

173.00 Scope—This work consists of planning and executing the Work in the manner and sequence specified in this Section.

Requirements

173.40 General—Comply with any project specific requirements set forth on the Plans, in the Special Provisions, and the following:

(a) Perform all operations involved in excavating, hauling, and placing of earthwork Materials so no damage or detriment to the completed or partially completed work results.

(b) Protect existing surfaces of all types, which are to remain in place, from being damaged or fouled with undesirable Material.

173.41 Project Specific Requirements—Project specific requirements are set forth in the Special Provisions.

Measurement

173.80 Measurement—No measurement of quantities will be made for Work performed under this Section.

Payment

173.90 Payment—No separate or additional payment will be made for Work performed under this Section.

— END OF SECTION —

Section 175—Preservation of Survey Monuments

Description

175.00 Scope—This work consists of all activities necessary to protect and preserve survey markers shown on Plans or discovered during the course of the Work.

175.01 Definitions—As used in this Section, the following words and phrases shall mean:

City Surveyor—The individual Surveyor, employed by City of Salem and appointed to the position of "City Surveyor".

Survey Monument—Any natural or man-made item specified or identified in a property deed, boundary survey, government document, or other instrument of public record, when the purpose of said item is to mark or reference a property boundary, geographical location, elevation, or other position.

Surveyor—An individual licensed in the state of Oregon as a Professional Land Surveyor

Requirements

175.40 General—Contractor shall preserve Survey Monuments according to this Section and as governed by applicable law.

(a) **Necessary Interference—**Contractor shall notify City Surveyor whenever it is necessary to interfere with or pave over a Survey Monument and shall protect the Survey Monument until the City Surveyor has referenced its location. Do not interfere with the Survey Monument until authorized by the City Surveyor.

(b) **Removal or Destruction—**If a Survey Monument is removed or destroyed without being referenced; Contractor shall notify City Surveyor and shall cause a Surveyor to reference and replace the Survey Monument in compliance with ORS 209.150.

175.41 Fees and Charges—Contractor shall pay all applicable fees and charges that may be assessed by both City and County in compliance with ORS 209.140-150.

— END OF SECTION —

Section 180—Progress Schedule

Description

180.00 Scope—This work consists of planning, preparing, maintaining, and updating a project work schedule to enable both the Contractor and the Owner to plan, coordinate, appraise, document, and control their respective Contract responsibilities. Contractor shall maintain and update the Progress Schedule in accordance with the requirements in SCS 180, however these schedule updates do not constitute written notice of a claim as required by the Contract General Conditions Article 10.

180.01 Definition and Standards

(a) **Definitions—**As used in this Section ,the following words and phrases shall mean:

Activity—Any task or portion of a project which takes time to complete.

Duration (D)—The estimated time to perform an activity.

Milestone—A marker in a network which is typically used to mark a point in time or to denote the beginning or end of a sequence of activities. A milestone has zero duration, but otherwise functions in a network as if it were an activity.

Early Start (ES)—The earliest time an activity can start.

Early Finish (EF)—The earliest time an activity can finish. It is equal to the early start time plus the duration of the activity. $EF = ES + D$

Critical Path Method (CPM)—A method of project planning that identifies discrete work activities, their estimated durations, and their necessary sequencing.

Critical Path—The longest interconnected path of activities through the network. Its length determines the overall duration of the project. All activities on the critical path have zero float times. A project may have more than one critical path.

Critical Activity—An activity that is on the critical path of a project network.

Late Start (LS)—The latest time an activity can be started without delaying the completion of the project.

Late Finish (LF)—The latest time an activity can be finished without delaying the completion of the project. $LF = LS + D$

Total Float (TF)—The amount of time an activity may be delayed without delaying the completion of the project.

Free Float (FF)—The amount of time an activity may be delayed without delaying the early start time of any following activity.

Resource—The people, materials, equipment, or services required to complete a project activity.

Start-Start (SS)—The network logic relationship whereby the successor activity cannot start until the predecessor activity is started.

Finish-Start (FS)—The network logic relationship whereby the successor activity cannot start until the predecessor activity is finished.

Finish-Finish (FF)—The network logic relationship whereby the successor activity cannot finish until the predecessor activity is finished.

Start-Finish (SF)—The network logic relationship whereby the successor activity cannot finish until the predecessor activity is started.

(b) **Critical Path Method (CPM) Schedule Standards—**The following standards apply for preparing, progressing, and revising CPM schedules using Project Management/CPM scheduling software:

(1) **Substantial Completion Milestone—**A milestone activity (zero duration) shall be used to identify when the project will reach Substantial Completion.

(2) **Successors Required—**All activities, except for the "finish" milestone, shall be connected to successor activities.

(3) **Predecessors Required—**All activities, except for the "start" milestone, shall be connected to predecessor activities.

(4) **Calendars—**The use of multiple work calendars for the same project is prohibited.

(5) **Leads and Lags—**The use of leads and lags on activity interrelationships shall be minimized. Whenever possible, use a separate activity with an estimated duration instead.

(6) **Prohibited Network Logic—**The use of SS and FF relationships between activities in a network shall be avoided whenever possible. The use of SF interrelationships between activities is prohibited.

(7) **Retained Logic Prohibited—**Computer automated updates of out-of-sequence work activities are prohibited. Instead, the network logic shall be revised whenever work is performed out of sequence.

(8) **Assigned Constraints—**The use of assigned constraints to activities shall be minimized and shall not be used unless approved by the Project Manager. When allowed, the schedule shall clearly identify the constraint.

Required Submittals

180.10 Initial Progress Schedule—Submit no later than dates set forth in the Contract General Conditions.

180.11 Detailed Progress Schedule—Submit prior to Contractor's first application for progress payment.

180.12 Updated Progress Schedules—Submit to accompany all applications for progress payments and also in support of any request for Contract time extensions.

Requirements

180.40 General—Unless otherwise provided in the Contract Special Provisions, Contractor may provide either a Bar Chart-type schedule or a CPM-type schedule. The content of progress schedules shall, at a minimum, include the following:

(a) **Owner Controlled Activities—**Include activities to represent submittal review periods or any such other work activities to be performed by the Owner that may potentially delay the Contractor if not performed in a timely manner.

(b) **Traffic—**Account for passage and handling of traffic, include notifications.

(c) **Submittal Preparation—**Activities for submittal/shop drawing preparation.

(d) **Delivery Lead Time—**Include delivery activity if lead time exceeds 21 days.

(e) **Utilities—**Activities representing utility relocation.

(f) **Construction—**All construction work activities described in common terminology, the durations of which are verifiable by resource allocation, or common units of measure.

180.41 Bar Chart

(a) **Initial Progress Schedule—**Contractor shall prepare a Preliminary Progress Schedule which:

(1) Includes a tabular listing of work activities and activity durations.

(2) Clearly indicate the times (number of days or dates) for starting and completing the various stages of Work including, if any, the principle events having intermediate completion dates prior to Substantial Completion.

(b) **Detailed Progress Schedule—**Contractor shall prepare a detailed progress schedule which:

(1) Conforms to the Contract times set forth in the Agreement, together with any work site restrictions or specified work sequencing.

(2) Include a tabular listing of the following:

A. Discrete project activities and activity durations.

B. Planned start and finish dates for each activity.

C. Percent complete for each activity.

(3) Include a graphical (bar chart) representation of planned work activities conforming to the following:

A. The bar chart is time-scaled in appropriate detail as determined by the Project Manager.

B. The activity bars are clearly identified or otherwise clearly associated with the tabular listing by being on the same page.

(4) Include the project name, Contractor name, date of schedule, and a legend of symbols.

(c) **Updated Progress Schedules—**Contractor shall diligently maintain and update status of the Progress Schedule in accordance with the following:

(1) **Work Sequence—**Update the schedule to reflect the most current work sequencing plan and activity duration estimates.

(2) **Status Date—**Identify the effective date of activity progress.

(3) **Activity Progress—**Show progress on activities that have started but are not yet complete by estimating the remaining duration or percent complete.

(4) **Change Orders—**Add new activities to represent additional work authorized by change orders.

(5) **Excusable Delays—**Add new activities to represent excusable delays as defined in the General Conditions.

180.42 CPM Schedule

(a) **Initial Progress Schedule—**Contractor shall prepare a Preliminary Progress Schedule using the Critical Path Method scheduling technique. The Preliminary Progress Schedule shall:

(1) Include a tabular listing of work activities, activity interrelationships and activity durations.

(2) Clearly indicate the times (number of days or dates) for starting and completing the various stages of Work including, if any, the principle events having intermediate completion dates prior to Substantial Completion.

(b) **Detailed Progress Schedule—**Contractor shall prepare a detailed progress schedule using the Critical Path Method schedule technique in conformance to the standards set forth in SCS 180.01. The Progress Schedule shall:

(1) Conform to the Contract Times set forth in the Agreement, together with any work site restrictions or specified work sequencing.

(2) Include a tabular listing of the following:

A. Discrete project activities, activity predecessors and successors, activity interrelationship types and activity durations.

B. Planned start and finish dates for each activity.

C. Remaining Duration for each activity.

D. Total Float for each activity.

(3) Include a graphical (bar chart) representation of planned work activities conforming to the following:

A. The bar chart is time-scaled in appropriate detail as determined by the Project Manager.

B. The activity bars are clearly identified or otherwise clearly associated with the tabular listing by being on the same page

C. The critical path is clearly discernible by being printed in either a different color or with a different graphical pattern than non-critical activities.

(4) Include the project name, Contractor name, date of schedule, and a legend of symbols.

(5) When requested, include a graphical (histogram) representation of selected resource allocations.

(c) **Updated Progress Schedules—**Contractor shall diligently maintain and update status of the Progress Schedule in accordance with the following:

(1) **Network Logic—**Update the network logic to reflect the most current work sequencing plan and activity duration estimates.

(2) **Status Date—**Identify the effective date of activity progress. This is usually earlier than the date the schedule is printed.

(3) **Activity Progress—**Record actual start and finish dates for activities. Show progress on activities that have started but are not yet complete by estimating the remaining duration.

(4) **Change Orders—**Add new activities to represent additional work authorized by change orders.

(5) **Excusable Delays—**Add new activities to represent excusable delays as defined in the General Conditions.

Measurement

180.80 Measurement—There will be no measurement of Work performed under this Section.

Payment

180.90 Lump Sum Basis—When listed as a separate item on Schedule of Pay Items, payment for the item Progress Schedule will be the Contract lump sum amount. The amounts paid for Construction Schedule in the Contract progress payments will be as follows:

(a) When Contractor prepares and submits a Progress Schedule conforming to the standards and requirements set forth in this Section, 50 percent of the lump sum amount for Progress Schedule will be paid.

(b) The remaining 50 percent will be paid in equal progress payments throughout the remaining Contract duration.

180.91 Incidental Basis—When not listed in Schedule of Pay Items, payment for Progress Schedule will be considered Incidental to the Work for which no separate payment will be made.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 180 Standard Pay Items	Unit of Measure
Progress Schedule (Bar Chart)	LS
Progress Schedule (CPM)	LS

Section 185—Contractor Acquired Permits

Description

185.00 Scope—This work consists of preparing required applications, supplemental drawings, Plans, and all things necessary for Contractor to obtain permits required by jurisdictions having authority.

Requirements

185.40 General—Contractor shall stay fully informed of all permits required by various jurisdictions having authority over the Work, and shall also bear all costs of fines or claims arising from, or based on, the violation of permit requirements. While not intended to be inclusive of all permit requirements for which Contractor may be responsible, the following requirements apply:

(b) **Public Right-of-Way—**Prior to commencement of construction work within or connecting to the public Right-of-Way, Contractor shall obtain necessary permits from proper jurisdiction.

(1) Inside City limits, obtain a closure permit from City of Salem prior to closing any street, travel lane, alley, or sidewalk.

(2) On Oregon State Highway routes, both inside and outside City limits, obtain permit from ODOT.

(3) Outside City limits, obtain permit from appropriate County authority.

(c) **Plumbing—**Obtain permits from City of Salem Permit Application Center for the following:

(1) Private sewer or storm drains to be constructed on private property.

(2) Water service reconnections on the private side of a City water meter.

(d) **Electrical—**Obtain permits from City of Salem Permit Application Center for the following:

(1) Electrical connections for street lights and traffic signals and beacons.

(e) **Blasting—**Obtain permits from City of Salem Fire Department when inside City Limits.

(f) **Tree—**Obtain permits from City of Salem Parks Division to plant, remove, or prune trees in the public Right-of-Way.

Measurement

185.80 Lump Sum Basis—There will be no measurement of work performed under this Section.

Payment

185.90 Lump Sum Basis—When listed as a separate pay item on the Schedule of Pay Items, payment for the item "Permit Requirements" will be the Contract lump sum amount.

185.91 Incidental Basis—When not listed in the Schedule of Pay Items, all "Permit Requirements" will be considered Incidental to the work for which no separate payment will be made.

— END OF SECTION —

Section 187—Project Meetings

Description

187.00 Scope—This work consists of Contractor's attendance and participation in regularly scheduled project meetings.

Requirements

187.40 Requirements—The Special Provisions will identify requirements, if any, for regularly scheduled project meetings.

Measurement

187.80 Measurement—No measurement of quantities will be made for work performed under this Section.

Payment

187.90 Payment—No separate or additional payment will be made for Project Meetings.

— END OF SECTION —

Section 190—Measurement of Pay Quantities

Description

190.00 Scope—Unless otherwise provided in the Contract, pay quantities for accepted Work will be measured according to the United States standard measure.

(a) **Rounding—**Unless otherwise specified in the Contract, all quantity computations will be rounded according to the following convention:

(1) The final significant digit will not be changed when the succeeding digit is less than 5.

(2) The final significant digit will be increased by 1 when the succeeding digit is 5 or greater.

(b) **Limitations—**The measurement provisions contained in the Specifications for each Pay Item will supplement or modify the above convention by:

- imposing measurement limitations.
- describing measurement or computation procedures.
- giving conversion factors or adjustment conditions.
- providing for determination of reasonably accurate and representative Pay Item quantities.
- providing for the Engineer's verification of any measurements required or allowed to be made by the Contractor.

190.10 Measurement Guidelines—Unless otherwise specified, measurement of quantities will be made on the following bases:

(a) **Unit Basis—**Unit will be each, unless otherwise specified and will be determined by actual count of units in place.

(b) **Length Basis—**Length will be feet or mile, unless otherwise specified, and will be determined by measuring the length at least to the nearest 0.1 foot or at least to the nearest 0.1 mile, as applicable. Measurements will be limited to the dimensions shown or specified.

(c) **Area Basis—**Area will be square foot, square yard, or acre, unless otherwise specified in the Contract and will be determined by measuring the width and the length (or height) at least to the nearest 0.1 foot and computed at least to the nearest 0.1 square foot, nearest 0.1 square yard, or nearest 0.1 acre, as applicable unless otherwise specified in the Contract.

(d) **Weight Basis—**Weight will be pound or ton, unless otherwise specified in the Contract and will be determined as follows:

(1) **Pound—**Pound weight will be determined by the net weight identified on the manufacturer's packaged labels, subject to periodic check weighing. Weight by pound will be measured at least to the nearest 1.0 pound unless otherwise specified in the Contract.

(2) **Ton—**Ton weight will be determined on Contractor-provided scales unless otherwise allowed by the Specifications. Weight by ton will be measured at least to the nearest 0.01 ton unless otherwise specified by the Contract.

(3) **Bulk Materials—**If bulk Materials are shipped by truck or rail, the supplier's shipping invoice with net scale weights, or volumes converted to weights, may be used for Pay Item quantity determination in place of weights determined on the Contractor-provided vehicle scales. Shipping invoice weights of the supplier's truck or transport shall be subject to periodic check weighing on the Contractor's vehicle sales, or other scales designated, according to SCS 190.40. If the check weight is less than the supplier weight by more than 0.4%, the discrepancy will be resolved by the Engineer. No payment will be made:

- for quantities in excess of the supplier weight.

- when Materials have been lost, wasted, or otherwise not incorporated into the Work.

- for additional hauling costs resulting from the check weighing.

(e) **Volume Basis—**Volume will be in-place measure or gallons, unless otherwise specified, and will be measured at least to the nearest 0.1 cubic yard, nearest 1.0 gallon, as applicable, unless otherwise specified. Quantities will be determined at the point of delivery, with no allowance for settlement of Material during transit. When required to facilitate measurement, the vehicle load shall be leveled at the point of delivery.

(1) **Truck Measure—**Truck measure will be the measured and calculated maximum "water level" capacity of the vehicle. Payment will not be made for Material in excess of the maximum "water level" capacity. Deductions will be made for loads below the maximum "water level" capacity.

(2) **Bituminous Materials—**When bituminous Materials are measured by volume, the volume will be measured at 60°F or will be corrected to the volume at 60°F using the correction factors found in the MFTP (ODOT TM 321).

(f) **Time Basis—**Time will be hour, Day, or year, unless otherwise specified, and will be measured to at least the nearest 0.5 hour, nearest 1.0 Day, or nearest 1.0 year, as applicable, unless otherwise specified.

(g) **Standard Manufactured Items—**If standard manufactured items, such as fence, wire, plates, rolled shapes, pipe, conduit and other similar items are specified by properties such as gauge, unit weight, or section dimensions, the manufacturing tolerances established by the industry involved will be accepted unless more stringent tolerances are cited in the Contract.

(h) **Lump Sum Basis—**Lump sum, when used, means the Work described shall be completed and accepted without measurement unless changes are ordered in writing by the Engineer.

Requirements

190.40 Contractor to Provide Vehicle Weigh Scales

(a) **General—**If the Specifications require measurement by weighing on vehicle weigh scales, the Contractor shall provide vehicle weigh scales and shall transport Materials to the scales. Subject to the Engineer's approval, weights may be determined by plant or hopper scales or commercial scales located in the vicinity of the Project according to SCS 190.41. Unless otherwise specified, Pay Items to be measured by weight shall include all Contractor costs for providing, maintaining, inspecting, and testing scales; for furnishing appropriate weigh tickets; for self-printing scales; and for transporting Materials to the scales or to check weighing.

(b) **Requirements—**Contractor provided vehicle weight scales shall be in full compliance with requirements set forth in ODOT 00190.20(b)-(f).

190.41 Plant Scales

(a) The Contractor, with the Engineer's written approval, may weigh plant-mixed Materials on scales that have either:

(1) An automatic weight batching and mixing control printer system; or

(2) A weigh hopper printer system.

(b) Any additional costs resulting from the use of these scales shall be borne by the Contractor. Check weighing will be done according to ODOT 00190.20(f).

(c) Except for Specifications regarding approaches, the Contractor's use of plant scales shall comply with all provisions of ODOT 00190.20.

(d) The Engineer's approval for the Contractor's use of plant scales to determine pay weights will be rescinded if check weighing or scale inspections indicate the scales do not consistently determine weights within the tolerances allowed by state law.

— END OF SECTION —

Section 195—Closeout Procedures

Description

195.00 Scope—This Work consists of preparing and providing documentation necessary prior to Final Acceptance and commencement of the required correction period.

195.01 Definitions—As used in this Section, the definition of the term "Engineer" is dependent on the context under which Work is being performed, as classified below:

(a) For privately financed public improvements being constructed under a permit with City of Salem, "Engineer" refers to the licensed Professional Engineer in "responsible charge" of the construction Plans, whose professional seal appears on the construction drawings.

(b) For Work being performed under Contract with City of Salem, "Engineer" is defined in the General Conditions of the Construction Contract.

Requirements

195.40 Contractor Requirements—Contractor shall:

(a) Notify City when it believes the Work is completed and ready for Final Inspection.

(b) Promptly correct defective Work, or if the Work has been rejected, remove it from the project and replace it with Work that is not defective.

(c) Submit marked-up construction drawings to Engineer, annotated to depict how as-constructed conditions vary from design drawings.

(d) Submit to City:

(1) Required bonds

(2) Maintenance and Operating Instructions (if any)

(3) Special Guarantees (if applicable)

195.41 City Requirements—City will:

(a) Promptly notify Contractor of defective Work that must be corrected or replaced prior to Final Acceptance.

(b) Provide Contractor with City approved bond forms.

(c) Provide written notice of Final Acceptance.

— END OF SECTION —

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.

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.

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.***

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.

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.

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.

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.

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.

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.

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.

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.

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 701 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.

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 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 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.

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.

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.

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***.

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.
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.

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 individual 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.

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.

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 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 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 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.

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.

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 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"

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 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.

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***.

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.

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 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.

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.

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.

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.

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

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

[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.

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:

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

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 *

*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.

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.

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.

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***.

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.

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.

207 Erosion Prevention and Sediment Control

207.0.00 DESCRIPTION

This work consists of implementing structural and non-structural Best Management Practices (BMPs) for the purpose of controlling soil erosion by wind or water and keeping eroded sediments and other construction-generated pollutants from moving off project sites.

Requirements described in these Specifications and shown on the plans are part of the project Erosion Prevention and Sediment Control (EPSC) Plan and are the minimum for all project construction sites and conditions.

207.0.30 STANDARDS

The provision of these Specifications shall be followed in conjunction with the City of Salem Revised Code (SRC) Chapter 75, Standard Plans, and the Design Standards. In the instances where there are discrepancies between these references, the more stringent requirements shall take precedence. Per SRC 75, no person shall cause or suffer visible and measureable erosion or sediment which enters or is likely to enter the public storm drainage system, drainage courses, or wetland.

Visible and measurable erosion or sediment means:

1. Deposits or tracking of mud, dirt, sediment, or similar material exceeding ½ cubic foot in volume, on public or private streets, adjacent property, or into the storm drainage system or a drainage course, either by direct deposit, dropping, discharge, or as a result of the action of erosion; or

2. Evidence of concentrated flows of water over bare soils, turbid or sediment-laden flows, or evidence of on-site erosion such as rivulets on bare soil slopes where the flow of water is not filtered or captured before leaving the site; or

3. Earth slides, mud flows, earth sloughing, or other earth movement in excess of ½ cubic foot in volume, which leaves the site.

Provide continuous erosion prevention and sediment control until permanent erosion control is established. Take all responsible steps to minimize or prevent any erosion and transport of sediment. Install and maintain all erosion and sediment control BMPs to function as required. If planned or installed BMPs are not effective, modify or change them so they are effectively functioning. Effective functioning is defined as preventing erosion, controlling runoff, or controlling sediment in each location where a measure is needed so all erosion-related impacts of site construction are fully mitigated as required.

207.0.31 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Comply with Federal, State, and local laws, rules, and regulations, and the applicable National Pollutant Discharge Elimination System (NPDES) 1200-C Permit, 1200-CA Permit, MS4 Permit, and all other Permits applicable to the project. A copy of the City's General Construction 1200-CA Permit and MS4 Permit, if applicable to the project, are available from the City.

207.1.00 REQUIRED SUBMITTALS

207.1.01 MODIFICATIONS TO APPROVED EPSC PLANS

Additional or revised erosion and sediment control features not shown on the initial EPSC plan may be required depending on the Contractor's methods of operation, schedule, and weather conditions. If modifications to the approved EPSC plan are necessary or desired, the Engineer of Record shall submit updated signed copies to the City for review and approval prior to the proposed ground disturbing activities. The revised EPSC plans shall meet the requirements of the City's Design Standards.

207.1.02 EPSC MANAGER

Designate and provide a representative that will conduct the required inspections as the EPSC Manager with the following minimum qualifications:

1. Knowledgeable in principles of and practice of erosion prevention and sediment control.

2. Skilled in assessing site conditions and effectiveness of erosion prevention and sediment control BMPs used.

3. Authority to immediately mobilize necessary personnel to correct and modify erosion prevention and sediment control BMPs, as required.

Provide the EPSC Manager's name, qualifying experience, and 24-hour contact phone number prior to ground disturbing activities. If changes to the appointment of the EPSC Manager occur during the term of the Contract, provide written notice to the City within three working days.

207.1.03 MONITORING RECORDS

For sites requiring a 1200-C permit or coverage under a 1200-CN permit, upon request from the City, provide copies of EPSC inspection records that meet permit requirements.

207.2.00 MATERIALS

207.2.01 PLASTIC SHEETING AND ANCHORING

Furnish plastic sheeting, slope and stock pile protection, anchoring system, and sediment barrier at toe of slope meeting the following requirements:

1. Plastic Sheeting—Minimum 6 mil thick polyethylene plastic sheeting.

2. Anchoring System—Minimum 65 pounds, non-puncture type anchor weights, secured with cords or ropes of adequate strength to support the weights on the slope meeting the requirements of Standard Drawing No. 908.

207.2.02 CHEMICAL SOIL BINDER AND TACKIFIER

Furnish a liquid stabilizing emulsion meeting the requirements of SCS 207.2.03.

207.2.03 CHEMICAL DUST CONTROL

Furnish non-toxic materials with no adverse effect on soil structure or establishment and growth of vegetation. Furnish one of the following materials and apply as directed by the manufacturer's instructions.

207.2.03A Liquid Stabilizer Emulsion

A tackifier of liquid and polyvinyl acetate polymers with emulsion resins containing not less than 55 percent total solids by weight. Do not use tackifiers containing polyacrylates or polyvinyl acrylics.

207.2.03B Dry Powder Tackifier

A tackifier consisting of one or more active hydrocolloids from natural plant sources which hydrates in water and blends with other slurry materials, and upon application and drying tacks the slurry particles to the soil surface, and exhibits no growth or germination inhibiting factors. Provide stabilizing emulsion in a dry powder form that may be re-emulsifiable and consists of a processed organic adhesive derivative of one of the following:

1. Gumbinder derived from guar (Cyamopsis tetragonoloba)
2. Gumbinder derived from plantain (Plantago insularis)

207.2.04 NON-CHEMICAL DUST CONTROL

Furnish water meeting the requirements of SCS 302.2.01.

207.2.05 MULCHING

Furnish mulch materials free of all weed or plant seeds and containing no substances detrimental to plant life. The kind of mulch material(s) acceptable for use will be shown on the plans, or will be as approved. Furnish mulch meeting the following requirements:

207.2.05A Hydromulch

Furnish cellulose fiber produced from virgin wood, straw, or paper fiber product from the ODOT Qualified Products List (QPL).

Furnish wood or straw mulch processed so the fibers remain uniformly suspended under agitation in water and the fibers have moisture-absorption and percolation properties. Ship hydromulch in packages of uniform weight, plus or minus 5 percent, and labeled with the manufacturer's name and air-dry weight.

207.2.05B Straw

Furnish straw mulch for non-hydroseeding applications from bentgrass, bluegrass, fescue, or ryegrass singly or in combination. Cereal grain straw from barley, oat, or wheat is not allowed.

Provide straw that is not moldy, caked, decayed or of otherwise low quality, and certified from the supplier that the straw is free of noxious weed seeds or plant parts. Acceptable documentation is any one of the following:

1. The straw source is an "Oregon Certified Seed" field.

2. The straw is certified by a recognized program accepted by the Oregon Department of Agriculture as being weed free.

3. Seed lab test results of seed harvested from the straw meet minimum Oregon Certified Seed quality for weed seed content.

207.2.05C Compost Mulch

Furnish commercially manufactured medium compost material meeting the following requirements:

1. Is processed through thermophilic composting meeting the EPA's definition of "Process to Further Reduce Pathogens".

2. Is from a commercial compost facility that holds a current DEQ composting permit or is registered with DEQ as a composting facility.

3. Meets the requirements of the U.S. Composting Council (USCC) and its Seal of Testing Assurance (STA) program.

4. Contains a minimum 65 percent by volume of the following recycled plant waste:

   A. Source-separated yard and garden wastes

   B. Wood wastes

   C. Agricultural crop residues

   D. Wax-coated cardboard

   E. Pre-consumer vegetative food wastes

   F. Other similar source-separated materials that the DEQ has determined to have a comparable low level risk in hazardous substances, human pathogens, and physical contaminants

   G. Manure or biosolids-based composts when approved

5. Meets the following compost particle size and media parameters:

Compost Particle Size

Sieve Size	Fine *	Medium *	Course **
	Percent Passing (By Dry Weight)		
3”	100	100	100
1”	99-100	95-100	90-100
¾”	99-100	95-100	70-100
⅝”	95-100	90-100	70-100
½”	80-100	70-100	60-100
¼”	75-100	70-90	30-60
* Maximum 3 inch particle length ** Maximum 6 inch particle length			

Media Parameters

Test	Test Method	Requirements		
Physical Contaminants*	TM ECC** 03.08-A	Less than 1.0%		
Organ Matter	TM ECC** 05.07-A	35% (Minimum)		
pH	TM ECC** 04.11-A	6.0 to 8.5		
Soluble Salt Concentration	TM ECC** 04.10-A	5 dS/m (Maximum)		
Total Carbon Total Nitrogen	TM ECC** 04.02-D TM ECC** 04.02-D	**Carbon/Nitrogen Ratio**		
		Fine	**Medium**	**Coarse**
		<25:1	<30:1	<35:1
Stability	TM ECC** 05.08-B	≤8		
Maturity	TM ECC** 05.05-A	80% or Greater		
Moisture Content	TM ECC** 03.09-A	35-60% (Wet Weight)		

* Man-made Inert
** Test Methods for Evaluation of Compost and Composting

207.2.06 EPSC SEEDING MIX

Furnish an EPSC grass seed mix that is Oregon Certified Seed meeting one of the following mixture requirements or an approved equal:

1. Dwarf grass mix (low height, low maintenance) consisting of Dwarf Perennial Ryegrass (80 percent by weight), Creeping Red Fescue (20 percent by weight), applied at a rate of 100 pounds minimum per acre.

2. Standard Height Grass Mix consisting of Annual Ryegrass (40 percent by weight), Turn-type Fescue (60 percent by weight), applied at a rate of 100 pounds minimum per acre.

207.2.07 SLOPE AND CHANNEL LINER MATTING

Matting is organized according to categories from Texas DOT/TTI Hydraulics and Erosion Control Laboratory. Furnish matting from the QPL that meets the following performance criteria categories:

1. Type A—Slope protection mat for clay soil slopes 1V:3H or flatter.

2. Type B—Slope protection mat for sandy soil slopes 1V:3H or flatter.

3. Type C—Slope protection mat for clay soil slopes steeper than 1V:3H.

4. Type D—Slope protection mat for sandy soil slopes steeper than 1V:3H.

5. Type E—Flexible channel liner for shear stress from 0 to 2 pounds per square foot.

6. Type F—Flexible channel liner for shear stress from 0 to 4 pounds per square foot.

7. Type G—Flexible channel liner for shear stress from 0 to 6 pounds per square foot.

8. Type H—Flexible channel liner for shear stress from 0 to 8 pounds per square foot.

207.2.07A Check Slot and Anchor Trench

Furnish check slot and anchor trench material for matting meeting the following requirements:

1. Class 50 Riprap—Class 50 riprap meeting the requirements of SCS 610.2.04.

2. Soil—Soil, selected as directed from specified excavations, and containing no particle with any dimension greater than 3 inches, or other unsuitable material.

207.2.07B Fasteners

Furnish U-shaped wire staples for matting meeting the following requirements:

1. Staples—⅛-inch diameter steel wire staples, 1½-inch "U" width with a length of 6 inches for use in compacted soils, and 12 inches for use in loose soils. If these specifications conflict with manufacturer's recommendations, comply with the more stringent of the two.

207.2.08 FIBER ROLLS (WATTLES)

Furnish fiber rolls (wattles) from the QPL made of rice or coconut straw material. Wrap the straw to a minimum density of 2.75 pounds per cubic foot in tubular plastic netting meeting the following requirements:

1. 9 to 10 inch diameter size

2. Minimum strand thickness of 0.003 inch

3. Knot thickness of $\frac{1}{16}$ inch

4. Weight on 0.35 ounces per ±10 percent

5. Made from 85 percent high density polyethylene, 14 percent ethyl vinyl acetate, and 1% color for UV inhibition

207.2.09 BIOFILTER BAGS

Minimum size 18-inch x 8-inch x 30-inch plastic mesh bags with ½-inch openings filled with approximately 45 pounds of clean, non-toxic, 100% recycled wood product waste containing no fine materials or sediments, or as shown on the standard drawings for this device.

207.2.10 COMPOST FILTER BERM

Furnish a compost filter berm with sock material meeting the following requirements:

1. 5 mil thick woven tubular mesh netting consisting of continuous HDPE filament or polypropylene material with ⅜-inch openings or 100 percent biodegradable burlap of coir as shown.

207.2.11 TEMPORARY SLOPE DRAINS

Furnish ABS, PVC, or Corrugated Aluminum Alloy pipe meeting the requirements of SCS 402.2.00. If runoff area is not established, use 12-inch diameter pipe. Flared End Sections shall be prefabricated of the same material and comply with the same material specifications as the Temporary Slope Drain.

207.2.12 FLOW SPREADER

Furnish an unweathered, hard, angular, durable, free draining aggregate for flow spreaders that is visibly well graded from coarse to fine, with a maximum size between 6 inches and 3 inches.

Perforated pipe may be used as an alternative level flow spreader.

207.2.13 SEDIMENT FENCE

Furnish sediment fence materials from the QPL meeting the following requirements:

Geotextile Property	**ASTM Test Method**	**Unit**	**Geotextile Property Requirements**		
			Supported	**Unsupported**	
			—	**Elongation* ≥50%**	**Elongation* ≤50%**
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	90 90	120 100	120 100
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	30	30	30
Permittivity (minimum)	D 4491	sec^{-1}	0.05	0.05	0.05
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	70	70	70

***** Measured according to ASTM D 4632.

207.2.14 SILT SACK

Furnish prefabricated silt sack filter inserts manufactured specifically for collecting sediment in drainage inlets, listed on the QPL, and meeting the requirements of Standard Drawing No. 913. Include handles and fasteners sufficient to keep the insert from falling into the inlet during maintenance and removal of the insert from the inlet.

207.2.15 SAND BAGS

Furnish durable, weather-resistant bags woven tightly enough to prevent leakage of filler material. Fill bags with at least 75 pounds of firmly-packed fine PCC ⅜"–0 aggregate or round $^{3}/_{8}$"–$^{3}/_{16}$" pea gravel.

207.2.16 CONCRETE MANAGEMENT FACILITY

Furnish a watertight concrete management facility designed to accept the anticipated concrete waste and washout needs for the project. If using the design shown on Standard Plan 917, use materials meeting the following requirements:

1. Straw Bales—Standard 45-65 pound rectangular straw bales that are wire bound or string tied, from bentgrass, bluegrass, fescue, ryegrass, barley, oat, or wheat, singly or in combination. Provide bales that are not moldy, caked, decayed, or otherwise low quality.

2. Plastic Sheeting—Furnish plastic sheeting meeting the requirements of SCS 207.2.01.

3. Stakes—Minimum 2-inch x 2-inch x 36-inch untreated wood stakes (wood stain is acceptable) or 36-inch, Number 4 J-bars.

4. Sand Bags—Furnish sand bags meeting the requirements of SCS 207.2.15.

207.3.00 EQUIPMENT

207.3.01 STREET CLEANING EQUIPMENT

Provide self-propelled street cleaning equipment meeting or exceeding the following requirements:

1. Heavy duty mechanical broom sweeping and vacuuming equipment with dust suppression, capable of thoroughly cleaning sediment and debris from paved surfaces.

2. Equipped with gutter brooms and capable of sweeping an 8-foot-wide path (as measured from the outside edge of the gutter broom) in a single pass.

3. Equipped with a 3 cubic yard minimum hopper capacity.

4. Equipped with fully functioning warning devices and lights for safe operation, meeting all vehicle operation requirements of State of Oregon Department of Motor Vehicles.

207.4.00 CONSTRUCTION

207.4.01 INSTALLATION

Install erosion prevention and sediment control BMPs as shown and according to the approved EPSC plan. Install these BMPs before performing clearing, grading, or other land-altering activities. Ensure that sediment or sediment laden water does not leave the Project boundaries, enter drainage systems or waterways, or violate applicable water quality standards.

Included in this work are both non-structural BMPs, such as limiting clearing of vegetation, and structural BMPs, such as various kinds of physical devices or materials like sediment fences. BMPs may be temporary or they may be permanent when required to continue functioning after the Contract ends. Coordinate temporary erosion control BMP with permanent BMPs and all related project work.

207.4.02 PHASING AND SEQUENCING OF GROUND DISTURBANCE AND GRADING AND PROTECTION OF EXISTING VEGETATION

Phasing of ground disturbance and grading, and protection of existing vegetation are the most effective methods for reducing site erosion. Ground disturbance activities shall be phased in such a way to minimize the area and duration of exposed soils. Before construction, existing vegetation including important trees and associated rooting zones and critical riparian areas shall be protected to the maximum extent feasible and areas of protection shall be clearly delineated in the field with sufficient buffers to enhance protection.

207.4.03 SENSITIVE AREA PROTECTION

Any project that disturbs areas near or within a stream or its associated buffer, a wetland or its associated buffer, or within 50 feet of a lake, pond, or other water body, has the potential to seriously damage water resource sensitive areas. Unless otherwise permitted by the appropriate authority, work shall be prohibited in sensitive area. If work poses potential impact to sensitive areas, the Contractor shall protect these areas from sediment and pollutants with the appropriate BMPs.

207.4.04 WORK RESTRICTIONS

Do not start construction activity until the initial erosion inspection has been completed by the City and deficiencies have been corrected. The following work restrictions also apply:

207.4.04A Disturbance Limits

Delineate all construction site-clearing limits with high visibility markings and do not disturb areas outside the clearing limits. Maintain the markings during Project construction.

207.4.04B Perimeter Controls

Construct perimeter controls including sediment fences, ditches, filter berms in flatter areas, and other methods for channeling flows. Install all appropriate perimeter controls before beginning any ground disturbing activities.

207.4.04C Wet Weather Season

The Wet Weather Season extends from October 15 through April 30, as defined by the City's MS4 Permit. During this time period, the duration and amount of site disturbance should be minimized.

Wet weather season work requires more rigorous measures to be employed and shall be reflected in the EPSC plan. The following items are additional items required during the wet weather season:

1. Soil stockpiles shall be fully covered with secured plastic sheeting or two inches of straw much, and isolated with sediment BMPs at the end of each workday.

2. Aggregate stockpiles shall be protected with sediment control BMPs at the end of each workday.

3. All exposed soil shall be covered with appropriate temporary stabilization BMPs at the end of the shift before a holiday, weekend, if rainfall is forecasted in the next 24 hours, or when not planned for work for a period of 48 hours or more.

4. Exposed soil not planned for work until the following spring shall be stabilized with established grass or other acceptable permanent stabilization BMPs.

207.4.04D Disturbance Restrictions

If soil erosion and sediment resulting from construction activities is not effectively controlled, reduce the amount of disturbed areas to that which can be effectively controlled. Implement erosion and sediment control BMPs at the earliest practicable time.

207.4.05 STABILIZATION

Where potential for erosion exists and if construction permits, construct permanent erosion control features immediately after clearing and grubbing and grading operations are complete. Protect exposed soils from erosion by water, wind, or vehicles. At a minimum, stabilize soil areas as follows:

207.4.05A Limitations on Exposed Soil

1. Temporarily stabilize soils at the end of the shift before holidays and weekends, or if rainfall is forecasted within the next 24 hours, or as needed. Rain storms can occur throughout the year, and the Contractor shall anticipate the occurrence of rainfall events that could cause erosion and sediment flow from the site at any time.

2. Within seven days of exposure, stabilize all areas within 100 feet of waterways, wetlands, or other sensitive areas using methods that to not rely solely upon germination to control erosion.

3. On any significant portion of the site, if construction activities cease for 14 calendar days or more, install temporary covering with blown straw and a tackifier, loose straw mechanically tracked into the soil, an adequate covering of compost mulch, or other approved BMP.

4. If all construction activities cease at the site for 30 days or more, the entire site must be stabilized using temporary seeding, vegetation, a heavy mulch layer, or other approved BMP.

207.4.05B Temporary Stabilization

Temporary stabilization includes BMPs with an anticipated useful life of approximately less than 30 days and may be used if permanent erosion control BMPs are not practicable to be installed. Temporary stabilization includes, but is not limited to, chemical soil binders, mulching and tacking, erosion control matting, plastic sheeting, temporary seeding, or other BMPs required to achieve the necessary stabilization.

Temporarily stabilize exposed soils:

1. every 14 days or more frequently if BMPs have lost effectiveness, or as directed.
2. a minimum of one day before expected rain events.
3. as an emergency measure when rain is falling on unprotected areas.
4. as outlined in SCS 207.4.04C—Wet Weather Season.
5. when wind or vehicle traffic is visibly causing more than minor dust.
6. soil surfaces at finish grade when working outside the permanent seeding dates.

Document all implemented BMPs on the EPSC Plan. Ensure that permanent slope stabilization is achieved before removing temporary BMPs.

207.4.05C Permanent Stabilization

Permanently stabilize exposed soil surfaces at finished grade as soon as practicable. Permanent stabilization methods include, but are not limited to, seeding, mulching, structural surface coverings such as riprap, and vegetative stabilization. Immediately perform permanent stabilization at each completed excavation and embankment area except for areas that are scheduled to be re-disturbed.

If finished grade areas are not sufficiently stabilized by an established stand of vegetation or if the soil surface is not sufficiently protected with temporary stabilization BMPs by the start of the Wet Weather Season of each year, do the following:

1. Use BMPs necessary to redirect water flows away from disturbed areas.
2. Re-grade disturbed areas to finish grade.
3. Apply permanent seeding at the original specified rate.
4. Apply temporary mulching or matting.

If areas of temporary stabilization are too steep or lack access for effective straw mulch application, apply, upon approval, another effective measure such as chemical soil binder.

Incorporate permanent erosion control features into the Project at the earliest practicable time. Use temporary erosion control features for the following situations:

1. To correct conditions that occur during construction activities that were not foreseen during the design phase of the project.

2. When they are needed prior to installing permanent erosion control features.

3. To temporarily control erosion that develops during normal construction activities.

If permanent erosion control BMPs are not practicable to construct, furnish and install temporary erosion control BMPs.

207.4.06 AREA PREPARATION

Remove any matter detrimental or toxic to the growth of plants, including weeds, clods, rocks, or debris. On slopes 1V:3H or flatter, remove all debris larger than 2 inches in any dimension. On cut slopes 1V:1.5H or flatter, roughen the surface with furrows parallel with slope contours and loosen the soil to a depth between 3 inches and 6 inches.

207.4.07 EROSION PREVENTION BMPs

Install erosion prevention BMPs as shown and according to the following:

207.4.07A Plastic Sheeting

Place plastic sheeting according to Standard Plan No. 908 on disturbed, temporary slopes or stockpiles where immediate protection is required and mulching or other methods of soil stabilization are not feasible.

Cover exposed soil with plastic sheeting and secure tightly using an anchoring system of sand bags or other weights on ropes with a maximum 10-foot grid spacing in all directions. Do not allow that anchoring system to puncture the plastic sheeting. All seams shall be taped or weighted down the full length and there shall be at least a 12-inch overlap of all seams. For seams parallel to the slope contour, the uphill sheet shall overlap the downhill sheet.

Do not allow runoff to run under plastic sheeting. Direct runoff away from areas above plastic sheeting to prevent undermining. Anchor trench plastic sheeting at the top of slope in a 6-inch by 6-inch trench backfilled with compacted native material. Provide protection at toe of slope using a sediment barrier BMP.

207.4.07B Chemical Soil Binder

Hydraulically apply a liquid stabilization emulsion at the following rates unless the manufacturer recommends a greater rate of application:

1. Long Term Control of Exposed Soil Surfaces—Apply 35 gallons per acre of emulsion. Dilute with water at a rate of one part emulsion to 20 parts water.

2. Steep Slopes with Raveling Small Rock—Apply 45 gallons per acre of emulsion. Dilute with water at the rate of one part emulsion to 10 parts water.

207.4.07C Chemical and Non-Chemical Dust Control

Apply appropriate dust control for wind or equipment-caused erosion according to the following:

1. Liquid Stabilizer Emulsions—Dilute the emulsion with water at a rate of one part emulsion to 30 parts water. Apply the diluted mixture at the rate of 865 gallons per acre unless the manufacturer recommends a greater rate of application.

2. Dry Powder Tackifier—Apply at a rate of 140 pounds per acre unless the manufacturer recommends a greater rate of application. Water tackifier to activate material.

3. Water—Apply water at a rate and manner of application that control dust without creating other detrimental effects.

207.4.07D Temporary Mulching

Evenly apply dry mulch and tackifier material to form a cohesive surface cover that is resistant to displacement by wind and water. In areas not accessible to heavy equipment, mulch by hand or by other approved methods.

1. Apply hydromulch with hydraulically applied tacking agent per manufacturer recommendations based upon project conditions.

2. Apply straw mulch on slopes 1V:1.5H or flatter. Spread straw mulch by hand or blower. Place approximately 2 inches deep, in loose conditions, at a rate between 2 to 3 tons per acre of dry mulch. Place straw mulch so that it is loose enough for sunlight to penetrate and air to circulate, but dense enough to shade the ground, reduce water evaporation, and materially reduce soil erosion. Anchor using hydraulically applied tackifier, crimping disc, sheep's foot roller, or other approved method.

3. Apply compost mulch with hydraulically applied tacking agent per manufacturer recommendations based upon project conditions. Apply with equipment that propels the material directly at the soil surface and achieves direct contact with the soil. Apply compost at a uniform depth of 2 inches to all exposed soil surfaces.

When using blower equipment to apply mulch, provide equipment that uses air pressure with an adequate spout that uniformly applies dry mulch at constantly measured rates. Apply the materials using sweeping, horizontal motion of the nozzle.

207.4.07E Tacking

Stabilize mulches with appropriate tacking agents or methods. Straw mulch may be tackified using hydraulically applied tacking agents or mechanical methods at the following rates of application:

1. Hydraulically Applied Tacking Agents:

    A. Liquid Stabilizer Emulsions—Dilute the emulsion with water at a rate of one part emulsion to 30 parts water. Apply the diluted mixture at a rate of 865 gallons per acre unless the manufacturer recommends a greater rate of application.

B. Dry Powder Tackifier—Apply at 80 pounds per acre with 2,000 pounds of hydromulch fiber unless the manufacturer recommends a greater rate of application.

2. Mechanical Methods—Straw mulch may be mechanically tackified using a crimping disk or sheep's foot roller.

A. Crimping Disc—A heavy disk with flat, scalloped discs approximately ¼-inch thick, having dull edges and spaced no more than 9 inches apart.

B. Sheep's Foot Roller—Modified sheep's foot roller equipped with straight studs, made of approximately ¾-inch steel plate, placed approximately 8 inches apart and staggered. Ensure that the studs are not less than 6 inches long or more than 6 inches wide, and rounded to prevent withdrawing the straw from the soil. Use roller with enough weight to incorporate the straw sufficiently into the soil providing uniform surface cover.

207.4.07F Seeding

Apply seed to areas at a minimum rate of 100 pounds per acre. If fertilizer is used to help establish vegetation, the application rates must follow manufacturer's guidelines and the application must be done in such a way to prevent discharge of nutrients to surface waters. Irrigate as necessary until vegetation has sufficiently developed to fully cover the area.

207.4.07G Slope and Channel Liner Matting

Ensure that the matting is installed according to plans, these Specifications, or the manufacturer's recommendations, whichever is more stringent. Install fully biodegradable matting within 25 feet of water courses or as otherwise indicated (photodegradable is not acceptable).

1. Remove all materials (vegetation, rocks, wood, etc.) larger than 2 inches in size. Smooth the surface and remove undulations sufficient to allow the matting to be placed in complete contact with the soil.

2. Apply seeding to all disturbed areas, including the area where matting is required prior to matting installation. If necessary, and approved by the City, seeding after matting installation shall be done at double the normal application rate.

3. Apply matting loosely so it is in complete contact with the soil to prevent erosion occurring beneath it. Apply mat and fasteners as shown. Construct check slots

and anchor trenches on all channel applications and on slope application when shown or specified.

4. Follow the manufacturer's recommended practices to hydraulically apply bonded fiber matrix at a rate of 3,000 pounds per acre.

207.4.08 RUNOFF CONTROL BMPs

Install check dams as shown on Standard Plan Nos. 915, 916, or as approved.

Construct overland flow control devices as shown on Standard Plan No. 903, 904, or as directed and in accordance with the following:

1. Compost Filter Sock—Construct overland flow control with compost filter sock as shown or directed per manufacturer recommendations.

2. Compost Filter Berm—Construct overland flow control with compost filter berm as shown or directed per manufacturer recommendations.

3. Interceptor Swales and Dikes—Construct interceptor swales as shown or directed and according to the following:

   A. Construct interceptor swales and dikes above the cut slope to divert runoff from undisturbed areas away from disturbed slope areas. Convey runoff to an undisturbed area and discharge in a non-erosive manner.

   B. Construct interceptor swales and dikes at the toe of fill slopes to divert and convey sediment-laden water to sediment control facility. Compact dike material to 95 percent proctor density.

   C. Immediately after construction of interceptor swales and dikes, place temporary seed and mulch according to these Specifications, or place erosion matting and seed as directed.

4. Temporary Slope Drains—Construct watertight slope drains and extend as embankment height increases. Construct temporary slope berms at the top of embankment slopes to direct water into the drains until permanent drainage structures are completed.

5. Flow Spreader—A flow spreader is a device that receives channeled runoff and uniformly disperses it along the length of the spreader. It may be constructed of clean aggregate in a berm or trench or lumber or similar materials. Place the flow spreader to discharge water into a stabilized area at non-erosive velocities. See the plans for details and locations of this device.

207.4.09 SEDIMENT CONTROL BMPs

Install perimeter sediment controls prior to any land disturbing activities. Install sediment controls as shown or directed and according to the following:

207.4.09A Construction Entrances

Install construction entrances as shown on plans at every point of access onto paved surfaces. Construction site entrances/exits, haul roads, construction roads, staging areas, and parking areas shall be stabilized using aggregate base materials to control sediment transport off site. Access points shall be installed prior to any soil disturbing activities and shall be limited to the fewest number possible.

Whenever practicable, slope entrances/exists downward into the site to prevent discharges onto roadway. When construction entrances are in use and mud and dirt tracking is still evident, take additional steps to eliminate tracking by hosing off tires before vehicles leave the site or by modifying construction techniques or work operation. Perform tire washing on gravel pads. Use silt trapping structures to collect and drain wash water before it leaves the construction site.

207.4.09B Sediment Fence

Construct sediment fence as shown or directed and according to the following:

1. When installing geotextile, use a continuous roll of geotextile cut to the length of the barrier to avoid joints. When joints are necessary, filter cloth shall be spliced together only at a support post, with a minimum 6-inch overlap and both ends securely fastened to a post.

2. Manufacturer's factory seams are acceptable. Field sewn seams are not acceptable.

3. Drive posts in to undisturbed soil as shown.

4. Securely fasten the geotextile to the upslope side of the posts. Securely fasten each end of the geotextile to the end supports.

5. Use stitched loops over posts.

6. Excavate a 6-inch trench on the upslope side of the fence and place the geotextile to the bottom of the trench. Backfill the trench with native material and compact.

7. Install the manufactured silt fence system according to the plans, Special Provisions, and manufacturer's recommendations. Connect end of rolls as shown.

8. Sediment fences shall not extend more than 30 inches above the original ground surface.

9. Sediment fences shall not be stapled to existing trees or structures.

207.4.10 INLET PROTECTION BMPs

Prior to any land disturbing activities, install inlet protection BMPs as shown on Standard Plan Nos. 912, 913, and 914 and per manufacturer's recommendations.

207.4.11 POLLUTION CONTROLS

The Contractor is solely responsible to properly manage pollutants, hazardous wastes, used oils, contaminated soils, concrete waste, sanitary waste, liquid waste, or other toxic substances discovered or generated during construction to prevent leakage, spills, or release of pollutants to the environment and surface waters.

In addition to EPSC BMPs, the Contractor shall also implement the following BMPs concerning pollutants other than sediment:

1. Written spill prevention and response procedures.

2. Employee training on spill prevention and proper storage, application, and disposal procedures.

3. Spill kits in all vehicles.

4. Regular maintenance schedule for vehicles and machinery.

5. Material delivery and storage controls, training, and signage.

6. Covered storage areas for waste and supplies.

Install pollutant controls as shown or directed and according to the following:

207.4.11A Concrete Management Facility

Before beginning any concrete work, furnish a water tight concrete management facility designed to accept the anticipated concrete waste and washout needs for the project. Do not place a concrete management facility within 50 feet of storm drains, open ditches, wetlands, or water bodies.

207.4.11B Sawcut and Core Drilling Waste Removal and Disposal

All waste generated from saw cutting and core drilling shall be vacuumed immediately behind the saw cutting or core drilling operation and disposed of according to applicable permits.

207.4.12 WORK QUALITY

Ensure work quality according to the following:

207.4.12A Drift

Prevent drift and displacement of seed and fertilizer regardless of equipment and methods used. Use protective covering on structures and objects where coverage and stains would be objectionable and when tacking are used with mulch. Protect vehicles and people from drifting spray. If equipment and methods of application result in wasting material, make corrections to prevent waste.

207.4.12B Displacement

Prevent seed, fertilizer, and mulch from falling or drifting onto areas occupied by rock base, rock shoulders, plant beds, or other areas where grass is detrimental. Remove material that falls on plants, roadways, gravel shoulders, structures, and other surfaces where material is not specified.

207.4.12C Damage

Prevent damage to prepared areas and to completed fertilizer, seed, and mulch work. Replace all material that becomes displaced before acceptance of work.

207.4.13 EMERGENCY MATERIALS

Provide, stockpile, and protect emergency EPSC plan BMP materials on site for unknown weather or erosion conditions. Replenish emergency materials as they are used. The emergency materials are in addition to other erosion control materials required to implement the EPSC Plan. Remove unused emergency materials from the project site at the completion of the project.

207.4.14 STREET CLEANING

Keep paved areas free of sediment, debris, mud, and visible dust, to the maximum extent practicable, as determined by Project Inspector. Perform street cleaning operations using equipment conforming to 207.3.01. Conduct street cleaning in a manner that will cause the least interruption to public traffic. Adjust street cleaning equipment speed to debris conditions, but in no case shall street cleaning equipment speed exceed 6 miles per hour.

Clean up and properly dispose of `all debris using manual methods, as necessary, to remove sediment and debris from driveways, curb ramps, and sidewalks. Do not sweep sediment or debris into storm drain inlets.

207.6.00 CITY EPSC INSPECTION AND ENFORCEMENT

207.6.01 CITY EPSC INSPECTION

The City will conduct EPSC quality assurance inspections of the project site in addition to the required Contractor inspection and documentation.

Active construction sites will be inspected weekly.

Inactive construction sites will be inspected bi-weekly until permanent stabilization of the site has been achieved.

Inspections will be conducted within 24 hours after any storm event of greater than 0.5 inches of rain per 24-hour period.

Additional inspections will be conducted, as needed, for enforcement purposes.

207.6.02 CITY EPSC ENFORCEMENT

The Contractor will be notified of the results of all City conducted EPSC inspections. Correction items will be required to be completed by the Contractor within 3 working days of the correction notice.

A follow up inspection will be conducted after 3 working days has elapsed. Any previous correction items not adequately resolved shall be corrected within 24 hours.

A follow up inspection will be conducted after 24 hours has elapsed. Any previous correction items not adequately resolved shall subject the entire project to a STOP WORK NOTICE and/or civil penalties of up to $2,000 per day.

207.7.00 MAINTENANCE

207.7.01 GENERAL

Maintain installed erosion and sediment control devices in good working order at all times to ensure compliance with SRC, State, and Regulatory permits, and that sediment does not enter a surface water system, roadway, or other properties. Keep the devices in place until the acceptance of stabilization. All maintenance and repairs are at no additional cost to the City.

Engineer may direct Contractor to remove erosion and sediment control devices prior to storm events that are anticipated to cause flooding issues. Engineer will attempt to provide Contractor at least one day advance notice of items that need to be removed prior to and reinstall after storm event.

207.7.02 INEFFECTIVE CONTROLS

If a control feature does not function effectively, immediately repair, replace, or provide additional devices. Device repair, replacement, or addition due to improper installation, insufficient maintenance, or damage from Contractor operations will be done at no additional cost to the City.

207.7.03 INSPECTION AND MONITORING

The Contractor shall ensure that a person with knowledge and experience in construction stormwater controls and management practices conducts regular site inspections, and that monitoring is performed according to the following schedule and record keeping requirements:

1. Daily, during periods of stormwater runoff or snowmelt runoff.

2. At least once every seven calendar days.

3. Within 24 hours after any storm event of greater than 0.5 inches of rain per 24-hour period.

The EPSC Plan must be kept onsite at all times. Written EPSC inspection logs shall be maintained onsite and available to City Inspectors upon request.

Monitoring Receiving Stream—Observe and record color and turbidity or clarity within 30 feet upstream and downstream of location where surface waters from the construction site enter the receiving stream. Describe in the report any apparent differences in color, the clarity of the discharge, and any observable difference in comparison with the receiving stream. Note whether sheen and floating matter are present or absent.

If permit non-compliance or serious water quality issues occur, verbally report to the Engineer within 24 hours and submit a written report within 48 hours.

207.7.04 SEDIMENT REMOVAL

Remove sediment and upgrade or repair the devices as needed as soon as practicable, but not later than 2 days, after the surrounding exposed ground has dried sufficiently to prevent further damage from equipment needed for repair operations. If rainfall continues over a 24-hour period, or other circumstances that preclude equipment operation in the area, hand carry and install additional erosion prevention and sediment control BMP devices.

207.7.04A Catch Basins

Maintain catch basin inserts and other forms of inlet protection by removing trapped sediment when storage capacity has been reduced by 50 percent. Prevent release of sediments during maintenance or removal work.

The Contractor shall remove any sedimentation/debris associated with their construction activities that have accumulated in the sump of newly-constructed stormwater facilities connected to the City's stormwater system by the end of the work day if construction is occurring during the Wet Weather Season or when directed if construction is occurring outside the Wet Weather Season.

207.7.04B Sediment Controls

Remove sediment from sediment fences once it has reached ⅓ of the above-ground fence height.

For other sediment controls, remove trapped sediment before it reaches ⅓ of the above-ground height.

Replace aggregate and rock filter material with new aggregate material when the sediment reduces the filtering capacity of the device by one-half.

Replace biofilter bags with clean, washed bags when removing sediment from them. Wash bags in an approved sediment control area.

Remove trapped sediments from sediment basins before design capacity is reduced by 50 percent.

If sidewalk concrete is to be poured prior to the establishment of permanent site cover, approved sediment barrier must be installed in lieu of sidewalk subgrade barrier and subgrade barrier must be inspected and approved to ensure material still meets applicable specifications prior to pouring concrete.

207.7.04C Paved Areas

Do not drag, drop, or permit to be deposited on paved areas in excess of ½ cubic foot of construction waste, dirt, sediment, or other such debris. Any visible and measureable material shall be immediately removed in accordance with 207.4.14. Adjust the frequency of cleaning to ensure compliance with the EPSC Plan or as directed by Project Inspector.

207.7.04D Construction Entrances

Construction entrances shall be maintained in a condition that will prevent tracking or flow of mud onto ROW or approved access point. The entrance may require periodic top dressing as conditions demand and repair and/or cleanout of any facilities used to trap sediment. Wheel washing shall be required to prevent sediment and material tracking on road surfaces if passive BMPs are not effective.

207.7.05 PERMANENT STABILIZATION

Maintain permanent stabilization work by re-stabilizing areas disturbed by the Contractor's operations or other causes within 2 calendar days.

207.7.06 CONCRETE MANAGEMENT FACILITY

Clean out concrete management facility when filled to 75 percent capacity. Leaking concrete washouts shall be repaired or replaced prior to continued use. Remove liquids or cover the facility before predicted rainstorms to prevent overflow. Dispose of material waste (liquids and solids) according to applicable permits. Vacuum or pump out liquids before transporting prefabricated container.

207.7.07 COMPLETION AND CLEAN UP

Sediment that leaves the site must be cleaned up within 24 hours, placed back on the site and stabilized or disposed of properly. In addition, the source(s) of the sediment must be controlled to prevent continued discharge within 24 hours. Any in-stream clean up of sediment must be performed according to requirements and timelines set by the Oregon Department of State Lands. Sediment must not be intentionally washed into storm sewers or drainage ways. Pick up released sediments using vacuuming or dry sweeping methods. Clean up of sediment that leaves the site due to improper installation of BMPs, insufficient maintenance of BMPs, or damage to BMPs from Contractor operations will be done at no additional cost to the City.

207.7.08 REMOVAL

All temporary control features that are not incorporated into the permanent work remain the property of the Contractor. Within 30 calendar days of the notification of acceptance of permanent stabilization, remove temporary EPSC devices and materials from the area.

Remove accumulated sediment before removing the devices and materials. Immediately shape and permanently stabilize areas affected by removal process. Do not remove temporary erosion and sediment control devices before permanent stabilization is accepted.

207.7.09 SEDIMENT DISPOSAL

Re-grade removed sediment into slopes or remove and dispose of offsite according to applicable permits. Do not flush sediment-laden water into waterways or drainage systems.

207.8.00 MEASUREMENT

Quantities of work performed under this Section will be measured according to the following:

207.8.01 LUMP SUM BASIS

No measurement of quantities will be made for lump sum items.

207.8.02 UNIT BASIS

Unit basis items will be measured on the unit basis of each device or location where the device is constructed or placed.

207.8.03 LENGTH BASIS

Length basis items will be measured on the line and grade of the item or device constructed or placed.

207.8.04 AREA BASIS

Area basis items will be measured along the ground surface, and computed to the square foot, square yard, or acre as applicable.

207.9.00 PAYMENT

The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement shown on the Contract Schedule of Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

207.9.01 PAY ITEMS

PAY ITEM	UNIT OF MEASURE
Erosion Control	Lump Sum
Street Cleaning	Lump Sum
Plastic Sheeting	Square Yard
Chemical Soil Binder	Square Yard or Acre
Chemical Dust Control	Square Yard or Acre
Mulching	Square Yard or Acre
EPSC Seeding	Square Yard or Acre
Erosion Control Matting	Square Yard
Compost Erosion Blanket	Square Yard
Aggregate Check Dam	Each
Prefabricated Check Dam	Each
Fiber Rolls (Wattles)	Foot
Biofilter Bags	Each
Sand Bags	Each
Compost Filter Sock	Foot
Interceptor Swale/Dike	Foot
Compost Filter Berm	Foot
Temporary Slope Drain—Type 1: ABS Pipe	Foot
Temporary Slope Drain—Type 2: PVC Pipe	Foot
Temporary Slope Drain—Type 3: Corrugated Aluminum Alloy Pipe	Foot
Flow Spreader	Foot
Construction Entrance	Each
Sediment Fence	Foot
Filter Fabric Inlet Barrier	Each
Prefabricated Filter Inserts	Each
Concrete Management Facility	Each

207.9.02 EROSION CONTROL

The lump sum Erosion Control item (as listed above) includes:

- Providing the Erosion and Sediment Control Manager
- Developing, revising, and documenting the EPSC Plan

- Mobilization
- Monitoring activities to maintain effective functioning
- Furnishing, stockpiling, protecting, restocking, and removing emergency materials
- Preparing Project for a period of extended non-activity
- Inspecting, maintaining, and removing erosion control devices
- Restoring, mulching, tacking, and seeding all disturbed ground, work, and storage areas, not otherwise covered
- Vacuum sweeping
- All work necessary to meet requirements of applicable permits

When only Erosion Control (as lump sum item) is listed in the Contract Schedule of Items, no separate or additional payment will be made for modification or additions to the EPSC Plan that become necessary for permit compliance during construction.

Partial payments for Erosion Control (as lump sum item) will be made as follows:

1. If applicable, when the initial Contractor develops EPSC Plan, narrative, and schedule are complete and accepted, and/or when the initial erosion control devices are installed.....25%

2. When 50 percent of the Contract is complete, excluding advances on materials 25%

3. When 75 percent of the Contract is complete, excluding advances on materials 25%

4. At completion of the work covered by this Section 25%

207.9.03 PLASTIC SHEETING - The Plastic Sheeting item (as listed in table) includes protecting exposed slopes, including stockpiles, with plastic sheets, anchoring devices, and providing toe protection.

207.9.04 EPSC SEEDING - The Seeding item (as listed in table) includes preparing the slope surface and stabilizing exposed soil with erosion matting materials and bonded fiber matrix matting application.

207.9.05 INCIDENTAL - When not listed in the contract Schedule of Items, Erosion Prevention and Sediment Control will be considered incidental to the work for which no separate payment will be made.

No separate or additional payment will be made for:

1. Inspection, monitoring, or record keeping and reporting.

2. Constructing and removing temporary slope berms.

3. Erosion control for work outside the construction limits including, but not limited to, borrow pits, haul roads, disposal sites, and equipment storage sites.

4. Water used for non-chemical dust control.

5. Removing and disposing of sediment build-up behind sediment fences and sediment barriers.

6. Manual removal and disposal of sediment and debris necessary to supplement Street Cleaning.

7. All activities associated with 207.7.00 MAINTENANCE

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 701 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.

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.

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.

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 support
2. Multiple mailbox support
3. Mailbox concrete collar

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.

DIVISION 3—STREETS

Section 310—Treated Subgrade

Description

310.00 Scope—This work consists of treating the upper layer of subgrade with water and either lime, chloride, or Portland cement to form a stabilized course of material at the locations and to the lines, grades, thicknesses, and cross sections shown on drawings.

310.01 Definitions

Treated Subgrade—Subgrade which is improved by the addition of soil stabilizing materials.

Deflection or Reaction—A movement or deviation of material which returns back to a former or less advanced condition in a localized area directly under the test vehicle tire.

Pumping—Vertical displacement of the top surface of the compacted layer, not directly under the vehicles tires.

Required Submittals

310.10 Certificates—Submit certificates of compliance for soil stabilizing materials.

Materials

310.20 Soil Stabilizing Materials—Furnish soil stabilizing materials meeting the following requirements:

Material	Type	Requirements
Hydrated Lime	AASHTO M 216, Type 1	Grade A
Granular Quicklime (CaO)	AASHTO T 27 and T 219 (grading and hydroxide content)	100% passing 3/8” 15% passing No. 100 sieve Min. 85% Calcium Hydroxide
Calcium Chloride	AASHTO M 144 (sampling) AASHTO T143 (testing)	-
Sodium Chloride	AASHTO M 143	-
Portland Cement	AASHTO M 85	Conform to Portland Cement ODOT Section 02010

310.21 Water—Furnish water meeting the requirements of SCS 320.

Construction

310.40 Preparation—Before starting subgrade work, complete all underground work contemplated in the area of the subgrade. Drain all depressions or ruts which contain water.

310.41 Addition of Soil Stabilizing Materials—Where shown on the drawings or required by the engineer, apply soil stabilizing materials at a uniform rate using equipment and methods that will ensure uniformity of distribution. The use of blade graders to distribute lime will not be allowed. Allow only equipment that is used for watering, applying, and mixing the stabilizing material to pass over the material until after it is mixed into the soil. Add water, if necessary, during mixing operations to provide optimum moisture content.

310.42 Mixing—Perform mixing operations until the treated subgrade material is uniform and free of streaks or pockets and all material, other than stones, will pass a 1 inch sieve. Do not allow the content of stabilizing material to vary by more than plus or minus 1% from the designed amount.

310.43 Finishing—Immediately after mixing the treated subgrade, grade the mixture to specified line, grade, and cross section and compact the mixture to the specified density. Compact and finish within 12 hours after compaction begins. If the Contractor has not compacted and finished the material within 12 hours, loosen the mixture and add stabilizing material and water as directed. Remix the freshened material, re-grade and re-compact. During compaction, maintain the mixture at proper grade and cross section and at optimum moisture content.

310.44 Curing—Limit traffic over treated subgrade to equipment which does not damage the subgrade and which does not deflect, ravel, or wear the surface. Keep the finished surface moist and protect from rutting, spalling, displacement, and disfiguration for a period of seven days, or until a subsequent course of material is placed which will prevent drying of the mixture by evaporation or absorption.

310.45 Compaction—Compact the subgrade until it is firm and unyielding. In-place subgrade materials shall meet the following moisture content, density, and deflection requirements, each of which has equal weight and each of which shall be satisfied:

(a) **Moisture Content**—Moisture content at the time of compacting the materials shall be prepared to within minus 4% to plus 2% of optimum moisture content. Material which does not contain sufficient moisture to obtain proper compaction shall be wetted and thoroughly mixed as directed. Material containing an excess of moisture shall be dried by manipulation, aeration, drainage or other means before being compacted.

(b) **Density**—After compaction of each layer the density shall be at least 95% of maximum density according to AASHTO T 180, to a depth of 1-foot below established subgrade elevation.

(c) **Deflection Requirement**—Conduct deflection testing according to 310.61 within 24-hours prior to placing aggregate base material on the subgrade.

310.46 Subgrade Stabilization—Over-excavate areas of visible deflection to a depth of 1-foot or more and stabilize in accordance with SCS 315.

Field Testing

310.60 Surface Tolerance—The completed surface of the subgrade shall be within 0.05 of one foot of the cross section and grade shown on the drawings and shall not vary more than 0.05 of one foot from specified line and grade at any point when checked with a 10-foot straightedge.

310.61 Deflection

(a) **Proof Roll**—Contractor shall perform deflection test of completed subgrade while under City Inspector observation and direction. The compacted layer will be observed for deflection by using a loaded haul vehicle, loaded to the vehicles (GVW). The vehicle will be driven over the entire compacted layer not faster than a speed at which a person can walk.

(b) **Subgrade Failure**—Deflection or reaction greater than 1/4-inch, or visible pumping of the ground surface under the moving vehicle's tires are evidence of unsatisfactory subgrade. Correct subgrade failure in accordance with SCS 315.

Measurement

310.80 Treated Subgrade—The quantities of treated subgrade will be measured on the area basis, measured along the lines and grades of the area actually treated.

310.81 Soil Stabilizing Materials—The quantities of soil stabilizing materials will be measured on the dry weight basis. 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. Measurement of stabilizing material will not include any which is lost, displaced, used in reworking, used in restoration work, or used contrary to direction.

Payment

310.90 Payment—The accepted quantities of treated subgrade, and soil stabilizing materials will be paid for at the Contract unit price, per unit of measurement shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

310.91 Incidental—No separate or additional payment will be made for excavation, shaping, compaction, and testing.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 310 Standard Pay Items	**Unit of Measure**
Treated Subgrade, ___-inches thick	SY
Soil Stabilizing Materials –<*>	Ton

* *Portland Cement; Calcium Chloride; Sodium Chloride*

Section 315—Subgrade Stabilization

Description

315.00 Scope—This work consists of excavating and disposing of unstable materials in excavation areas only and placing subgrade geotextiles, stone embankment, and aggregate backfill to the lines and grades as shown or directed.

315.01 Definitions

Deflection or Reaction—A movement or deviation of material which returns back to a former or less advanced condition in a localized area directly under the test vehicle tire.

Pumping—Vertical displacement of the top surface of the compacted layer, not directly under the vehicles tires.

Required Submittals

315.10 General—Submittals shall be provided for the following as applicable:

- Aggregate Base and Subbase
- Stone Embankment
- Subgrade Geotextile

Materials

315.20 Materials—Furnish materials meeting the following requirements:

Aggregate Base ..... SCS 325.10
Aggregate Subbase ..... SCS 323.20
Stone Embankment ..... ODOT 00330.16
Subgrade Geotextile, Certification Level B ..... ODOT 02320
Water ..... SCS 320

315.21 Acceptance of Backfill—The backfill material will be accepted based on visual inspection. The Engineer may perform tests if deemed necessary.

Construction

315.40 Excavation—Excavate unstable material to the lines and grades as shown or directed. Waste materials become the property of the Contractor at point of origin. Unless specifically allowed and subject to the Erosion and Sediment Control Plan, dispose of waste materials outside and beyond the limits of the Project. Do not dispose of materials on wetlands, either public or private, or within 300 feet of rivers or streams.

315.41 Geotextile—Place subgrade geotextile prior to backfill.

315.42 Backfill—Place the backfill material to lines and grades as shown or directed, to provide a homogeneous mixture. Compact the backfill until there is no reaction or yielding under the compactor.

Field Testing

315.60 Deflection Test—Contractor shall perform deflection test of completed sub-base while under City Inspector observation and direction. The compacted layer will be observed for deflection by using a loaded haul vehicle, loaded to the vehicles (GVW). The vehicle will be driven over the entire compacted layer not faster than a speed at which a person can walk. If the layer exhibits any yielding, deflection, reaction or pumping, rework the area to provide acceptable test results prior to placement of any additional material.

Measurement

315.80 Subgrade Stabilization—The quantities of subgrade stabilization will be measured on a volume basis or an area basis according to the following:

(a) **Volume Basis—**When measurement is by volume, quantities will be measured by neat line computation as verified by the Inspector. The measurement shall only be for volume directed by the Engineer to be excavated below the lines and grades shown on the plans.

(b) **Area Basis—**When measurement is by area, the quantity will be the number of square yards of aggregate base constructed to the full thickness. The surface area will be determined by horizontal measurements. The measurement shall only be for area directed by the Engineer to be excavated below the lines and grades shown on the plans.

Payment

315.90 Payment—The accepted quantities of subgrade stabilization will be paid for at the Contract unit price, per unit of measurement shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

315.91 Incidental—No separate or additional payment will be made for excavation, geotextile, stone embankment or aggregate backfill material, or water.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 315 Standard Pay Items	**Unit of Measure**
Subgrade Stabilization, <*> Aggregate Base Backfill	CY
Subgrade Stabilization, <*> Aggregate Subbase Backfill	CY
Subgrade Stabilization, <*> Stone Embankment Backfill	CY
__-Inch Subgrade Stabilization, <*> Aggregate Base Backfill	SF

NOTE: <> indicates variable gradation size (e.g., 2½" – 0).*

Section 320—Watering

Description

320.00 Scope—This work consists of furnishing and applying water or combinations of water and additives for compacting and preparing roadbed excavations, embankments, backfills, subgrades, bases and surfacing or for preventing or alleviating dust nuisance.

320.01 Definitions

Additives—Emulsified asphalt, magnesium chloride or other materials added to water for the purpose of aggregate binder or dust control.

Required Submittals

320.10 Additives—Submit product data and application instructions for additives.

Materials

320.20 Water—Furnish water free of silts and other matter harmful to the quality of the material to which it is applied or with which it is mixed. Comply with Chapter 537 of the "Oregon Water Laws", which is administered by the Water Resources Department, covering the appropriation of water.

320.21 Water Mixtures—When called for or ordered, perform watering with a mixture of water and additives. Use and mix according to the manufacturer's recommendations.

Construction

320.40 General—Make all necessary arrangements to obtain water and pay all costs involved in its procurement. Water may be purchased through a bulk water station or metered fire hydrant, information is available at City of Salem, Permit Application Center Room 320. Perform watering when and where directed at an approved rate and manner of application.

320.41 Maintenance—Water at any hour of the day, and on any day of the week, as directed, for proper performance or protection of the work and for alleviation of dust nuisance.

Measurement

320.80 Measurement—No measurement of quantities will be made for work performed under this section.

Payment

320.90 Payment—No separate or additional payment will be made for work performed under this section.

— END OF SECTION —

Section 321—Geosynthetic Installation

Description

321.00 Scope—This work consists of furnishing and placing geotextile in drains, under embankments, for embankment reinforcement, under riprap, buttresses, inlays, shear keys, over roadbed subgrades, and beneath pavement overlays as shown or directed.

321.01 Definitions—Terms not defined in this subsection may be found in ASTM D 123 and ASTM D 4439. If there is a conflict, definitions in this subsection take precedence.

Cross-Machine Direction—The direction in the plane of the fabric perpendicular to the direction of manufacture.

Drainage Geotextile—For installation as a filter in subsurface drains or other drainage locations.

Embankment Geotextile—For installation as a reinforcement within embankments and/or as a separator under embankments.

Geosynthetics—A planar product manufactured from polymeric material used with soil, rock, earth or other geotechnical, engineering related material as an integral part of a man-made product, structure or system.

Geogrid—A geosynthetic used for reinforcement which is formed by a regular network of tensile elements with apertures of sufficient size to allow strike-through of surrounding soil, rock or other geotechnical material.

Geotextile—A permeable geosynthetic comprised solely of textiles.

- ***Nonwoven Geotextile—***A textile produced by bonding and/or interlocking of fibers by mechanical, heat or chemical means.

- ***Woven Geotextile—***A textile comprising of two or more sets of filaments or yarns interlaced in such a way that they result in a uniform pattern.

Machine Direction—The direction in the plane of the fabric parallel to the direction of manufacture.

Pavement Overlay Geotextile—For installation as a reinforcement beneath an asphalt concrete overlay.

Riprap Geotextile—For installation as a filter and/or separator behind or beneath riprap, buttresses, inlays, shear keys and/or erosion control applications.

Roll—Unit of continuous geosynthetic without transverse seams as furnished by the manufacturer. Roll sizes may vary between manufacturers and types of geosynthetics.

Roll Values:

- ***Average Roll Value*—**The average roll value for each property is determined by testing a representative number of samples in a roll according to the test methods specified in ODOT 02320. An average of these tests becomes the average roll value for each roll tested.

- ***Minimum Average Roll Value*—**The minimum average roll value for each property is the mean of the average roll values for all rolls tested minus two standard deviations, all as determined by the manufacturer. The minimum average roll value for each property is determined by testing a representative number of rolls in a production run according to ASTM D 4354 sampling procedures and the test methods specified in ODOT 02320.

- ***Minimum Value*—**The minimum value is the specified value for each geosynthetic property that shall be met or exceeded by the manufacturer's minimum average roll value for the production run and, if sampled and tested by the Agency, by the average roll value for any roll.

Seam Allowance—The minimum distance from the edge of a geotextile to the stitch line nearest to that edge.

Seam Type—A designation relating to the essential characteristics of geotextile positioning and rows of stitching in a specified sewn seam as shown on the plans.

Selvage—The finished edge of a geotextile parallel to the machine direction.

Stitch Type—A designation relating to the essential characteristics of the interlacing of sewn thread(s) in a specified seam as shown on the plans.

Subgrade Geotextile—For installation as a separator and/or reinforcement on subgrades and in other material separation applications.

Ultraviolet (UV) Rays—Direct radiation from the sun during daylight hours, even on cloudy days.

Ultraviolet Stability—The ability of a geosynthetic to resist deterioration when exposed to UV radiation.

Required Submittals

321.10 Manufacturer's Documentation—Furnish Level B Manufacturers Quality Compliance Certificate conforming to requirement in ODOT 02320.

Materials

321.20 Materials—Furnish materials meeting the requirements of ODOT 02320.

Equipment

321.30 Field Seam Stitching Equipment—Use field seam stitching equipment that provides an acceptable lock-type stitch as recommended by the geotextile manufacturer and approved by the Engineer.

321.31 Asphalt Distributor—Design, equip, maintain, and operate the asphalt distributor according to SCS 355.

Construction

321.40 General—Provide geosynthetic as furnished by the manufacturer and protect against damage and deterioration. Prevent excessive mud, wet concrete, epoxy, and like materials from coming in contact with the geosynthetic. Store all geosynthetics in a dry place and off the ground at all times according to ASTM D 4873. Cover all geosynthetics with a dark protective covering when received.

321.41 Geotextile Installation Requirements

(a) **General**

(1) **Placement**

A. **Surface Preparation—**Prepare the surface receiving the geotextile to a smooth condition free of obstructions, depressions and debris unless otherwise directed. Do not drag the geotextile on the ground or mishandle in any way.

Loosely place the geotextile without wrinkles so placement of the overlying material will not tear the geotextile. Lap or sew the geotextile at the ends and sides of adjoining sheets as specified.

B. **On Slopes—**Place the geotextile with the machine direction oriented up-down the slope. Lap the upper sheets over the lower sheets. When the geotextile is placed on a slope steeper than 6V:1H, securely anchor the laps to the ground surface with pins or stakes as necessary to prevent the slippage and tearing of the geotextile. Start placement of fill material on the geotextile at the toe of the slope and proceed upwards.

C. **Where Exposed To Water—**If geotextiles are placed under water or in areas where water will flow, the geotextile may be placed with the machine direction parallel to the direction of water flow instead of the placement direction specified in SCS 321.41(a-1-b). Overlap sheets so the upstream sheet is placed over the top of the downstream sheet. Adequately secure the geotextile to prevent slippage. As the geotextile is placed under water, place the backfill material on it to the required thickness. Do not place geotextile more than 50 feet ahead of the specified cover material.

(2) **Overlaps—**Overlap requirements for geotextiles are:

Application	Overlap (inches)
Drains	12 min.
Embankment Stabilization	24 min.
Pavement Overlays	6 max.
Riprap and Rock Buttresses	24 min.
Roadbed Subgrade Stabilization	24 min.

Note: *Increase the overlap if directed by the Engineer or, if approved, sew the geotextile in accordance with this Section.*

(3) **Field Seams**

A. **General—**Sew field seams with polymeric thread consisting of polypropylene, polyester, or kevlar, and as resistant to deterioration as the geotextile being sewn. Use a color of thread that contrasts with the geotextile being sewn so the stitches are exposed for inspection when the geotextile is placed. Where field sewn seams will be used, furnish the following:

- The manufacturer's test result certificate that includes wide strip, tensile strength test results and verifies that seam tensile strength and seam grab tensile strength meet or exceed 90 percent of the minimum specified tensile strength values for the geotextile.

- A field-stitched seam test sample.

B. **Stitch Requirements—**Use two rows of lock-type stitching, Type 401, to make the seams, as shown. The two rows of stitching shall be 1/2 inch apart with a tolerance of plus or minus 1/4 inch and not cross except for restitching.

C. **Minimum Seam Allowance—**The minimum seam allowance (the minimum distance from the edge of geotextile to the nearest stitching) is:

Seam Type (See Plans)	Minimum Seam Allowance (Inches)
Flat or Prayer Seam, Type SSa-1	1½
"J" Seam, Type SSn-1	1
Butterfly-folded Seam, Type SSd-1	1

D. **Seam Type—**Obtain the geotextile manufacturer's recommendation for the type of seam and stitch to be used. If the Contractor does not obtain and provide the foregoing technical information use a "J" seam with at least three stitches per

1 inch. The flat, or prayer, seam may be used for repair of damaged in-place geotextile.

(4) **Protection of Geotextile**

A. Protect the geotextile at all times from ultraviolet (UV) rays, contamination by surface runoff and construction activities.

B. Traffic or construction equipment will not be allowed directly on the geotextile except as authorized in SCS 321.41(f-5) or as directed.

C. During installation cover the geotextile with specified cover material as soon as possible. Do not leave in uncovered condition for more than 5 days.

D. Place cover material on the geotextile in such a manner that the geotextile is not torn, punctured, or shifted. Use a minimum 6 inch thick cover layer or twice the maximum aggregate size, whichever is thicker. Do not end-dump cover material directly on geotextiles other than riprap geotextile.

E. Limit construction vehicles in size and weight so rutting in the initial layer above the geotextile is not more than 3 inches deep or half the layer thickness, whichever is lesser. Do not turn vehicles on the first layer.

(5) **Repair of Geotextile—**Repair or replace all torn, punctured, or contaminated geotextiles during construction. Repair by placing a patch of the specified geotextile over the affected area. Overlap the existing geotextile with the patch according to SCS 321.41(a-1). Where geotextile seams are required to be sewn, repair any damaged sheet by sewing unless otherwise indicated on the plans or Special Provisions, or as directed.

(b) **Drainage Geotextile—**When used in trenches for drains, place the geotextile in the trench as shown on the plans to loosely conform to the shape of the trench with no wrinkles or folds.

(c) **Embankment Geotextile—**Construct embankment stabilization according to details shown on the plans. Place the geotextile layers so the geotextile machine direction is transverse to the embankment centerline. Spread the geotextile so all slack and wrinkles are eliminated. Construct embankment in uniform layers according to SCS 204.

(d) **Riprap Geotextile—**Place geotextile behind and beneath riprap, buttresses, inlays, shear keys and erosion control applications according to the details shown. Demonstrate to the satisfaction of the Engineer that the combination of the rock-fill drop height and the thickness of any aggregate cushion, when specified or required, is adequate to prevent puncturing or damaging the geotextile when placing the riprap or stone embankment material. If an aggregate cushion is used, place according to SCS 321.41(a-4). In addition, the following limits apply:

Maximum Drop Height (Feet)		
Size of Rock	**Onto Geotextile Material**	**Onto an Aggregate Cushion Blanket**
Greater than 200 pounds	0	3
200 pounds or less	3	3

Note: *After placing the riprap, backfill all voids in the riprap face so the geotextile is completely covered and not visible.*

(e) **Subgrade Geotextile—**or roadbed subgrade separation, prepare the subgrade according to SCS 204. Correct geotextile failures, as evidenced by soil pumping or roadbed distortion, by removing any covering material in the affected area and placing a geotextile patch on the exposed geotextile according to SCS 321.41(a-5). Cover the patch with the specified cover material and compact before proceeding.

(f) **Pavement Overlay Geotextile**

(1) **General—**Place geotextile and pavement overlay in four basic steps:

- Surface preparation
- Sealant application
- Geotextile placement
- Overlay placement

(2) **Weather Limitations—**Do not place sealant and geotextile unless the weather limitations of SCS 360 are met, as appropriate, except the minimum air temperature shall be 50 degrees F for paving grade asphalt sealant placement and 60 degrees F for asphalt emulsion sealant placement.

(3) **Surface Preparation—**Prepare the pavement surface on which the sealant is to be placed according to SCS 355 and the following:

- Clean and fill cracks exceeding 1/8 inch width with a bituminous crack filler from the QPL.
- Repair minor irregularities or depressions as directed.
- Allow crack filling material to cure before placing geotextile.
- Place a leveling course as directed instead of extensive surface preparation where the pavement is severely cracked, rutted, deformed, or otherwise distressed.

(4) **Sealant Application**

A. Use a normal paving grade asphalt. A cationic or anionic emulsion may be used as approved. Do not use cutbacks or emulsions that contain solvents.

B. Uniformly spray the asphalt sealant at normal application temperature by means of a pressure distributor conforming to SCS 321.31 on the prepared dry pavement surface. Apply at the rate of 0.20 - 0.30 gallon per square yard, or as recommended by the geotextile manufacturer or as directed.

C. If using emulsions, increase the application rate 50 percent or as directed. Some underlying surfaces may require a higher application rate. Within street intersections, on steep grades or in other zones where vehicle speed changes are commonplace, reduce the normal application rate by 20 percent or as directed.

D. The target width of the sealant application shall be the geotextile width plus 6 inches. Apply the sealant only as far in advance of the geotextile installation as appropriate to ensure a tacky surface at the time of geotextile placement. Place the geotextile the same day as the sealant. Do not allow traffic on the sealant. Clean excess asphalt from the road surface.

(5) **Geotextile Placement**

A. Place the geotextile into the sealant using mechanical or manual laydown equipment capable of providing a smooth installation with a minimum amount of wrinkling or folding from the water (break) before placing the geotextile.

B. Slit wrinkles or folds exceeding 1 inch and lay flat. Shingle-lap not more than 6 inches in the direction of the paving. Broom and/or pneumatic roll to maximize geotextile contact with the pavement surface. Additional hand-placed sealant material may be required at laps as determined.

C. Limit traffic to necessary construction equipment and emergency vehicles on the geotextile before and during paving unless otherwise directed. Turn the paver and other vehicles gradually. Keep turning to a minimum to avoid geotextile movement and damage. Avoid abrupt starts and stops.

(6) **Overlay Placement—**Place the overlay the same day the geotextile is placed. Remove sealant that bleeds through the geotextile. Do not windrow asphalt concrete material on the geotextile ahead of the paving machine. Do not use an asphalt concrete material pickup machine.

Measurement

321.80 Measurement—The quantities of each geosynthetic installation will be measured on the area basis along the lines and grades of the surface area actually covered as shown or as required, except for drainage applications.

321.81 Drainage Geotextile—The quantities of drainage geotextile will be measured on the area basis, computed by multiplying the length of the trench where geotextile is used by the perimeter of the trench as determined from the neat lines shown, or as directed.

Payment

321.90 Payment—The accepted quantities for geosynthetics will be paid for at the Contract unit price, per unit of measurement, shown on the Schedule of Pay Items. Payment will be payment in full furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

(a) **Pavement Overlay Geotextile—**Payment includes preparation work, sealant, and geotextile.

321.91 Incidentals—No separate or additional payment will be made for constructing laps, seams, joints, and patches unless the Engineer orders additional amounts over the minimum. For laps wider than the minimum or specified width, payment will be made for the added lap width at the Contract unit price.

(a) **Subgrade Geotextile—**No separate payment will be made for Subgrade Geotextile when not listed in the Schedule of Pay Items. Payment will instead be incidental to other applicable items in the Schedule of Pay Items.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 321 Standard Pay Items	Unit of Measure
Drainage Geotextile, Type <*>, <**>	SY
Embankment Geotextile, <**>	SY
Riprap Geotextile, Type <*>, <**>	SY
Subgrade Geotextile, <**>	SY
Pavement Overlay Geotextile	SY

* *Type 1 or 2*

** *Woven or Nonwoven. Refer to ODOT 02320.*

Section 323—Aggregate Subbase

Description

323.00 Scope—This work consists of furnishing and placing Aggregate Subbase to the lines, grades, thicknesses shown or established.

Materials

323.20 Aggregate—Aggregate for subbases shall be crushed or uncrushed, including sands, reasonably well graded from coarse to fine. The aggregate gradation shall be adequate to produce a dense, firm base when placed and compacted.

(a) Maximum size aggregate shall not exceed 75% of the compacted thickness of the layer in which it is incorporated.

(b) Aggregates passing the ¼ inch sieve shall not be less than 10% or more than 50% of the whole, by weight. No more than 10% of the aggregate shall pass the No. 100 sieve.

323.21 Material Acceptance—Aggregate material will be accepted based on the Engineer's visual inspection. Samples will be obtained and tested for compliance with 323.20, if it is suspected that the material does not meet these specifications.

Construction

323.40 Thickness and Number of Layers—The maximum compacted thickness of any one layer shall not exceed 9 inches.

323.41 Shaping and Compacting—Compact each layer of aggregate subbase material until no reaction or yielding is observed under the compactor. Water or aerate the material to ensure each layer can be compacted to form a dense mass, free of pumping.

Field Testing

323.60 Deflection Test—Contractor shall perform deflection test of completed subbase while under City Inspector observation and direction. The compacted layer will be observed for deflection by using a loaded haul vehicle, loaded to the vehicles (GVW). The vehicle will be driven over the entire compacted layer not faster than a speed at which a person can walk. If the layer exhibits any yielding, deflection, reaction or pumping, rework the area to provide acceptable test results prior to placement of any additional material.

Measurement

323.80 Measurement—The quantities of aggregate subbase will be measured on the volume basis, or on the area basis according to the following:

(a) **Volume Basis—**When measurement is by volume, quantities will be measured by neat line computation. No measurement will be made for volumes beyond that which is shown on applicable typical sections and details.

(b) **Area Basis—**When measurement is by area, the quantity will be the number of square yards of aggregate base constructed to the full thickness. The surface area will be determined by horizontal measurements. No measurement will be made for area beyond that which is shown on the plans.

Payment

323.90 Payment—The accepted quantities of aggregate subbase will be paid for at the Contract unit price, per unit of measurement shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

323.91 Incidental—No separate or additional payment will be made for excavation, shaping, compaction, and testing.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 323 Standard Pay Items	**Unit of Measure**
Aggregate Subbase	CY
Aggregate Subbase, __-Inches Thick	SY

Section 325—Aggregate Base

Description

325.00 Scope—This work consists of furnishing and placing one or more courses of aggregate base on a prepared surface to the lines, grades, thicknesses, and cross sections shown or established.

Required Submittals

325.10 General—Submit product data and certificates of compliance.

Materials

325.20 Base Aggregate—Furnish Dense-Graded Aggregates conforming to ODOT 02630. If aggregate size is not shown, furnish either 1"–0 or ¾"–0 as the Contractor elects.

Equipment

325.30 Spreading Equipment—Provide equipment capable of spreading the material and striking it off to designated line, grade, and transverse slope without segregation, dragging, or fracture of aggregate.

325.31 Compacting Equipment—Provide self-propelled rollers and compactors capable of reversing without backlash. Rollers and compactors shall have a gross static weight of at least 8 tons, and shall be capable of compacting to specified density while the mix is still moist.

325.32 Proof Roll—Provide fully loaded truck no smaller than 10 CY for proof roll performance testing.

Construction

325.40 Preparation of Foundation—Provide a firm surface on which aggregates are to be placed according to SCS 203 and SCS 204. Do not place aggregate in standing water or on a soft, muddy, frozen, or otherwise unsatisfactory subgrade.

325.41 Thickness and Number of Layers—If the required compacted depth of the base course exceeds 6 inches, construct it in two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches. Place each layer in spreads as wide as practical and to the full width of the course before a succeeding layer is placed.

325.42 Shaping and Compacting—Compact each layer of material placed in shoulder and base areas by rollers. Shape and maintain the surface of each layer during the compaction. Produce a uniform texture and firmly key the aggregates. Apply water over the materials for proper compaction and continue compaction effort until there is no reaction or yielding observed under the compactor.

325.43 Maintenance—After construction of each layer and completion of base, maintain the layer to specified conditions and prevent or repair segregation, raveling, rutting, or

contamination until it is covered with a following layer or until all work is completed. Damaged subgrade, aggregate materials, or completed aggregate base shall be restored, removed, or reconstructed.

Field Testing

325.60 Surface Tolerance—The completed surface of the base course shall be within 0.05 FT of the cross section and grade shown on the drawings and shall not vary more than 0.05 FT from specified line and grade at any point when checked with a 12-FT straightedge.

325.61 Density Requirements—Each lift of aggregate base shall be compacted to not less than 95 percent of maximum density as determined by AASHTO T 180.

325.62 Deflection—Contractor shall perform deflection test of completed aggregate base while under City Inspector observation and direction. The compacted layer will be observed for deflection by using a loaded haul vehicle, loaded to the vehicles (GVW). The vehicle will be driven over the entire compacted layer not faster than a speed at which a person can walk. If the layer exhibits any yielding, deflection, reaction or pumping, rework the area to provide acceptable test results prior to placement of any additional material.

Measurement

325.80 Measurement—The quantities of aggregate will be measured on the weight basis, on the volume basis, or on the area basis according to the method shown on the Schedule of Pay Items.

325.81 Weight Basis—When measurement is by weight, quantities will be measured in the hauling vehicle. No measurement will be made for aggregate placed under sidewalks, driveways, or other miscellaneous asphalt concrete surfaces.

325.82 Volume Basis—When measurement is by volume, quantities will be measured by neat line computations. No measurement will be made for aggregate volume beyond that which is shown on applicable typical sections and details.

325.83 Area Basis—When measurement is by area, the quantity will be the area of aggregate base constructed to the full thickness. The surface area will be determined by horizontal measurements. Each area constructed with varying thicknesses, as directed or shown, will be adjusted by converting it to an equivalent area at the pay item thickness on a proportionate volume basis. No measurement will be made for area beyond that which is shown on the plans.

Payment

325.90 Payment—The accepted quantities of aggregate bases will be paid for at the Contract unit price, per unit of measurement, as listed on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 325 Standard Pay Items	**Unit of Measure**
Aggregate Base	Tons or CY
Aggregate Base, __-Inches Thick	SY

Section 335—Cold Plane Pavement Removal

Description

335.00 Scope—This work consists of removing existing pavement to prepare a foundation for placing new surfacing.

Required Submittals

335.10 General—The following submittals shall be provided for cold plane removal detailing the equipment to be used in both the grinding and sweeping of the existing pavement:

(a) Pavement Grinder

(b) Street Cleaning Equipment

Equipment

335.30 Pavement Grinding Equipment—Provide self-propelled planing machines or grinders meeting or exceeding the following requirements:

(a) Capable of loosening pavement material.

(b) Capable of accurately establishing profile grades within a tolerance of 0.02 foot by reference from either the existing pavement or from independent grade control.

(c) With a positive means for controlling cross-slope elevations.

(d) With a totally enclosed cutting drum with replaceable cutting teeth.

(e) With an effective means of removing loosened material from the surface and preventing dust from escaping into the air.

(f) Capable of providing a true cross-slope grade that will allow placement of overlay pavement to a uniform thickness.

335.31 Street Cleaning Equipment—Provide self-propelled street cleaning equipment meeting or exceeding the following requirements:

(a) Capable of sweeping and removing all visible loosened surface particles not removed by the pavement grinding equipment.

(b) Vacuum and dust control.

Construction

335.40 Pavement Removal

(a) **General**—Remove the existing pavement to the depth, width, grade and cross section shown or as directed. The use of a heating device to soften the pavement is not allowed. Remove all existing underlying pavement that becomes detached through delamination, exposure to construction equipment, or any other item. When existing structures are in the area of work, smaller equipment and handwork may be necessary to remove the material adjacent to the structures.

(b) **Depth 1 inch to 2 inches**—If the depth of the pavement to be removed is 2 inches or less, but more than 1 inch and the section will be under traffic, schedule the work so the full width and length of travel lanes pavement can be removed during the same shift. Remove the shoulder area within 24 hours.

(c) **Depth over 2 inches**—If the depth of the existing pavement to be removed is over 2 inches and the section will be under traffic, schedule the work so the full width and length of the travel lanes and shoulders can be removed, leaving no longitudinal or transverse drop-offs, during the same shift.

(d) **Transitions and Ramping**—Construct a wedge of HMAC, at a slope of 1V: 10H or flatter along each exposed longitudinal drop-off, and 1V: 50H or flatter along each exposed transverse drop-off prior to allowing traffic onto the cold planed surfaces. Place wedges completely across the milled area at intersections, points of beginning and ending of the milling operation, and around manholes, valve boxes and other structures. Longitudinal drop-offs of 1 inch or less do not require a wedge. Maintain wedges as long as the area remains under traffic or until pavement is replaced. Remove and dispose of wedges before placing new pavement.

335.41 Schedule of Pavement Removal—the existing surfacing shall not be removed more than 5-days prior to construction of the new surfacing unless otherwise approved by the Engineer.

335.42 Warning Signs—Provide warning signs where abrupt or sloped drop-offs occur at the edge of the existing or new surface according to SCS 202.

335.43 Disposal of Materials—Materials removed under this Section that are not used on the Project become the property of the Contractor at the point of origin.

335.44 Maintenance Under Traffic—If the cold planed pavement surface will be exposed to traffic, sweep and clean prior to allowing traffic to use the roadway.

Field Testing

335.60 Surface Tolerance—Test with a 12-foot straightedge furnished and operated by the Contractor, as directed. The variation of the top of the ridges from the testing edge of the straightedge, between any two ridge contact points, shall not exceed 1/4 inch.

Measurement

335.80 Measurement—The quantities of cold plane pavement removal will be measured on the area basis, in place, or on a linear basis according to the method(s) shown on the Schedule of Pay Items.

(a) **Area Basis—**When the depth of pavement to be removed is variable, the depth as shown is an estimate and is approximate only. No guarantee is made that the actual depth will be the same as the estimated depth.

(b) **Linear Basis—**When the quantity of cold plane pavement removal is measured on a linear basis, the approximate cross sectional (taper grind) area will be detailed on the plans.

Payment

335.90 Payment—The accepted quantities of work performed under this Section will be made at the Contract unit price, per unit of measurement shown on the Schedule of Pay Items. Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

335.91 Incidental—No separate or additional payment will be made for temporary wedges constructed, maintained, and removed under SCS 335.40(d), or for replacement of cutting teeth.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 335 Standard Pay Items	**Unit of Measure**
Cold Plane Pavement Removal, <*>-Inches Deep	SY
Cold Plane Pavement Removal,<*>-Inches Deep Taper	LF

* *Depth of AC grind may be either fixed or variable.*

Section 340—Commercial Grade Concrete

Description

340.00 Scope—This work consists of furnishing, placing and finishing commercial grade concrete (CGC).

340.01 Definitions

High Early—CGC formulated to achieve required compressive strength in 48 hours or less.

Required Submittals

340.10 Proportions—Submit the proportions by weight of the following materials before using any CGC:

- air entraining admixtures
- cement
- each size of aggregate
- fly ash
- other admixtures
- water

Materials

340.20 Materials—Furnish materials meeting the following requirements:

Admixtures	ODOT 02040
Aggregates	ODOT 02690
Bonding Agents	ODOT 02070
Cement	ODOT 02010
Curing Materials	ODOT 02050
Grout	ODOT 02080
Modifiers	ODOT 02030
Water	ODOT 02020

340.21 Properties of CGC—Furnish a workable CGC mixture that is uniform in composition and consistency, and has the following characteristics:

(a) Entrained Air – 4.0% to 7.0%

(b) Slump – 5 inches or less

(c) Compressive Strength – Minimum 3,000 psi at not more than 28 days.

(d) Temperature – Minimum 50 °F to maximum 90 °F

340.22 CGC Acceptance Sampling and Testing

(a) **General**—Acceptance sampling and testing will be based on samples obtained at the site of placement from the discharge of the delivery vehicle. All sampling and testing shall be performed by a QCT.

(b) **Delivery Tickets**—Send a delivery ticket with each load of CGC recording the source, day, time of batch, size of load, and quantity of individual constituents in the load.

(c) **Plastic CGC**—Acceptance of plastic CGC will be based on tests performed by the QCT according to SCS 340.21.

(d) **Hardened CGC**—Acceptance of the hardened CGC will be according to SCS 340.21. Cast one set of cylinders per 20 cubic yards, with a maximum of one set per day.

340.23 Field-Mixed Concrete—CGC may be field mixed conventionally, or by volumetric/mobile mixers conforming to ASTM C 685 for minor work items such as: bollards; fence post footings; irrigation thrust blocks; mailbox support footings. CGC mixture may be accepted visually for Field-Mixed Concrete.

Labor

340.30 Quality Control Personnel—Provide technicians having CSTT and QCT technical certifications.

Construction

340.40 General—Construct CGC according to the appropriate Sections in which CGC is required and the following:

(a) **Mixing**—Mix CGC to the extent that ensures a uniform distribution of materials throughout the mixture.

(b) **Placing**—Place CGC within 90 minutes after batching and mixing using the best common practices to avoid segregation. Vibrate and spade to achieve a dense homogeneous concrete, free of voids and rock pockets.

(c) **Forms**—Provide forms for CGC according to the appropriate Sections in which CGC is required and best common practices. Place to the lines and grades shown or directed.

(d) **Weather**—Do not place CGC when the air temperature is below 35 °F. Protect CGC from freezing if the air temperature is expected to drop below 35 °F during the first five calendar days after placement.

(e) **Curing**—Cure CGC by covering with wet burlap, canvas, sand, or other acceptable material, and keep moist for a minimum of seven calendar days. Alternatively, spray applied curing compounds may be used except on concrete surfaces that will come in contact with adjacent concrete pours.

340.41 General Surface Finish—Give concrete surfaces a general surface finish, according to the following in addition to the finish specified for a particular item of work:

(a) Remove form bolts and metal to a depth of 1 inch.

(b) Remove rock pockets and unsound concrete.

(c) Fill holes and depressions at least 1/2 inch in depth or diameter with an approved patching material.

(d) Correct bulges, fins, depressions, stains, discolorations and other imperfections.

340.42 Replacement—Remove and replace concrete represented by cylinders that fail to meet the minimum strength requirement.

340.43 Concrete Waste Management—Manage excess concrete and concrete wash water according to the following:

(a) Wash off concrete trucks and equipment off site or in water tight designated concrete washout facilities meeting the specifications of SCS 207.2.16. Direct all wash water into an appropriately designed facility so that no overflows can occur due to structural failure, inadequate sizing, precipitation, etc.

(b) Handle wash water and excess concrete as waste. Do not dispose of these materials onto the ground, streets, or into sewers, storm drains, open ditches, or streams.

(c) Maintain concrete management facilities according to Section 207.7.06. Handle hardened concrete water consistent with handling of other construction waste.

Measurement

340.80 Measurement—No measurement of quantities will be made for CGC.

Payment

340.90 Payment—No separate or additional payment will be made for CGC. Payment will be included in payment made for the appropriate items under which this work is required.

— END OF SECTION —

Section 350—Surface Treatments

Description

350.00 Scope—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.

350.02 Definitions

Seal Coat—One or more applications of bituminous binder, either with or without a cover of aggregate.

Penetration Macadam—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.

Materials

350.20 Asphalt—Asphalt materials incorporated in the mix shall conform to requirements of SCS 205.

350.21 Aggregates—Aggregates shall conform to requirements of SCS 205 and to additional requirements contained herein.

(a) 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					
2½"	95–100					
2"		100				
1½"		95–100	100			
1¼"	0–10		90–100			
1"				100		
¾"	0–1	0–15	0–15	90–100	100	
½"		0–2	0–2	0–15	85–100	100
¼"				0–3	0–15	85–100
No. 10					0–4	0–15
No. 40						0–5

Equipment

350.30 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.

(a) 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.

(b) 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.

(c) 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.

Construction

350.40 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 shown or specified.

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" to No. 4	25 to 35	0.25 to 0.35
Double			
1st application	½" to No. 4	25 to 35	0.20 to 0.35
2nd application	¼" to No. 10	12 to 16	0.15 to 0.25

350.41 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 drawings. Rates of spreads and quantities of materials are subject to variance as directed to adjust for variable conditions encountered or experienced during construction.

350.42 Preparation of Base—Conform to the applicable requirements for preparation of bases in SCS 360.

350.43 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.

350.44 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 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.

350.45 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.

(a) 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.

(b) 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.

(c) Spread asphalt toward the source of mineral aggregate to avoid injury to the freshly treated surface.

(d) Before application to the roadway, heat asphalt materials to the temperatures directed, but within the applicable limits for material used.

(e) 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.

350.46 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.

350.47 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.

350.48 Correction of Defects—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.

350.49 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.

Field Testing

350.60 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 straight edge.

Maintenance

350.70 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:

(a) 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.

(b) Perform rolling and compacting of materials to maintain or restore firmness and stability to the materials.

(c) Trim abutting shoulders. Remove materials which come into side ditches or on to curbs, sidewalks, or driveways and dispose of as approved.

(d) Perform above operations under traffic and at frequencies directed to develop and establish the course to uniform firmness and stability throughout.

Measurement

350.80 Aggregate—The quantities of Aggregate will be measured on the weight basis, or on the volume basis according to the method shown on the Schedule of Pay Items.

(a) **Weight Basis**—When measurement is by weight, quantities will be measured to the nearest 0.01 ton. Shipping invoice weights of the supplier's truck or transport shall be used to verify weight. No measurement will be made for materials lost, wasted, or otherwise not incorporated into the Work.

(b) **Volume Basis**—When measurement is by volume, the quantity will be measured in the hauling vehicle at points of deposit in accordance with SCS 190.

350.81 Bituminous Cement—The quantity of bituminous cements will be measured on the weight basis according to the method shown on the Schedule of Pay Items. No measurement will be made for water added to emulsion.

350.82 Surface Treatment—Measurement of surface treatment will be made on an area 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 precision shall be in accordance with SCS 190.

Payment

350.90 Payment—The accepted quantities of Surface Treatment incorporated into the project, will be paid for at the Contract unit price, per unit(s) of measurement shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

350.91 Incidental—No separate or additional payment will be made for preparing the road surface, placing materials in final position, brooming, or maintenance.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 350 Standard Pay Items	Unit of Measure
Aggregate <*>	Ton or CY
Bituminous Cement	Ton
Surface Treatment	SY

* *Gradation may be inserted.*

Section 355—Emulsified Asphalt Tack Coat

Description

355.00 Scope—This work consists of furnishing and placing emulsified asphalt on a prepared asphalt concrete, portland cement concrete, or other paved surface to ensure bond between lifts as specified.

355.01 Standards—Apply a tack coat to existing and new asphalt concrete surfaces prior to placing each lift of HMAC, regardless of the time period between each lift.

Required Submittals

355.10 Emulsified Asphalt—Submit certificate of compliance.

Materials

355.21 Emulsified Asphalt—Furnish CSS-1, CSS-1h, CMS-2, CMS-2S, CMS-2h, CRS-1, CRS-2, HFRS-2, or HFMS-2 as selected by the Contractor.

(a) **Reference**—Furnish emulsified asphalt meeting the requirements of ODOT publication "*Standard Specifications for Asphalt Materials*". Copies of the publication are available from the ODOT Pavement Services Engineer. The applicable specifications are those contained in the current publication on the date the Project is advertised, or for privately funded development, the date the plans are approved. The materials may be conditionally accepted at the source or point of loading for transport to the Project.

(b) **Dilution**—Dilution of the tack coat material may be allowed to a maximum 1:1 ratio. Determine the proportion of water to be added to the emulsified asphalt. Do not dilute the emulsified asphalt until the Engineer approves the dilution ratio. Add the water to the emulsified asphalt and mix according to the asphalt supplier.

Equipment

355.30 Asphalt Distributor—Provide an asphalt distributor designed, equipped, maintained, and operated so the emulsified asphalt material may be applied uniformly at even heat. The distributor shall be capable of applying the asphalt on variable surface widths up to 16 feet, at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, and with uniform pressure. The variation allowed from any specified rate shall not exceed 0.02 gallons per square yard. Provide distributor equipment that includes a tachometer, pressure gauges, accurate volume measuring devices and a thermometer for measuring temperature of tank contents. Provide distributors equipped with a positive power unit for the asphalt pump, and full circulation spray bars adjustable both laterally and vertically. Set the bar height for triple lap coverage.

Construction

355.40 Temperature Limitations—Apply tack coat only when the surface temperature in the shade is not less than the appropriate minimum surface temperature according to SCS 360.

355.41 Traffic Control—Do not apply the tack to more than one-half the width of the travel way at one time. The remaining width shall remain open to traffic.

355.42 Preparation of Underlying Surfaces—Immediately before applying the tack coat, the surface to be tacked shall be clean and dry. Clean all loose material by brooming, flushing with water or other approved methods.

355.44 Applying Tack Coat

(a) **Equipment**—Apply the emulsified asphalt with a pressure distributor conforming to SCS 355.30.

(b) **Application Rate**—Apply the emulsified asphalt to the prepared surface at a rate between 0.05 and 0.20 gallons per square yard. Application rates for tack coat diluted will be increased as necessary to provide the same amount of residual asphalt as the application rates specified above.

(c) **Temperature**—Apply when the emulsified asphalt temperature is between 140 °F and 185 °F as recommended by the manufacturer.

355.45 AC Paving—Do not place plant mixed asphalt concrete pavement on the tack coat until the emulsified asphalt separates from the water (breaks), but before it loses its tackiness.

Measurement

355.80 Measurement—No measurement of quantities will be made for Asphalt Tack Coat.

Payment

355.90 Payment—No separate or additional payment will be made for Asphalt Tack Coat.

— END OF SECTION —

Section 360—Hot Mixed Asphalt Concrete (HMAC) Pavement

Description

360.00 Scope—This work consists of constructing one or more courses of hot mixed asphalt concrete (HMAC) pavement, plant mixed into a uniformly coated mixture, hot laid on a prepared foundation, compacted to specified density, and finished to a specified smoothness to the lines, grades, thicknesses, and cross sections shown or established.

360.01 Abbreviations

TSR	Tensile Strength Ratio
VFA	Voids Filled with Asphalt
VMA	Voids in Mineral Aggregate
RAP	Reclaimed Asphalt Pavement
JMF	Job Mix Formula
MDV	Mix Design Verification
MFTP	Manual of Field Tested Procedures (ODOT Publication)
MDT	Maximum Density Test
Gmm	Maximum theoretical or "Rice" specific gravity of mixture
MAMD	Moving Average Maximum Density

360.02 Definitions

Hot Mixed Asphalt Concrete (HMAC)—A hot plant mixed, uniformly coated mixture of asphalt cement, graded aggregate and additives as required.

Job Mix Formula (JMF)—The recommended mixture of aggregate and asphalt binder for HMAC mixture, which also includes requirements for aggregate gradation and asphalt binder type.

Moving Average Maximum Density (MAMD)—The average of the MDT obtained at the beginning of the current shift, and, if available, the previous two shift MDT's for the JMF used.

Sublot—A Sublot is 100 tons of HMAC.

360.03 Standards

(a) MDT (English) = Gmm x 62.4 lb/Ft^3

(b) Determine MDT in accordance with AASHTO T 209

(c) Determine MDT for each Sublot produced each day. Report MDT to the nearest 0.1 lb/Ft^3

Required Submittals

360.10 Job Mix Formula—Submit a JMF that conforms to the HMAC specifications and also has been pre-approved by ODOT Materials Engineer or designee. Perform a new TSR if the source of the asphalt cement changes.

(a) **Performance Test—**For dense graded Level 3 mixes, the mix design submittal shall include the results of performance testing as outlined in the latest ODOT Contractor Mix Design Guidelines for Asphalt Concrete.

360.11 Quality Control Personnel Information—Submit names and contact information for all personnel included in the Quality Control Program (QCP). Include a list of each individual's qualifications, certifications with expiration dates, and QCP responsibilities. Also include contact information for HMAC production sample testing and Mix Design Verification testing.

360.12 Test Results—During HMAC production submit production sample test results and Mix Design Verification results, via e-mail or fax, within 24 hours after test completion. Include a summary of any production changes made necessary by test results.

Materials

360.20 Aggregate—Furnish coarse, fine, and RAP aggregates for HMAC meeting the following requirements:

(a) **Soundness**—Provide coarse and fine aggregate with a weighted loss not exceeding 12% when subjected to five cycles of the soundness test using sodium sulfate solution according to AASHTO T 104.

(b) **Durability**—Provide aggregate not exceeding the following maximum values:

Test	Test Method		Aggregates
	ODOT	AASHTO	Coarse
Abrasion		T 96	30.0%
Degradation—Passing No. 20 Sieve	TM 208		30.0%
Sediment Height	TM 208		3.0"

(c) **Fractured Faces**—Provide crushed aggregate with not less than the minimum number of fractured faces as determined by AASHTO TP 61 as follows:

Percent of Fracture (by Weight)		
Type of Mix	Material Retained on 1½", 1", ¾", ½" and No.4 Sieve (two fractured faces)	Material Retained on No.8 Sieve (one fractured face)
All Dense Graded HMAC	75	75

(d) **Harmful Substances**—Do not exceed the following maximum values:

Test	Test Method		Aggregate	
	ODOT	AASHTO	Coarse	Fine
Lightweight Pieces		T 113	1.0%	
Wood Particles	TM 225		0.10%	
Elongated Pieces (at ratio 5:1)	TM 229		10.0%	
Plasticity Index		T 90		0 or NP
Sand Equivalent		T 176		45 min

(e) **Coarse Aggregate**—Produce coarse aggregate from crushed rock or other inert material of similar characteristics.

(f) **Fine Aggregate**—Produce fine aggregate from crushed rock or other inert material of similar characteristics. Blend sand is allowed for Levels 1, 2, and 3 mixes. Do not blend more than 10 percent by weight of natural or uncrushed blend sand into the total fine aggregate.

(g) **RAP Aggregate**—Use no more than 30 percent RAP material in the new HMAC pavement. Use RAP aggregates in the HMAC that are no larger than the specified maximum allowable aggregate size before entering the cold feed. Blend the RAP material with new aggregate to provide a mixture conforming to the JMF within the tolerances specified.

360.21 Asphalt Cement—Use PG 64-22 or PG 70-22 asphalt. Provide asphalt cement conforming to the most current published version of ODOT *"Standard Specifications for Asphalt Materials"*.

(a) Use PG 64-22 Performance Graded Asphalt Binder with mixes containing 20 percent or more RAP.

(b) Use PG 70-22 Performance Graded Asphalt Binder with mixes containing less than 20 percent RAP.

360.22 Asphalt Cement Additives—When required by the JMF, add anti-stripping additives which (1) satisfy the Tensile Strength Ratio (TSR) specified in 360.24; and (2) are standard recognized products of known value for the intended purpose and approved for use on the basis of laboratory tests. Additives shall have no deleterious effect on the asphalt material and be shall be completely miscible. Do not use silicones as an additive.

360.23 Mix Type and Broadband Limits—Mix type and broadband limits shall meet the following:

(a) **Mix Type**—Furnish the type(s) of HMAC as shown on the Plans. The broadband limits for each of the mix types are specified in (b) below.

(b) **Broadband Limits**—Provide a JMF for the specified mix type within the control points listed below:

Sieve Size	¾" Dense		½" Dense		⅜" Dense	
	Control Points (% passing by Weight)		Control Points (% passing by Weight)		Control Points (% passing by Weight)	
	Min.	Max.	Min.	Max.	Min.	Max.
1"	100					
¾"	90	100	100			
½"		90	90	100	100	
⅜"				90	90	100
No.4						90
No.8	23	49	28	58	32	67
No.200	2.0	8.0	2.0	10.0	2.0	10.0

360.24 Job Mix Formula (JMF) Requirements—The JMF shall have been developed according to the ODOT Contractor Mix Design Guidelines for Asphalt Concrete or verified according to the ODOT Mix Design Verification process. Provide a JMF that was either developed or verified within three years of either (1) the date when bids were first solicited for the Contract, or (2) the date when the public construction permit was issued, (whichever applies) and that also meets the following criteria:

	Level 1	Level 2	Level 3
Design Method	Superpave	Superpave	Superpave
Compaction Level	65 Gyrations	65 Gyrations	80 Gyrations
Air Voids, %	3.5	4.0	4.0
VMA, % minimum	½ inch – 14.0 ⅜ inch – 15.0	¾ inch – 13.0 ½ inch – 14.0 ⅜ inch – 15.0	¾ inch – 13.0 ½ inch – 14.0 ⅜ inch – 15.0
VMA, % maximum	min + 2.0%	min + 2.0%	min + 2.0%
P No.200 / Eff. AC ratio	0.8 to 1.6	0.8 to 1.6	0.8 to 1.6
TSR, % minimum	80	80	80
VFA, %	70-80 ⅜ inch: 70 - 80	65-78 ⅜ inch: 70 - 80	65-75 ⅜ inch: 70 - 80

360.25 Tolerances and Limits—Produce and place HMAC within the JMF tolerances and limits shown below. When a JMF tolerance applies to a constituent, full tolerance will be given even if it exceeds the Control Points established in 360.23(b).

Gradation Constituent	HMAC Type		
	¾"	½"	⅜"
1"	JMF ± 5% *		
¾"	90-100%	JMF ± 5% *	
½"	JMF ± 5%	90-100%	JMF ± 5% *
⅜"	—	—	90-100%
No.4	JMF ± 5%	JMF ± 5%	JMF ± 5%
No.8	JMF ± 4%	JMF ± 4%	JMF ± 4%
No.30	JMF ± 4%	JMF ± 4%	JMF ± 4%
No.200	JMF ± 2%	JMF ± 2%	JMF ±2%

* Maximum not to exceed 100%

Constituent of Mixture	HMAC All Types
Asphalt Cement - ODOT TM 321 (Cold Feed/Meter)	JMF ± 0.20%
Asphalt Cement - AASHTO T 308 (Ignition) and ODOT TM 323	JMF ± 0.50%
RAP Content - ODOT TM 321	JMF ± 2.0%
Moisture content at time of discharge from the mixing plant - WAQTC TM 6	0.80% max.

360.26 HMAC Production QC/QA—Provide and maintain a quality control program according to the following:

(a) **Personnel Requirements**—Maintain quality control by:

(1) Obtaining samples conducted by or under the direct supervision of a current ODOT Certified Asphalt Technician I (CAT-I).

(2) Having all testing, data analysis, and reporting of test results performed by a CAT-I or an assistant technician under the direct observation of a CAT-I.

(3) Having a current ODOT Certified Asphalt Technician II (CAT-II) available to make necessary process adjustments.

(b) **Laboratory Requirements**—Furnish and maintain an ODOT certified quality control laboratory.

(1) Furnish the laboratory with the necessary equipment and supplies for performing Contractor quality control testing. Calibrate all testing equipment according to the required test methods. The Engineer may inspect measuring and testing devices to confirm both calibration and condition.

(2) The laboratory shall be operational prior to the beginning of HMAC production. Provide laboratory equipment meeting the requirements of the applicable test methods identified in these Specifications.

(c) **HMAC Production Sampling and Testing Frequency**—Sample and obtain the Gmm (AASHTO T 209) at the beginning of each shift to use in establishing the MDT. Allow Quality Assurance personnel on site to take a split of the sample obtained by Contractor for determining the Gmm. Test results shall be made available to Quality Control and Quality Assurance personnel within 1 hour of plant production.

If Gmm value determined from QC test and QA test differs by more than .02 (1.25 lbs/ft3 – MDT value), an additional sample shall be collected and tested. Subsequent test results shall be made available to Quality Control and Quality Assurance personnel within 1 hour of respective test.

(d) **Mix Design Verification (MDV)**—Perform MDV testing on projects with Level 2 or Level 3 dense graded HMAC and at least once per calendar year for each JMF. If MDV testing has been completed for the JMF previously, submit verification to the Engineer. Perform gradation and asphalt content testing once per shift. Test results shall be made available to Quality Assurance personnel by the beginning of the following working shift.

Labor and Equipment

360.30 Quality Control Personnel—Contractor shall provide a technician certified in density testing (CDT) and also ODOT HMAC Inspection Certification.

360.31 Hauling Equipment—Hauling equipment shall comply with the following:

(a) **Condition—**Provide hauling vehicles in good operating condition with tight, clean, smooth beds. Coat the beds with a minimum amount of an approved material to keep the HMAC from sticking to the beds. Do not use diesel oil. Drain excess coating material before loading by raising the truck bed, opening belly dump gates, or operating the conveyor belt, as appropriate.

(b) **Weight—**Provide hauling equipment that when fully loaded does not exceed the legal limit loads from transportation to placement. The gross weight of a single axle shall not exceed 600 pounds per inch of total tire width on the axle (limited also by manufacturer's sidewall tire rating), or 20,000 pounds, whichever is less.

360.32 HMAC Pavers—Pavers shall comply with the following:

(a) **Power and Support—**Self-contained, self-propelled, supported on tracks or wheels, none of which contact the mixture being placed.

(b) **Augers and Screed—**Equipped with augers and a screed or strike-off assembly, heated if necessary, which: (1) can spread and finish the HMAC to a uniform texture, in the specified widths, thicknesses, lines, grades and cross sections; (2) will not segregate, tear, shove or gouge the HMAC.

(c) **Automatic Grade Control System—**Equipped with a fully functioning, electronic, automatic paver control system which:

(1) Controls the HMAC placement to the following tolerances:

A. Specified thickness within +/- ⅛-inch

B. Slope and grade within +/- 0.10 percent.

(2) Maintains the paver screed in proper position;

(3) Provides the specified results through mechanical sensors and sensor-directed devices actuated from independent line and grade control references.

(d) **Illumination—**Provide adequate lighting to illuminate the paver and the roadway in front of and behind the paver during the period from 30 minutes after sunset to 30 minutes before sunrise. Shield lighting from adjacent traffic as necessary. Provide a minimum light level of 10 footcandles as measured on the roadway surface at a distance of 16 feet from the front and back edges of the paver.

360.33 Compactors—Provide self-propelled rollers capable of reversing without backlash and complying with the following:

(a) **Vibratory Rollers—**Vibratory rollers shall:

(1) be equipped with working amplitude and frequency controls.

(2) be specifically designed to compact HMAC.

(3) be capable of at least 2000 vibrations per minute.

(4) have a minimum gross static weight of at least 8 tons.

(b) **Pneumatic-tired Rollers—**Pneumatic-tired rollers shall:

(1) be tandem, or multiple axle, multiple wheel type.

(2) have smooth-tread, pneumatic tires of equal size.

(3) have tires staggered on the axles, spaced and overlapped to provide uniform compacting pressure for the full compacting width.

(4) have a minimum total load of 2,800 pounds per tire with tire inflation pressures of 45 psi to 90 psi.

(5) be fully skirted to reduce tire heat loss and mixture pick up.

Construction

360.40 Prepaving Conference—Supervisory personnel of the Contractor, including any subcontractors who are to be involved in the paving work, shall meet with the Engineer at a mutually agreed time to discuss methods of accomplishing all phases of the paving work. A representative of the Contractor responsible for quality control on the project shall also attend.

360.41 Preparation of Underlying Surfaces—All bases and foundations on which the pavement is to be constructed shall meet the applicable Specifications and be approved prior to the start of paving. The pavement surface shall be dry prior to the preparation work and paving. Complete the following:

(a) Trim broken or ragged edges to firm material.

(b) Treat all paved surfaces on and against which HMAC is to be placed with an asphalt tack coat, according to SCS 355.

(c) Level and compact depressed areas with HMAC as specified. Perform the leveling work as a separate operation and at the locations and to the extent as shown. Spread the leveling material with a paving machine.

(d) Protect all existing structures from the overlay operation and check and clean as necessary after the overlay.

(e) Remove existing pavement markers, recessed markers, and any durable pavement legends prior to paving.

360.42 Weather and Temperature Limitations—Place HMAC only when weather and temperatures are conducive for paving as specified below:

(a) **Surface Temperature**—Place HMAC only when the temperature of the surface to be paved is not less than the temperature indicated below. Do not use field burners or other devices to heat the pavement surface.

Nominal compacted thickness of individual lifts	Surface Temperature
Less than 2 inches	60 degrees F
2-inches to 2 ½-inches	50 degrees F
Greater than 2 ½-inches	40 degrees F
Temporary Paving	40 degrees F

(b) **Weather**—Do not place HMAC during rain or other adverse weather conditions. HMAC in transit at the time adverse conditions occur may be placed if (1) it has been covered during transit, (2) the HMAC temperature is satisfactory, (3) it is placed on a foundation free from pools or flow of water, and (4) all other requirements are met.

360.43 Mixing and Placing Temperatures—Establish the allowable mixing and placement temperature ranges by the JMF. The allowable production temperatures may be adjusted based on the asphalt cement supplier's recommendation if approved by the Engineer. The maximum mixture temperature of the HMAC and the minimum placement temperature shall be as follows:

HMAC Type	AC Temperature, degrees F	
	Maximum at Mixer	Minimum Behind Paver
HMAC Dense	350	240
HMAC Open	350	205

360.44 Tack Coat—Construct a tack coat prior to placing each lift of HMAC according to SCS 355. A tack coat is not required prior to placing HMAC on aggregate base.

360.45 Hauling, Delivery Rate, Depositing, and Placing—Haul, deposit, and place HMAC as follows:

(a) **Hauling—**Cover HMAC if rain or air temperatures less than 65 degrees Fahrenheit are encountered any time between loading and placement. HMAC will be rejected before placing if one or more of the following is found:

(1) Below specified placing temperature limit
(2) Slumping or separating
(3) Solidifying or crusting
(4) Absorbing moisture

(b) **Delivery Rate—**Deliver the mixture to the paving machine at a rate that provides continuous operation of the paving machine, except for unavoidable delay or breakdown. If excessive stopping of the paving machine occurs during paving operations, the Engineer may suspend paving operations until the mixture delivery rate matches the paving machine operation.

(c) **Depositing—**Deposit HMAC from the hauling vehicles so segregation is prevented. When HMAC is windrowed, the pick-up equipment shall:

(1) Pick up substantially all of the HMAC deposited on the roadway.

(2) Be self-supporting, not exerting any vertical load on the paving machine, or causing vibrations or other motions which could have a harmful effect on the riding quality of the completed pavement.

(d) **Placing—**Place HMAC pavement using a fully functioning paver meeting the specifications found in 360.32. Alternative equipment and means may be allowed by the Engineer if the use of a paver is impractical.

(1) When leveling irregular surfaces and raising low areas, do not exceed 2 inches actual compacted thickness of any one lift. This may require portions of the mixture to be laid in two or more lifts.

(2) Place the mixture in the number of lifts and courses, and to the compacted thickness for each lift and course, as shown. Do not exceed a compacted thickness of 3 inches for any lift. Limit the minimum lift thickness to twice the maximum aggregate size in the mix.

(3) Do not intermingle HMAC produced from more than one JMF.

(4) Each base and wearing course panel placed during a working shift shall conform to a single JMF.

360.46 Control of Line and Grade—Use a floating beam device incorporated into the electronic, automatic grade control system of the HMAC Paver. The beam shall be of adequate length and sensitivity to control the grade of the paver. Where this method is impractical, manual control of grade may be allowed on a case by case basis when approved by the Engineer.

360.47 Compaction and Quality Control—Contractor shall provide a technician certified in density testing (CDT) and also ODOT HMAC Inspection Certification.

(a) **General**—Immediately after the HMAC has been spread, struck off, and surface irregularities and other defects remedied, roll it uniformly until compacted as specified.

(1) **Temperature—**Complete breakdown and intermediate compaction before the HMAC temperature drops below mix design recommendations. If the rolling causes tearing, displacement, cracking or shoving, make necessary changes in compaction temperature, type of compaction equipment, and rolling procedures.

(2) **Rolling**—Provide sufficient rollers of appropriate type to compact the mixture while it is still within the specified temperature. Do not use equipment which crushes the aggregate. Perform rolling as follows:

A. Do not displace line and grade of edges.

B. Moisten steel roller wheels with a minimum amount of water, or other approved material, necessary to prevent the HMAC from sticking to them and spotting or defacing the HMAC.

C. Operate rollers at a slow, uniform speed recommended by the manufacturer. Drive rolls or wheels shall be nearest the paver unless otherwise approved. Operate pneumatic rollers no faster than 3 mph. Operate vibratory rollers at frequencies of at least 2,000 vibrations per minute, but do not operate in vibratory mode for lifts thinner than two times the maximum aggregate size for the type of HMAC being compacted.

D. Begin rolling at the sides and proceed longitudinally, parallel to the road centerline, gradually progressing to the center, unless otherwise directed. On

superelevated curves, begin rolling at the low side and progress to the high side. When abutting a previously placed lane, roll the longitudinal joint first, followed by the regular rolling pattern. Do not make sharp turns or park rollers on hot HMAC. Stop each pass at least 5 feet longitudinally from preceding stops.

E. Perform finish rolling until all roller marks are eliminated.

(b) **Normal Pavement (Nominal Thickness 1.5 Inches or Greater)**

(1) **General—**Compliance with the density specifications for dense graded HMAC shall be determined by random testing of the compacted road surface with calibrated nuclear gauges. Use the MAMD method of compaction measurement.

A. The CDT shall notify the Engineer and CAT II when the average density for a Sublot exceeds 95% of MAMD. Initiate an investigation to determine if the results indicate that a problem with the mix is developing. An adjustment to the JMF will not be allowed unless MDV testing supports a required change.

(2) **Random Testing—**Determine the density of each Sublot by averaging five QC tests performed at random locations with the nuclear gauge operated in the backscatter mode. Sublots shall correspond with those defined in SCS 360.02. In addition, perform at least one density test each day of production.

A. **Testing—**After completion of the finish rolling, test density according to WAQTC TM 8. Do not locate the center of a density test less than 1 foot from the panel edge. Complete density testing before traffic is allowed on the new mat.

B. **Core Correlation of Nuclear Gauge Readings—**Correlate each nuclear gauge on the Project when requested or required. The party that requested the core correlation pays the cost of the coring and lab testing of cores. New correlations are required if the aggregate source or the asphalt cement source changes. Apply correlation factors to all nuclear gauge readings for all dense graded mixtures placed on the Project. Cut the required cores and patch the core holes with dense graded HMAC. Determine the core correlation factor according to WAQTC TM 8 and ODOT TM 327.

(3) **Moving Average Maximum Density (MAMD) Method—**Compact the HMAC to at least 92.0 percent of the MAMD for the JMF used.

(4) **Test Results—**Provide density results for the completed Sublots by the middle of the following working shift. Density test reports shall:

- Identify MAMD and required percent compaction.
- Report date and location of each QC test.
- Report measured density and percent compaction for each QC test.
- Group QC tests by Sublot and compute average density for each Sublot.

(c) **Thin Pavement—**Compaction to a specified density will not be required for leveling, skin patches, or where the nominal compacted thickness of a course of dense graded mixtures will be less than 1.5 inches. Perform breakdown and intermediate rolling until the entire surface has been compacted by at least four coverages of the roller(s). Perform additional coverages, as directed, to obtain finish rolling of the HMAC.

360.48 Longitudinal Joints—At longitudinal joints, bond, compact and finish the new HMAC equal to the HMAC against which it is placed.

(a) **Location—**Place the HMAC in panel widths which hold the number of longitudinal joints to a minimum. Offset the longitudinal joints in one panel by at least 6 inches from the longitudinal joints in the panel immediately below.

(1) **Base Course—**Place base course longitudinal joints within 12 inches of the edge of a lane, or within 12 inches of the center of a lane, except in irregular areas, unless otherwise shown.

(2) **Wearing Course—**Longitudinal joints shall not occur within the width of a traffic lane. They shall be located at either skip lines or fog lines unless approved. On median lanes and on shoulder areas the joints shall occur only at lane lines or at points of change in the transverse slopes, as shown or directed.

(b) **Drop-offs**—Protect drop-off edges from being broken down by traffic. Provide warning signs and markings where abrupt or sloped edge drop-offs 1 inch or more in height occur.

(1) **Wedges**—If unable to complete the pavement without drop-offs according to SCS 360.48(c) construct and maintain a wedge of HMAC at a slope of no steeper than 1V:10H along the exposed longitudinal joint.

(2) **Pedestrian Access**—If work site is open for pedestrian access, construct and maintain a minimum 48-inch long wedge of HMAC at a slope of no steeper than 1V:12H along the base of curb ramps or at any other drop off location.

(c) **Placing HMAC Under Traffic—**When placing HMAC pavement under traffic, schedule work for the nominal thickness being laid as follows:

(1) **More Than 2 Inches—**Schedule work so at the end of each working shift the full width of the area being paved, including shoulders, is completed to the same elevation with no longitudinal drop-offs.

(2) **Less Than or equal to 2 Inches—**Schedule work so that at the end of each working shift one panel of new travel lane pavement does not extend beyond the adjoining panel of new travel lane pavement more than the distance normally covered by each shift. At the end of each workweek complete the full width of the area to be paved, including shoulders, to the same elevation with no longitudinal drop-offs.

360.49 Transverse Joints—On travel lanes, construct transverse joints on all specified pavement courses, except leveling courses, as follows:

(a) **Temporary End Panel—**Construct temporary end panel. Maintain pavement depth, line and grade at least 2 feet beyond the selected transverse joint location, and from that point, slope down until the top of the course being laid meets the underlying surface at a slope no steeper than 1V:50H.

(b) **Vertical Face—**After the mixture has reached the required density construct a smooth, vertical face the full depth of the course being laid at the location selected for the joint by sawing, cutting, or other approved method.

(c) **Resume Paving—**When permanent paving resumes, remove the temporary end panel and any bond-breakers. Clean the surface of all debris and apply a tack coat to the vertical edge and the surface to be paved.

(d) **Joint Requirements—**Compact both sides of the joint to the specified density. When tested with a straightedge placed across the joint, the joint surface shall conform to the specified surface tolerances.

360.50 Abutting Bridge Ends—Compact the HMAC abutting bridge ends and other rigid type structures in the transverse and/or diagonal direction, as well as longitudinally.

360.51 Bridge Deck Overlays—Saw cut the wearing course of pavement directly over the joints in bridge decks, bridge end joints and end panel end joints as soon as practical but not in excess of 48 hours from paving each stage of the wearing course.

(a) The saw cut shall be ⅜ inch wide, ± ⅛ inch, and ½ inch less than the thickness of the panel of pavement, to a maximum depth of 1½ inches.

(b) Flush the saw cut thoroughly with a high-pressure water stream immediately after the cut has been made. Before the cut dries out, blow it free of water and debris with compressed air. Fill the joint with a poured filler from the ODOT QPL.

360.52 Correction of Defects—Correct all defects in materials and workmanship, as described below:

(a) **Fouled Surfaces—**Immediately repair, clean and retack fouled surfaces that would prevent full bond between successive lifts of mixture.

(b) **Boils, Slicks, and Oversized Material—**Immediately replace boils, slicks, and oversized materials with fresh mixture.

(c) **Segregation—**Take immediate corrective measures when segregation or non-uniform surface texture is occurring in the finished mat. If segregation continues to occur, stop production until a plan for providing uniform surface texture is approved.

(d) **Roller Damage to the Surface—**Immediately correct surface damage from rollers with additional fresh mixture or by other means approved.

(e) **Longitudinal Joints—**Take immediate corrective measures when open longitudinal joints are being constructed or when the elevation of the two sides of a longitudinal joint does not match.

(f) **Other Defects—**Remove and replace any HMAC that is loose, broken, or mixed with dirt; shows too much or too little asphalt; or is defective in any way.

360.53 Correction of Pavement Roughness—Immediately correct equipment or paving operation procedures when field tests show the pavement smoothness does not comply with SCS 360.60 In addition, do the following:

(a) **Methods—**Correct surface roughness to the required tolerances, using one of the following methods as approved by the Engineer:

(1) **Base Course**

A. Profile grind to a maximum depth of 0.4 inch to remove pavement ridges/highs; or

B. Remove and replace the base lift.

(2) **Wearing Course**

A. Remove and replace the wearing surface lift; or

B. Profile to a maximum depth of 0.3 inch with abrasive grinder(s) equipped with a cutting head comprised of multiple diamond blades and apply an emulsion fog seal as directed.

(b) **Time Limit**—Unless otherwise directed, complete correction of all surface roughness within 14 calendar days following notification.

(c) **Area Limits**—Removal shall not be less than a full lane width for a distance of not less than 12 feet. For multiple occurrences in a single lane, the Contractor shall remove and replace the full width and length of the affected area where there are more than three occurrences within a 100-foot length.

360.54 Sealing Joints—Seal all joints abutting existing asphalt concrete and fill any sawcutting kerfs with AR-4000. Cover with sufficient clean sand to prevent tracking.

Field Testing

360.60 Pavement Smoothness—Test pavement smoothness with a 12 foot straightedge parallel to and perpendicular to the centerline, as directed by Inspector. Pavement surface variation greater than ¼ inch within the 12 foot distance indicates unsatisfactory construction. Contractor shall make corrections in accordance with SCS 360.53.

Measurement

360.80 Measurement—The quantities of HMAC will be measured on the weight basis, or on the area basis according to the method shown on the Schedule of Pay Items.

(a) **Weight Basis**—When measurement is by weight, quantities will be measured to the nearest 0.01 ton. Shipping invoice weights of the supplier's truck or transport shall be used to verify weight. No measurement will be made for materials lost, wasted, or otherwise not incorporated into the Work.

(b) **Area Basis**—When measurement is by area, the quantity will be the area of HMAC constructed to the full thickness. The surface area will be determined by horizontal measurements. Each area constructed with varying thicknesses, as directed or shown, will be adjusted by converting it to an equivalent area at the pay item thickness on a proportionate volume basis.

Payment

360.90 Payment—The accepted quantities of HMAC incorporated into the project, whether or not recycled materials are used, will be paid for at the Contract unit price, per unit of measurement shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, Quality Control, compaction testing, and incidentals necessary to complete the work as specified.

360.91 Incidental—No separate or additional payment will be made for constructing and removing temporary wedges and end panels, or sawing, cleaning, sealing edges, and filling joints on bridge deck overlays.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 360 Standard Pay Items	Unit of Measure
Level *, ** Dense HMAC	Tons
Level *, ** Dense HMAC, __-Inches Thick	SY
Level *, ** Open HMAC	Tons
Level *, ** Open HMAC, __-Inches Thick	SY

* *Level 2, or 3, as shown on plans.*

** *Insert aggregate size (¾ inch, ½ inch, or ⅜inch) as per plans.*

Section 361—Asphalt Concrete Pavement Repair

Description

361.00 Scope—This work consists of excavating and removing existing asphalt concrete surfaces, aggregate bases, and aggregate subbases and constructing new subbases, bases, and asphalt concrete surfaces to the lines and grades shown.

Materials

361.20 Materials—Furnish materials meeting the following requirements:

Aggregate Base ..... SCS 325
Aggregate Subbase ..... SCS 323
HMAC ..... SCS 360

361.21 Acceptance of Material—All material will be accepted by visual inspection by the Engineer. The Engineer may perform tests to verify that the materials meet the appropriate specifications.

Construction

361.40 Excavation—Excavate and remove material to the lines and grades shown.

361.41 Embankment and Aggregate Backfill—Place the backfill to lines and grades shown or directed. Compact each layer of material until there is no reaction or yielding under the compactor.

361.42 Asphalt Concrete—Place HMAC to the lines and grades shown on drawings. Compact HMAC according the following:

(a) Compaction to a specified density will not be required, regardless of thickness. Perform breakdown and intermediate rolling until the entire surface has been compacted with at least four coverages by the roller(s). Perform additional coverages, as directed, to obtain finish rolling of the HMAC.

(b) Along irregular areas, and other areas not practically accessible to large rollers, compact the mixture with small, self-propelled rollers, mechanical tampers, hot hand tampers, or hand rollers. 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.

Measurement

361.80 Measurement—The quantities of asphalt concrete pavement repair will be measured on the area basis, of surfacing area repaired to the full depth as shown. The surfacing area will be determined by horizontal measurements.

Payment

361.90 Payment—The accepted quantities of asphalt concrete pavement repair will be paid for at the Contract unit price, per unit of measurement shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, testing, and incidentals necessary to complete the work as specified.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 361 Standard Pay Items	**Unit of Measure**
Asphalt Concrete Pavement Repair __-Inch AC over __-Inch Aggregate Base	SY
Asphalt Concrete Pavement Repair __-Inch AC over __-Inch Aggregate Base over __-Inch Aggregate Subbase	SY

Section 365—Miscellaneous Asphalt Concrete/Aggregate Base Structures

Description

365.00 Scope—This work consists of furnishing and placing asphalt concrete over aggregate base foundation in driveways, parking areas, guardrail flares, mailbox turnouts, bicycle or footpaths, and other miscellaneous or minor items of asphalt concrete over base. These items in this Section will be collectively referred to as "structures".

(a) **Exclusions—**The scope of this section excludes asphalt concrete construction on traffic lanes, shoulders, median areas, tapers, areas of street widening, or patching and leveling on similar areas.

Materials

365.21 Aggregate Base—Furnish aggregate base materials for base, foundation courses, leveling courses, and bedding meeting the requirements of SCS 325. If a designated size is not shown on Project Plans or Standard Drawings, furnish either 1" – 0 or ¾" – 0, as the Contractor elects.

365.22 Asphalt Tack Coat—Furnish asphalt tack coat material meeting the requirements of SCS 355.

365.23 Asphalt Concrete—Unless another class is shown, furnish Level 2, ½ inch Dense HMAC according to SCS 360.

Equipment

365.30 Equipment—Plant and equipment shall conform to SCS 360.

Construction

365.41 Earthwork—Make excavations and backfills for the structures according to SCS 204 and to the depths, widths and cross-sections shown, specified, or directed.

365.42 Foundation—Construct aggregate base to the lines and grade shown. Compact each layer of material until there is no reaction or yielding under the compactor.

365.43 Foundation Preparation—Bring areas on which asphalt concrete is to be constructed to established line, and make firm, dry and free of all unsuitable material before placing asphalt concrete. Trim broken or ragged edges to firm material.

365.44 Tack Coat—Tack contact areas where asphalt concrete is to come in contact with previously placed portland cement concrete, asphalt concrete, or bituminous surfaces according to SCS 355.

365.45 Placing Asphalt Concrete—Place asphalt concrete according to SCS 360 except place asphalt concrete structures of uniform width by either mechanical extrusion methods or between suitable forms. When conditions merit, use small or special pavers, spreader boxes, or blade

graders for placing asphalt concrete. Construct all structures within the following lines and grades:

- 1-inch of true line
- 0.04 foot of established surface grade, cross section and slope
- 0.04 foot of specified thickness

365.46 Compacting Asphalt Concrete—Compact asphalt concrete according to the following or as directed:

(a) Compaction to a specified density will not be required, regardless of thickness. Perform breakdown and intermediate rolling until the entire surface has been compacted with at least four coverages by the roller(s). Perform additional coverages, as directed, to obtain finish rolling of the HMAC.

(b) Along curbs and walls, on walks, irregular areas, and other areas not practically accessible to large rollers, compact the mixture with small, self-propelled rollers, mechanical tampers, hot hand tampers, or hand rollers. 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.

Field Testing

365.60 Pavement Smoothness—Test top surfaces with a 12 foot straightedge furnished and operated by the Contractor under the Engineer's direction. The surface shall not vary more than ¼ inch from the straightedge except at grade changes.

Measurement

365.80 Measurement—Work performed under this Section will be measured by one of the following methods:

(a) **Unit Basis—**Measurement will be the actual count of each location where the structure is constructed.

(b) **Area Basis—**Measurement will be the ground surface, limited to the neat lines of the structure, and converted to the nearest square foot.

(c) **Length Basis—**Measurement will be from end to end of the pertinent structure along its longitudinal axis for each separate item or continuous run.

Payment

365.90 Payment—The accepted quantities of structures placed under this Section will be paid for at the Contract unit price, per unit of measurement, for the items listed in on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, including asphalt concrete, aggregate base, asphalt tack coat, and for furnishing all equipment, labor, and incidentals necessary to complete the respective structures in place as specified.

365.91 Incidentals—No separate or additional payment will be made for surface removal, excavation, and foundation preparation.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 365 Standard Pay Items	**Unit of Measure**
Driveway Approach, __-Inch AC over __-Inch Aggregate Base	Ea or SY
Footpath, __-Inch AC over __-Inch Aggregate Base	SY or LF
Parking Area, __-Inch AC over __-Inch Aggregate Base	SY
Ramp, __-Inch AC over __-Inch Aggregate Base	Ea or SF
< Variable Name >, __-Inch AC over __-Inch Aggregate Base	< Units * >

* *Set units as appropriate for variable structure.*

Section 370 – Portland Cement Concrete (PCC) Pavement

Description

370.00 Scope—This Section covers work necessary for construction of Portland Cement concrete pavements, with or without reinforcement, on a prepared subgrade or base course, complete.

Materials

370.20 Materials—All materials shall conform to requirements of SCS 205. If not specified or shown elsewhere, furnish Class 4000-1 ½ concrete.

Equipment

370.30 Paving Machine—The paving 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.

Construction

370.40 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 SCS 602.

370.41 Hauling—Hauling of Portland Cement concrete mixed at a central plant or in transit will conform to the provisions of SCS 602.

370.42 Forms—Conform to the applicable requirements of forms in SCS 602.

370.43 Handling And Placing—Conform to requirements for Handling and Placing in SCS 602. 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.

370.44 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.

370.45 Slip Form Equipment Operation

(a) **Continuous Motion**—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.

(b) **Guides**—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.

370.46 Tamping and Screeding

(a) **Tamping**—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.

(b) **Screeding**—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.

370.47 Roadway and Alley Finishing

(a) **Line and Grade**—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 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.

(b) **Broom Finish**—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.

(c) **Edges**—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.

370.49 Joints—Conform to applicable requirements of SCS 602. 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.

370.50 Correcting Defects—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.

370.51 Curing—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 for a period not less than 72 hours in accordance with one of the following provisions as specified:

(a) 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.

(b) 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.

(c) 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.

Field Testing

370.60 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.

Maintenance

370.70 Protection of Concrete

(a) 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.

(b) 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.

(c) 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.

Measurement

370.80 Measurement—The quantities of Portland Cement Concrete Pavement will be measured on the area basis, of surface area constructed to the full depth as shown. The surface area will be determined by horizontal measurements.

(a) **Extra Thickness**—The measurement of extra thickness of pavement, as shown or as ordered, will be determined by conversion on a proportionate volume basis to an equivalent area of specified thickness pavement.

Payment

370.90 Payment—The accepted quantities of Portland Cement Concrete Pavement will be paid for at the Contract unit price, per unit of measurement shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, testing, and incidentals necessary to complete the work as specified.

370.91 Incidentals—No separate or additional payment will be made for construction joint reinforcement bars, tie bars, dowel bars, curing materials, saw cutting and maintenance.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 370 Standard Pay Items	**Unit of Measure**
Plain Concrete Pavement __-Inches Thick	SY
Reinforced Concrete Pavement __-Inches Thick	SY
Continuous Reinforced Concrete Pavement __-Inches Thick	SY

Section 380—Curbs

Description

380.00 Scope—This work consists of furnishing, placing, and finishing commercial grade concrete (CGC) curbs, combination curb and gutter hereinafter referred to as "curbs"; mechanically extruded curbs hereinafter referred to as "drainage curbs"; and "landscape curbs" which are a component of curb ramps.

Materials

380.20 Materials—Furnish materials meeting the following requirements:

Commercial Grade Concrete ..... SCS 340
Epoxy Bonding Agent ..... ODOT 02070.10
Preformed Expansion Joint Filler ..... ODOT 02440.10

Construction

380.40 General—Construct curbs in accordance with Standard Plan details at the locations and to the lines, grades, and dimensions shown on the plans. Construct drainage curbs according to details on plans to the lines, grades, and dimensions shown on the plans.

380.41 Preparation of Base

(a) **Curbs**—Construct aggregate base of the thickness shown on the plans in accordance with SCS 325.

(b) **Drainage Curbs**

(1) Clean pavements upon which drainage curbs are to be constructed so that they are free of dirt, dust, oil, grease or other extraneous matter.

(2) Bond drainage curbs to underlying pavements with an epoxy bonding agent from the conforming to SCS 380.20. Apply according to the manufacturer's recommendations and at a rate that provides a thorough coating to the surface with all voids and depressions filled. Place the new curb on the epoxy bonding agent within 15 minutes after spreading, or before it loses its tackiness, whichever is sooner.

380.42 Line and Grade—Set top of curb grade by an offset guide line established by the engineer. Do not place concrete until stringline or forms have been inspected and approved. Any adjustments in excess of 0.05 feet must be approved or directed by the engineer.

380.43 Finishing and Curing—Perform finishing work as required to achieve a uniform texture and smooth, dense surface. Cure in accordance with SCS 340. Keep the curb free from contact, strain and public traffic for at least seven calendar days or when test cylinders reach design strength.

380.44 Transverse Contraction Joints—Space contraction joints as shown on Standard Plans. Form joints no wider than ¼ inch and deep enough so that at least one-third of the cross-sectional area of Curb is severed. Tool the edges of the joints.

380.45 Transverse Expansion Joints—Space expansion joints as shown. The width of the joint and thickness of the filler shall not be less than 1/2 inch. Construct each expansion joint at right angles to the curb alignment, normal to the surface of the curb and provide complete separation of new concrete.

Field Testing

380.60 General—When a straightedge 12 feet long is laid on a finished surface tangent, the surface shall not vary more than ¼ inch from edge of the straightedge except at grade changes or curves. Remove and replace any unconsolidated (honeycombed) or other defective sections in full sections.

Measurement

380.80 Measurement—The quantities of curbs and drainage curbs will be measured on the length basis measured along the line and grade of the structure.

Payment

380.90 Payment—The accepted quantities of curbs and drainage curbs will be paid for at the contract unit price per unit of measurement for each of the respective curb types shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, equipment, tools, labor and incidentals necessary to complete the work as shown and specified.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 380 Standard Pay Items	Unit of Measure
Type __ Curb	LF
Drainage Curb	LF
Landscape Curb	LF

Section 381—Wheel Stops

Description

381.00 Scope—This section covers work necessary to furnish and install precast concrete wheel stops at locations shown in the drawings or as directed by the Engineer.

Required Submittals

381.10 Shop Drawings—Submit shop drawings of stops, including installation details and attachment details to at-grade concrete and asphalt pavement.

381.11 Product Data—Submit manufacturers' product data of precast stops and epoxy adhesive.

Materials

381.20 General—Wheel stops shall be manufactured for the intended purpose by a company specializing in the manufacture of precast concrete appurtenances.

381.21 Wheel Stop—Precast, 3.5% minimum air-entrained concrete; 4000 psi minimum compressive strength. Each stop shall be reinforced with two No. 4 deformed steel reinforcing bars, minimum. Provide chamfered corners and drainage slots on underside, and provide holes for dowel-anchoring to substrate. Unless indicated otherwise, provide stops of half octagonal configuration and 72-inch length.

Construction

381.40 Installation—Install wheel stops per manufacturer’s recommendations, and as shown in the drawings.

Measurement

381.80 Measurement—The quantity of wheel stops will be measured on a unit basis by actual count of units in place as specified.

Payment

381.90 Payment—The accepted quantities of wheel stops will be paid for at the contract unit price shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, equipment, tools, labor and incidentals necessary to complete the work as shown and specified.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 381 Standard Pay Items	**Unit of Measure**
Wheel Stops, __-Inch Long	Ea

Section 385—Miscellaneous Portland Cement Concrete (PCC) / Aggregate Base Structures

Description

385.00 Scope—This work consists of furnishing, placing and finishing commercial grade concrete walks, curb ramps, driveways, monolithic curb and sidewalk, and miscellaneous surfaces and stairs on aggregate base foundation, and furnishing and installing metal handrail in close conformity to the lines, grades and dimensions shown or established. The commercial grade concrete over aggregate base items in this Section will be collectively referred to as "structures".

Required Submittals

385.10 Concrete Surface Retarder—Submit product data for Concrete Surface Retarder (CSR). Submittal shall include manufacturer's instructions for concrete placement, proper application of the CSR, and (if any) color selection.

385.11 Welding Procedures—Submit all welding procedure specifications to the Engineer for approval.

385.12 Metal Handrails—Submit shop drawings.

Materials

385.20 Materials—Furnish materials meeting the following requirements:

Bar Reinforcement	ODOT 02510
Commercial Grade Concrete	SCS 340
Dowels	ODOT 02510.50
Epoxy Bonding Agent	ODOT 02070.10
Metal Handrail	ODOT 02830
Preformed Expansion Joint Filler	ODOT 02440.10
Welded Wire Fabric	ODOT 02510.40

385.21 Aggregate Base—Furnish aggregate base materials for base, foundation courses, leveling courses, or bedding meeting the requirements of SCS 325. If a designated size is not shown or given, furnish either 1" - 0 or 3/4" - 0, as the Contractor elects.

385.22 Concrete Surface Retarder—When exposed sand or exposed aggregate surfaces are required, furnish a concrete surface retarder chemical product formulated for the specific purpose of temporarily retarding concrete "set" at the surface so the desired surface texture can be achieved.

Construction

385.41 Earthwork—Make excavations and backfills for the structures, according to SCS 204, to the depths, widths, and cross-sections shown, or required by existing conditions.

385.42 Foundation—Construct aggregate base to the lines and grade shown. Compact each layer of material until there is no reaction or yielding under the compactor.

385.43 Foundation Preparation—Bring areas on which structures are to be constructed to established line, and make firm, dry and free of all unsuitable material before placing concrete. Trim broken or ragged edges to firm material.

385.44 Joining New to Existing Concrete—Construct suitable connections between new and existing concrete where existing driveways, walks, and other structures are cut back to permit the new construction or where the new construction abuts the existing concrete. Unless shown or directed otherwise, furnish and place minimum ½ inch thick preformed expansion joint filler between new and existing concrete.

385.45 Reinforcement, Dowels, and Tie Bars—Furnish and place reinforcement, dowels, and tie bars as shown or directed. Provide dowels with "slip sleeves" and place as load transfer devices where shown. Place dowels without "slip sleeves" as fastenings or ties between new and existing underlying concrete when shown.

385.46 Concrete—Construct the structures between suitable forms or by the extrusion method. Place concrete according to SCS 340 and subject to this Section.

385.48 Expansion Joints—Construct expansion joints of the preformed filler type in sidewalks and driveway in locations shown on City of Salem Standard Drawings and in accordance with the following:

(a) Not less than ½ inch wide, except where abutting or underlying concrete joints are larger, then the width shall match those joints.

(b) At right angles to the structure alignment and normal to the structure surface.

(c) Which completely separate the concrete segments.

(d) Placed flush or no more than 1/8 inch below the concrete surface.

385.49 Contraction Joints—Construct transverse contraction joints of the weakened plane or dummy type in the exposed surfaces of the concrete structures as shown on Plans or City of Salem Standard Drawings and the following:

(a) **Locations**—Locate opposite contraction joints in abutting concrete.

(b) **Spacing**—Confine joint spacing to a maximum of 15 feet.

(c) **Dimensions**—Contraction joints shall (1) be not less than 1/8 inch or more than 1/4 inch wide, and (2) be a depth of one-third the thickness of the concrete.

(d) **Methods**—Construct contraction joints by one of the following methods:

- Inserting and removing plates, or other devices.

- Inserting and leaving in place preformed expansion joint filler even and flush with the concrete surface.

- Sawing as soon as practical after concrete placement but before any uncontrolled cracking occurs.

- Tooling or other approved methods.

385.50 Surface Finishing

(a) **General**—Remove forms, if any, from structures after the concrete has taken its initial set and while the concrete is still green. Repair minor defects with mortar containing one part portland cement and two parts sand. Do not plaster exposed surfaces. The top and face of structures shall be true and straight, free from humps, sags, or other irregularities. Unless otherwise shown or directed, tool edges to 1/4 inch radius.

(b) **Stairs**—While the concrete is still green, finish the exposed surfaces as required to produce a smooth surface and uniform texture.

(c) **Driveways, Walks, and Surfacings**—Finish concrete surfaces to smooth and uniform texture by troweling, floating and cross brooming. Lightly groove or mark surfaces into squares or other shapes to match markings on similar existing surfaces in the vicinity, or as shown or directed. Do not allow rinse water or cement matrix residue to flow into stormwater systems.

(d) **Exposed Sand or Aggregate Finishes**—Finish exposed sand or exposed aggregate surfaces following the instructions provided by the CSR product manufacturer, as approved by City.

385.51 Curing—Cure and protect concrete after placing and finishing according to SCS 340. Keep the concrete structure free from contact, strain and public traffic for at least seven calendar days or until design strength is achieved.

385.52 Metal Handrail—Fabricate and assemble free standing and bolted down metal handrail as shown.

385.53 Welding—Welding, welder qualifications, prequalification of weld details and inspection of welds shall conform to AWS D1.1. Submit all welding procedure specifications to the Engineer for approval.

385.54 Bolt Holes

(a) **Punched Holes—**Use a die with a diameter not exceeding the diameter of the punch by more than 1/16-inch. Ream any holes that are required to be enlarged to admit the anchor bolts. Make clean cut holes without torn or ragged edges.

(b) **Accuracy of Punched Holes—**Locate all holes punched full size so accurately that when multiple anchor plates are stacked with the edges even, a cylindrical pin ⅛ inch smaller in diameter than the nominal size of the punched hole may be entered perpendicular to the face of the plate without drifting in each of the connecting holes in the same plane. Non-conforming pieces will be rejected.

Field Testing

385.60 General—Any of the following items are evidence of unsatisfactory construction:

(a) Unconsolidated (honeycombed) or otherwise defective concrete not in conformance with SCS 340.

(b) Impounding of water on the surface (birdbaths).

(c) Cracking that occurs outside contraction joints.

(d) Vertical discontinuity greater than 1/4-inch between adjacent surfaces, or at meter boxes and valve boxes.

(e) Finished surface slopes not conforming to standards.

(f) Color dye on concrete not intended to be colored.

(g) The surface varies more than 1/4 inch from the edge of 12 foot long straightedge laid on the top or face of the structure, except in curves.

Maintenance

385.70 Protection of Concrete

(a) Erect and maintain suitable barriers to protect the concrete from traffic or other detrimental trespass. If necessary, post a guard to ensure that barriers remain effective.

(b) Construct and maintain suitable bridges, as directed, wherever it is necessary that traffic be carried across uncured structure.

Measurement

385.80 Measurement—The quantities of structures constructed under this Section will be measured according to the following:

(a) **Volume Basis**—Measurement will be limited to the neat lines of the finished structure as shown or directed.

(b) **Area Basis**—Measurement will be horizontal measurements, limited the neat lines of the structure. No deduction will be made for curb ramps, flares, or detectable warning surfaces constructed under SCS 390.

(c) **Length Basis**—Measurement will be along the centerline of the structure, from end to end.

(d) **Each Basis**—Measurement will be by actual count.

Payment

385.90 Payment—The accepted quantities of structures will be paid for at the Contract unit price, per unit of measurement shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

385.91 Incidental—Unless otherwise shown on the Schedule of Pay Items, no separate or additional payment will be made for Earthwork or Foundations constructed for structures.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 385 Standard Pay Items	**Unit of Measure**
Bus Boarding Area, __-inch PCC over __-inch Aggregate Base	SF
Sidewalk (Sand Exposed Surface), __-inch PCC over __-inch Aggregate Base	SF
Sidewalk, __-inch PCC over __-inch Aggregate Base	SF
Sidewalk, __-inch PCC over __-inch Aggregate Base, __-ft wide	LF
Concrete Driveway, __-inch PCC over __-inch Aggregate Base	SF or Ea
Concrete Stairs	CY
Metal Handrail, _#_ Rails	LF
Monolithic Curb and Sidewalk, __-inch PCC over __-inch Aggregate Base	SF or LF

 # Number of horizontal rails.

Section 390—Curb Ramps

Description

390.00 Scope—This work consists of furnishing, placing, and finishing commercial grade concrete curb ramps in close conformity to the lines, grades and dimensions shown or established.

390.01 Definitions

Blended Transition—A connection (with a grade of 5 percent or less) between the level of the pedestrian walkway and the level of the crosswalk.

Cross Slope—The grade that is perpendicular to the direction of accessible pedestrian travel. On a sidewalk, shoulder, or blended transition, it is measured perpendicular to the curb line or edge of the street; on a curb ramp, it is measured perpendicular to the running slope.

Curb Ramp—A perpendicular or parallel ramp and its landing that cuts through or is built up to the curb.

Detectable Warning—A surface feature of truncated dome material built in or applied to the walking surface to advise pedestrians of an upcoming change from pedestrian way to vehicular way.

Parallel Curb Ramp—A curb ramp with a running slope that is in-line with the direction of sidewalk travel.

Perpendicular Curb Ramp—A curb ramp with a running slope that crosses the curb at right angles or meets the gutter grade break at right angles.

Pedestrian Access Route—A continuous and unobstructed walkway within a pedestrian circulation path that provides accessibility.

Pedestrian Circulation Path—A prepared exterior or interior way of passage provided for pedestrian travel.

Running Slope—The grade that is parallel to the direction of travel, expressed as a ratio of rise to run or as a percent.

390.02 Standards

(a) **Curb Ramps and Blended Transitions**—Standards for curb ramps and blended transitions are depicted on applicable Standard Plans.

(b) **Detectable Warning Surfaces**—Detectable Warning Surfaces shall comply with SCS 390.21 and the following:

(1) **Surface**—The surface shall consist of truncated domes aligned in a square or radial grid pattern.

(2) **Dome Size**—Truncated domes shall have a base diameter of not less than 0.9 inches or more than 1.4 inches, a top diameter of not less than 50 percent or more than 65 percent of the base diameter, and a height of 0.2 inches.

(3) **Dome Spacing**—Truncated domes center-to-center spacing shall be not less than 1.6-inches or more than 2.4 inches, and a base-to-base spacing of not less than 0.65 inches, measured between the most adjacent domes.

(4) **Contrast**—Detectable warning surfaces shall contrast visually with adjacent gutter, street, or walkway surfaces, either light-on-dark or dark-on-light.

(5) **Size**—Detectable warning surfaces shall extend 24-inchs minimum in the direction of travel and the full width of the curb ramp (exclusive of flares), the landing, or blended transition.

Required Submittals

390.10 Detectable Warning Surface—Submit Product Data.

Materials

390.20 General—All materials not specified in this section shall be in accordance with SCS 385.

390.21 Detectable Warning Surfaces—Furnish detectable warning surfaces meeting the following requirements:

(a) **Material**

(1) **Wet Set**—Precast tiles of high strength, integrally colored concrete, polymer concrete, or polymer composite material designed to be wet-set into fresh concrete. Approved products are as follows:

- Masons Supply Company (MASCO) CASTinTACT
- ADA Solutions, Inc. Cast In Place Replaceable

(2) **Surface Mount**—When allowed, surface mount detectable warning surfaces shall be as follows:

- Flint Trading, Inc. TopMark Preformed Thermoplastic Detectable Warnings

(b) **Color**—Brick Red (Federal Color Standard #20109) is required whenever adjacent concrete is of normal gray color. Yellow detectable warning surfaces may be required if necessary to contrast visually with adjacent gutter, street, or walkway surfaces.

Construction

390.40 General—Construct curb ramps in accordance with SCS 385 and this Subsection.

390.41 Curb Ramps—Plan and layout curb ramps in close coordination with Public Works Inspector. Do not place concrete without approval of concrete forms.

390.42 Detectable Warning Surfaces—Install detectable warning surfaces only in accordance with manufacturer's instructions. New curb ramps shall be constructed with Wet Set detectable warning surfaces. Surface Mount detectable warning surfaces are not permitted except by approval of the City Engineer.

Field Testing

390.60 General—Any of the following items are evidence of unsatisfactory construction:

(a) Curb ramps that do not conform to the accessibility standards set forth on applicable City of Salem Standard Plan.

(b) Impounding of water on the surface.

Measurement

390.80 Measurement—Except for Detectable Warning Surface, no measurement of quantities will be made for work performed under this Section. Curb Ramps and Blended Transitions will be measured according to SCS 385. Curbs will be measured according to SCS 380.

390.81 Detectable Warning Surface—Detectable Warning Surfaces will be measured on an area basis.

Payment

390.91 Detectable Warning Surface—The accepted quantity of Detectable Warning Surface will be paid for at the Contract unit price as shown on the Schedule of Pay Items.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 390 Standard Pay Items	**Unit of Measure**
Detectable Warning Surface	SF
Detectable Warning Surface – Surface Mount	SF

Section 395—Traffic Islands

Description

395.00 Scope—This work consists of furnishing, placing and finishing concrete islands and traffic separators in close conformity to the lines, grades and dimensions shown on Project Plans or Standard Drawings, as applicable.

Materials

395.20 Materials—Furnish materials meeting the following requirements:

Bar Reinforcement	ODOT 02510.10
Commercial Grade Concrete	SCS 340
Dowels	ODOT 02510.50
Preformed Expansion Joint Filler	ODOT 02440.10
Welded Wire Fabric	ODOT 02510.40
Detectable Warning Surface	SCS 390

395.21 Aggregate Base—Furnish aggregate base materials for base, foundation courses, leveling courses, or bedding meeting the requirements of SCS 325.

Construction

395.41 Foundation Preparation—Bring areas on which structures are to be constructed to established line, and make firm, dry and free of all unsuitable material before placing concrete. Existing concrete surfaces shall be clean and moist at the time of placing new concrete.

395.42 Joining New To Existing Concrete—Construct suitable connections between new and existing concrete where existing driveways, walks, and other structures are cut back to permit the new construction or where the new construction abuts the existing concrete. Unless shown or directed otherwise, furnish and place minimum 1/2 inch thick preformed expansion joint filler between new and existing concrete.

395.43 Reinforcement—Furnish and place reinforcement as shown on Project Plans or Standard Drawings as applicable. The reinforcement shall be straight, clean, and free of scale or other matter which would interfere with its bonding to the concrete.

(a) **Support Devices**—Place the reinforcement on support devices that maintain it in specified position during concrete placement. Support devices shall (1) hold the reinforcement within 1 1/2 inch of the vertical position shown, and (2) not displace more than 2 cubic inches of concrete when embedded in the slab.

(b) **Deformed Bar Reinforcement**—Tie or clip at every other transverse bar intersection, as a minimum, in a manner that does not allow for displacement. Tie or clip every lap splice as shown.

(c) **Welded Wire Fabric**—Store, handle and place with care to prevent distortion.

395.44 Concrete—Construct the concrete islands between suitable forms or by the extrusion method. Place concrete according to SCS 340 subject to this Section.

395.45 Expansion Joints—Construct expansion joints in accordance with SCS 385.45.

395.46 Contraction Joints—Construct contraction joints in accordance with SCS 385.46.

395.47 Surface Finishing—While the concrete is still green, finish the exposed surfaces as required to produce a smooth surface and uniform texture. The top and face of structures shall be true and straight, free from humps, sags, or other irregularities.

395.48 Curing—Cure and protect concrete after placing and finishing according to SCS 340. Keep the concrete structure free from contact, strain and public traffic for at least seven calendar days.

Measurement

395.80 Measurement—The quantities of traffic islands and traffic separators constructed under this Section will be measured according to one of the following:

(a) **Area Basis**—Measurement will be limited the neat lines of the structure.

(b) **Length Basis**—Measurement will be along the centerline of the Island, from end to end.

(c) **Each Basis**—Measurement will be by actual count.

Payment

395.90 Payment—The accepted quantities of traffic islands and traffic separators will be paid for at the Contract unit price, per unit of measurement shown on the Schedule of Pay Items. With the exceptions listed in 395.90(a-c), payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

(a) Detectable Warning Surfaces will be paid according to SCS 390.

(b) Landscaping will be paid according to SCS Div7.

(c) Signs and Markings will be paid according to SCS Div8 and Div9.

395.91 Exceptions—When traffic islands are not listed separately on the Schedule of Pay Items, payment for various components will be in accordance other applicable Sections.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 395 Standard Pay Items	**Unit of Measure**
Traffic Island	SF
Traffic Separator	LF
Traffic Island (Sta. __+__)	Ea

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.

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.

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.

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.

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.

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

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)***.

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.

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.

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.

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

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

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).

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.

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 to 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.

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.

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.

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.

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)

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.

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

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.

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

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.

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

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

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.

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.

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.

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 event 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.

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

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.

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

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.

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.

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

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

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.

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.

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***.

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.

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.

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.

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.

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.

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 cost to be borne solely by the Contractor incidental to performance of the work.

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***.

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

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.

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.

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***.

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

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.

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:

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.

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.

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.

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

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.

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

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.

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.

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

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.

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

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.

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

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.

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.

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.

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

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.

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

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

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.

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.

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

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 Components—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.

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.

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.

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

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.

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

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.*

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

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

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.

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.

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

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

City of Salem—Department of Utilities

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

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 buildup 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.

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.

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.

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.

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.

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

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)

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,

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.

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

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.

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

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,

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:

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*.

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***.

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.

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

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

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.

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.

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.

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.

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:

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

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

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

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

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

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.

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.

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.

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.

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.

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.

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.

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.

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

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.

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.

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.

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

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.

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.

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.

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

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

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.

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.

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.

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.

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.

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.

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.

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.

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

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.

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.

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

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.

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.

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.

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.

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.

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.

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.

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

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.

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.

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

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.

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.

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

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

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.

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:

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

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.

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

Apply 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.

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.

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.

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.

Division 7—Right-of-Way Development

701 Landscaping

701.1.00 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.

701.2.00 MATERIALS

701.2.01 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.

701.2.02 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.

701.2.03 SOD

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

701.2.04 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.

701.2.05 SAND

Conform to requirements of Subsection 205.2.12C for fine aggregate.

701.2.06 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.

701.2.07 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.

701.2.08 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.

701.2.09 IRRIGATION AND WATERING SYSTEMS

701.2.09A 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.

701.2.90B 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.

701.2.09C 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.

701.2.09D 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.

701.2.09E 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.

701.2.09F 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.

701.2.09G 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.

701.2.09H 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.

701.2.10 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.

701.2.11 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.

701.2.12 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.

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.

701.2.13 SOIL STERILANT

Use granular calcium cyanamide, manufactured for use as an herbicide, or other approved sterilant.

701.3.00 CONSTRUCTION

701.3.01 GENERAL

Conform to manufacturer's and supplier's recommendations and instructions and to accepted practices in the industry.

701.3.02 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.

701.3.03 LAWNS AND GRASS

701.3.03A 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

701.3.03B 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.

701.3.03C 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.

701.3.03D 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.

701.3.03E 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.

701.3.03F 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.

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.

701.3.03G 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.

701.3.03H 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.

701.3.03I 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.

701.3.03J 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

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.

701.3.03K 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.

701.3.03L 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.

701.3.04 TREES, SHRUBS, AND GROUND COVER

701.3.04A 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.

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.

701.3.04B 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.

701.3.04C 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

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 than 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

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.

701.3.04D 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.

701.3.04E 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.

701.3.04F 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.

701.3.04G 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.

701.3.04H 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.

701.3.04I 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.

701.3.05 IRRIGATION SYSTEMS

701.3.05A 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

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.

701.3.05C 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.

701.3.05D 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.

701.4.00 MEASUREMENT AND PAYMENT

701.4.01 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.

701.4.02 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.

DIVISION 8—TRAFFIC SAFETY AND GUIDANCE DEVICES

Section 815—Bollards

Description

815.00 Scope—This work consists of furnishing and installing bollards at locations shown or as directed.

815.01 Standards—Unless shown otherwise on Drawings, construct bollards in accordance with ODOT Standard Drawing RD130.

Materials

815.20 Materials—Furnish materials meeting the following requirements:

Commercial Grade Concrete..... SCS 340
Granular Drain Backfill ..... ODOT 00430.11
Reflective Sheeting (Type III and Type IV) .....ODOT QPL

815.11 Posts and Sleeves—Use Schedule 40 steel posts and sleeves conforming to ASTM A 53.

815.12 Plates, Shapes, Fasteners, and Hardware—Use plates and shapes conforming to ASTM A 36. Use fasteners and hardware conforming to ASTM A 449.

815.13 Galvanizing—Hot-dip galvanize all metal components after fabrication according to AASHTO M 111 (ASTM A 123) or AASHTO M 232 (ASTM A 153), as applicable.

Construction

815.40 Bollards—Install bollards as shown or as directed.

Measurement

815.80 Measurement—The quantities of bollards and removable bollards will be measured on a unit basis.

Payment

815.90 Payment—The accepted quantities of bollards will be paid for at the Contract unit price, per unit of measurement, shown on the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

815.91 Incidentals—No separate or additional payment will be made for excavation work.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 815 Standard Pay Items	**Unit of Measure**
Bollards	Ea
Removable Bollards	Ea

Section 840—Delineator Posts

Description

840.00 Scope—This work consists of furnishing and installing delineator posts at locations shown or established.

840.01 Standards—Refer to ODOT Standard Drawing TM570 and TM571.

Materials

840.10 Materials—Furnish materials meeting the following requirements:

Barrier Markers	From ODOT QPL
Flexible Delineators	From ODOT QPL
Reflective Sheeting for Delineators (Type III and Type IV)	From ODOT QPL

Construction

840.40 Lines, Grades, And Preparation Work—Install delineator posts to the lines, grades, and spacing shown and as established. To avoid difficult installation at any individual post site, the spacing may be varied 5 percent in either direction and may deviate from line by 6 inches in either direction. Remove vegetative growth, litter, and debris from the post sites.

840.41 Installation of Posts—Set posts firmly into the ground and vertical. Remove and discard posts that become split, cracked, twisted, or bent, or whose tops become badly misshapen during installation.

(a) **Embedment Depth**—Field verify post length. Posts set in sandy, gravelly, or other unconsolidated material may require an anchor system or need to be longer to provide adequate anchorage. Posts may be shortened to avoid unnecessary penetration in solid rock or in large rock fragments. If set in rock, drill a 9-inch deep hole, 1-inch greater in diameter than the large dimension of the post, and grout in place with a fine mortar grout.

(b) **Guardrail Locations**—At wood guardrail post installations, attach Type 4 delineators (alternate 1, plastic or alternate 2, steel) to the wood guardrail posts as shown on the standard drawings. At metal guardrail post installations, install full length Type 1, 1U, or 2 ground mounted delineators behind the rail, adjacent to metal guardrail posts.

(c) **Concrete Barrier Locations**—At concrete barrier installations, attach Type 5 delineators to the concrete barrier according to the manufacturer's recommendations and as shown on the standard drawings.

840.42 Target Members for Delineator Posts—Assemble, fasten, set, and align target members and reflective material appropriate to the type and color of delineators as shown. Attach reflective sheeting to the targets as recommended by the manufacturer.

840.43 Finishing and Cleanup—Remove and properly dispose of excess excavated materials, litter, and debris resulting from the operations. Finish the surface around the support to match the surrounding surface or as shown.

Measurement

840.80 Measurement—The quantities of delineators posts will be measured on the unit basis.

Payment

840.90 Payment—The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for each item that appears in the Schedule of Pay Items. Payment will be in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

840.91 Incidentals—No separate or additional payment will be made for preparation work, earthwork, grouting, backfilling, and cleaning up.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 840 Standard Pay Items	Unit of Measure
Delineators, Type _*_	Ea

Section 850—Common Provisions for Pavement Markings

Description

850.00 Scope—This work consists of furnishing, preparing, and installing all forms of pavement markings.

Required Submittals

850.10 Preconstruction—Submit two copies of the following:

(a) A list of materials the Contractor proposes to install. List all material shown or specified by manufacturer's name, size, and model number if applicable. Supplement the list with other data as necessary.

(b) Manufacturer's installation instructions for all materials.

(c) Use materials from the current list of acceptable materials. The updated list is available from the Engineer. Mark the list according to the instructions on it. The list eliminates the need for most catalogue cut sheets.

Materials

850.20 General—Furnish the following materials from the ODOT QPL:

(a) Adhesive for Pavement Markers

(b) Methyl Methacrylate

(c) Pavement Markers

(d) Marking Paint

(e) Thermoplastic

850.21 Reflective Elements—Use the following reflective elements according to the manufacturer's recommendations:

(a) In thermoplastic pavement legends, use Swarco 3130 glass beads.

(b) In methyl methacrylate (MMA) pavement striping, use Swarco 3132 glass beads.

(c) For painted pavement markings, use glass beads from the ODOT QPL.

Labor and Equipment

850.30 Equipment—Use equipment acceptable by the marking material manufacturer for the method specified and the following:

(a) Use manual or automatic application equipment for Pavement Legends and Bars.

(b) For Longitudinal Lines, use applicators, sprayers or extruders made specifically for applying the specified pavement marking material at a uniform width and thickness on the roadway surface.

(c) Use automatic bead applicators that place a uniform layer of beads on the line.

(d) Use equipment capable of placing two parallel lines simultaneously with 4-inch minimum to 12-inch maximum spacing between the two lines and capable of placing the entire width of a line in one pass.

(e) Use a three-gun system for applying sprayed markings.

850.32 Manufacturer-Certified Installers—For Sections referencing subsection 850.32, provide installers certified by the marking materials manufacturer for the specified marking material and method. Do not begin installation prior to receiving the Engineer's approval.

Construction

850.40 Projects Without Striping Plans—For projects without striping plans, replace striping to match existing pavement markings in-kind. Document existing striping location and submit documentation to the Engineer seven calendar days prior to loss of existing pavement markings.

850.41 Projects With Striping Plans—For projects with striping Supplemental Drawings, install striping as shown.

850.42 Pre-Striping Conference—Meet with the Engineer and striping subcontractor, if striping is done by a subcontractor, two weeks prior to beginning striping work to discuss methods and practices of accomplishing all required striping work. Submit the following in writing five calendar days before the pre-striping conference for approval:

(a) A striping schedule showing areas and timing of work, and placing of material.

(b) A list of materials proposed for use and the application method.

(c) A copy of the manufacturer’s installation instructions and Material Safety Data Sheets (MSDS).

(d) Proof of installer’s certification for those Sections referencing subsection 850.32.

(e) Equipment specifications.

(f) A spill recovery plan including:

(1) Name, address, and phone number of the Contractor’s contact with the DEQ.

(2) Name, address, and phone number of the persons certified and on-call to do clean-up.

(g) After the striping layout has been completed, contact the City of Salem Sign Shop Supervisor at 503-588-6482 a minimum of 48 hours prior to any striping operations for striping layout approval.

850.43 Prepare and Prime Pavement—Prepare pavement surfaces according to the following:

(a) **Existing Pavement Surfaces**:

(1) When required by the pavement marking manufacturer, remove pavement markings from existing pavement surfaces that will adversely affect the bond of new pavement marking material to the roadway surface according to SCS 851.

(2) Remove all other contaminants from existing pavement surfaces that may adversely affect the installation of new pavement markings by sandblasting, shot-blasting, or sweeping. Air blast the pavement with a high-pressure system to remove extraneous or loose material.

(b) **New Asphalt Concrete Surfaces**—Remove contaminants from new AC surfaces that may adversely affect the installation of the pavement markings by sandblasting, shot-blasting, or sweeping. Air blast the pavement with a high-pressure system to remove extraneous or loose material. Apply materials to new asphalt concrete that is sufficiently cured according to the manufacturer's recommendations.

(c) **New Portland Cement Concrete Surfaces**—Remove curing compounds and laitance by an approved mechanical means. Air blast the pavement with a high-pressure system to remove extraneous or loose material. Apply materials to concrete that has reached a minimum compressive strength of 3,000 psi and that is sufficiently cured according to the manufacturer's recommendations.

(d) **Priming the Pavement**—After the pavement surface is clean and dry, apply primer as recommended by the manufacturer to the area receiving the pavement markings. Apply the primer in a continuous, solid film according to the recommendations of the primer manufacturer and the pavement markings manufacturer.

850.44 Alignment Layout—Layout of permanent striping and pavement markings is the responsibility of the Contractor. The City will not provide striping layout. Place control points for lines every 50 feet on tangent and every 25 feet on a curve. Using these control points, layout a continuous narrow guideline for each line, along one edge of, or uniformly offset from the intended permanent line location. Do not proceed with installation until the guidelines are approved by the Engineer.

850.45 Installation—Apply pavement marking materials to clean dry pavement surfaces and according the following:

(a) Place material according to the manufacture's recommendations.

(b) Place parallel double lines in one pass.

(c) Place the specified width of lines in one pass.

(d) The pavement surface shall not be visible in the striped areas.

(e) The top of pavement marking shall be smooth and uniform.

(f) Skip line ends shall be square and clean.

(g) Place pavement marking lines parallel and true to line.

(h) Place skip lines so that they are in cycle with at least one end of any adjacent project.

(i) Place markings in proper alignment with existing markings.

(j) Immediately clean up marking material dribbled beyond the cutoff.

850.46 Placement Tolerance—Allowable tolerances for installation are:

(a) Lateral location on roadway: ½-inch on tangents; 1-inch on curves

(b) 40-foot skip cycle length: ± 2 inches for skip length, ± 2 inches for gap length

(c) 12-foot skip cycle length: ± ¾-inch for skip length, ± 1-inch for gap length

(d) 8-foot skip cycle length: ± ½-inch for skip length, ± ¾-inch for gap length

(e) Skip Cycle: A tolerance of 1/10 of the skip line length on the first skip line of a run, but it shall be on cycle within one skip

(f) Double lines: Parallel, with a gap tolerance of ± ½-inch

(g) Width of lines: + ⅜-inch, −1/16-inch

(h) Thickness of flat, surface applied lines: + ⅓ of the specified thickness, −1/10 of the specified thickness

(i) Divergence of parallel double lines: ± ⅜-inch

850.47 Quality Control—Record the following readings for each type and color of marking material and the locations where they were taken. Submit the results to the City within one day of taking the readings.

(a) Placement Tolerances—For surface applied markings, except paint applications, measure the thickness of the lines, at 300 foot intervals. Thickness is measured from the top of the pavement marking to the top of the wearing surface. Marking material placed in a depression left by pavement line removal will not be included in measuring the thickness of the line.

(b) Curing of Material—Rate the line, markings, and pavement marker adhesive at the time of installation to determine if the material has properly cured. Note any soft spots, abnormally darkened areas, or other indications that the line has not properly cured.

(c) Retroreflectivity—Use a 30 meter geometry retroreflectometer to measure the retroreflectivity within 48 hours of curing, except for paint applications:

(1) At 300-foot intervals for longitudinal lines.

(2) At each pavement legend/bar. Take ten individual readings per pavement legend/bar. If the Project has more than ten pavement legend/bars, measure a minimum of ten legends/bars or 10 percent of the total number of legends/bars, whichever is greater. The legends to be measured will be selected by the Engineer.

(3) Estimate the bead embedment depth for longitudinal lines and pavement legends/bars at the same location as the retroreflectivity reading.

850.50 Disposal of Waste—Waste material becomes the property of the Contractor at the point of origin. This includes all grindings and all removed marking material. Dispose of waste according to all applicable federal, state, and local laws as they pertain to the storage, handling, management, transportation, disposal, and documentation of waste, hazardous waste, and hazardous substances.

850.51 Removal and Repair of Unacceptable Work—Remove unacceptable materials according to SCS 851. If more than one repair is required in a single 300-foot section, remove and repair the entire 300-foot section.

Temporary Protection

850.70 General—Protect all applied markings from traffic until sufficiently cured so as not to be damaged or tracked by traffic movements.

Measurement

850.80 Measurement—No measurement of quantities will be made for work under this section.

Payment

850.90 Payment—No separate or additional payment will be made for work under this section. Payment will be included in payment made for the appropriate items under which this work is required.

— END OF SECTION —

Section 851—Pavement Marking Removal

Description

851.00 Scope—This work consists of removing markings from the pavement surface.

Construction

851.40 General—Remove durable and non-durable pavement markings so that the pavement surface is not damaged below a depth of ⅛-inch.

(a) Remove pavement markings the same day permanent or temporary markings are applied.

(b) Use vacuum shrouded equipment or other equally effective containment procedures.

(c) Properly dispose of all waste materials according to all applicable federal, state, and local laws as they pertain to the storage, handling, management, transportation, disposal, and documentation of waste, hazardous waste, and hazardous substances.

851.41 In-Service Pavement—On pavement surfaces to remain in service after completion of the project, remove pavement markings by hydroblasting or steel shot blasting.

851.42 End-Service Pavement—On pavement to be removed, replaced, or overlaid during the project, remove pavement markings by hydroblasting, steel shot blasting, or grinding.

Measurement

851.80 General—No measurement will be made under this section when pavement line, pavement bar, or pavement legend removal is performed in conjunction with Cold Plane Pavement Removal.

851.81 Pavement Line Removal—The quantities of pavement line removed will be measured on the length basis. Unless separate pay items are included in the Schedule of Pay Items, pavement line removed will be based on a nominal width of 4 inches. In the event no separate pay item is included, if the width of the line is other than 4 inches, measurement will be adjusted by converting to an equivalent length of nominal 4-inch line on a proportionate area basis. Measurement will be the actual stripe removed. Gaps between broken and dotted stripes will not be measured.

851.82 Pavement Bar Removal—The quantities of pavement bars removed will be measured in the area basis for each stop bar and crosswalk bar removed.

851.83 Pavement Legend Removal—The quantities of pavement legends removed will be measured on either a unit basis or an area basis according to the method shown on the Schedule of Pay Items.

(a) **Unit Basis**—When measurement is by a unit basis, the quantities of pavement legends removed will be by actual count. One legend is considered to include all letters, characters, and all markings associated with the particular pavement legend.

(b) **Area Basis**—When measurement is by an area basis, the quantities of pavement legends removed and will be the nominal area determined by multiplying the width times the length of the legend. No deductions will be made for corners or irregular shapes.

Payment

851.90 Payment—The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for each item that appears in the Schedule of Pay Items. Payment will be in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

851.91 Incidentals—Removing existing pavement markings when directed by the pavement marking manufacturer, for the preparation of applying new pavement markings is incidental to the new pavement markings.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 851 Standard Pay Items	Unit of Measure
Pavement Line Removal	LF
Pavement Line Removal, 8-inch wide	LF
Pavement Bar Removal	SF
Pavement Legend Removal	SF or Ea

Section 855—Pavement Markers

Description

855.00 Scope—In addition to the requirements of SCS 850, install reflective and non-reflective pavement markers according to the following Specifications.

Construction

855.40 Pavement Markers

(a) **General**—Install reflective (Type I) markers as shown.

(b) **Surface Preparation**—Remove contaminants from the wearing course surface which would adversely affect the bond of the adhesive. Sandblast or steel shot blast the pavement surface to remove all surface contaminants. Use a blast of clean air to remove all loose particles from the surface.

(c) **Installation**—Apply pavement markers to a clean, dry surface and in accordance with the following:

(1) Do not install markers spanning a pavement joint or crack. To avoid longitudinal cracks and joints, adjust pavement markers up to one half the width of the marker. To avoid transverse cracks and joints, adjust pavement markers ahead or back on line ± 5 inches.

(2) Place the adhesive uniformly on the prepared pavement surface or on the bottom of the marker in a quantity sufficient to result in a complete coverage of the area of contact of the marker with no voids present and a slight excess of material after the marker has been pressed in place.

(3) Place the marker in position and apply pressure until firm contact is made with the pavement. Visually inspect the installation to ensure that a small bead approximately ⅛ inch thick forms around all edges and corners and the marker is fully supported on a pad of adhesive. Immediately remove excessive adhesive on the pavement, and adhesive on the exposed surfaces of the markers. Completely remove adhesive from the surfaces of pavement markers using an approved adhesive remover.

Measurement

855.80 Measurement—The quantities of pavement markers will be measured on the unit basis, for each type of marker.

Payment

855.90 Payment—The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for each item that appears in the Schedule of Pay Items. Payment will be in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

855.91 Incidentals—No separate or additional payment will be made for pavement preparation, adhesive, and clean-up.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 855 Standard Pay Items	**Unit of Measure**
Mono-Directional White Type I Markers	Ea
Bi-Directional Yellow Type I Markers	Ea

Section 856—Surface Mounted Tubular Markers

Description

856.00 Scope—This work consists of furnishing and installing permanent surface mounted tubular markers as shown or directed.

Materials

856.20 Materials—Furnish surface mounted tubular markers from the ODOT QPL

Construction

856.40 General—Install surface mounted tubular markers straight and true to line at the spacings shown. Bond the surface mounted tubular marker to the surface using an adhesive recommended by the manufacturer according to the manufacturer's recommendations.

Measurement

856.80 Measurement—The quantities of permanent surface mounted tubular markers will be measured on the unit basis, for each type of marker.

Payment

856.90 Payment—The accepted quantities of work performed under this section will be paid for at the Contract unit price, per unit of measurement, for each item that appears in the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 856 Standard Pay Items	Unit of Measure
Surface Mounted Tubular Markers, Type <*>	Ea

** Refer to Standard Plan 322C keynote HH and ODOT TM 570*

Section 860—Longitudinal Pavement Markings – Paint

Description

860.00 Scope—In addition to the requirements of SCS 850, install painted longitudinal pavement markings, according to the following Specifications.

Construction

860.45 Installation—Apply painted pavement markings as follows:

(a) Apply two separate applications of painted longitudinal pavement markings. Retrace the second application directly over the first application, within 1/16-inch as follows:

(1) Apply the second application after 2 hours but within 48 hours of the first application.

(2) For yellow colored markings, apply the second application in the opposite direction of the first application. For white colored markings, apply the second application in the same direction of the first application.

(b) Temporary painted pavement markings intended for use 60 days or less may be installed as a single application of materials.

(c) Apply each painted marking application at a thickness of 15 mils wet, equivalent to 17 gallons per mile for a 4-inch wide solid stripe.

(d) Apply reflective elements for each application at a minimum rate of 5 pounds per gallon of paint. Embed, by means of paint wicking, a minimum of 80 percent of the reflective elements in the paint to a minimum depth of 50 percent of their diameter.

(e) Minimum initial retroreflectivity shall be the following:

(1) White – 250 mcd/m2/lx
(2) Yellow – 200 mcd/m2/lx

Measurement

860.80 Measurement—The quantities of painted longitudinal pavement markings will be on a length basis. Unless separate pay items are included in the Schedule of Pay Items, painted longitudinal pavement markings will be based on a nominal line width of 4 inches. In the event no separate item is included, if the width of the line is other than 4 inches, measurement will be adjusted by converting to an equivalent length of nominal 4-inch line on a proportionate area basis. Measurement will be the actual stripe. Gaps between skip stripes will not be measured.

Payment

860.90 Payment—The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for each item that appears in the Schedule of Pay Items. Payment will be in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified. Temporary items will included the term "Temporary" in the description of the pay item.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 860 Standard Pay Items	**Unit of Measure**
Longitudinal Pavement Markings, Paint *	LF
Longitudinal Pavement Markings, Paint <_-inch wide>	LF

** NOTE: An 8-inch wide painted line would require a quantity estimate twice that of the 4" wide stripe.*

Section 865—Longitudinal Pavement Markings – Durable

Description

865.00 Scope—In addition to the requirements of Section 850, install durable longitudinal pavement markings according to the following Specifications.

865.01 Abbreviations

MMA—Methyl Methacrylate

865.02 Standards

Durable Pavement Markings—Profile and non-profile longitudinal pavement markings (Stripes) shall be MMA having dimensions conforming to City Standard Plans.

Labor

865.31 Manufacturer-Certified Installers—Provide certified installer's according to subsection 850.32.

Construction

865.40 General—Before installing, and in the presence if the Engineer, conduct a performance test by applying a 15-foot test section on roofing felt. Do not place permanent material without the City approval of the performance test. Additional performance tests may be required.

865.45 Installation—Place pavement markings only when the pavement is in compliance with manufacturer's standards.

(a) Apply reflective elements at a rate to obtain the following minimum initial reflectivity readings:

(1) White – 250 mcd/m2/lx
(2) Yellow – 200 mcd/m2/lx

(b) Apply marking materials using an extrusion process. For profiled markings, place lines and bumps straight and square.

Measurement

865.80 Measurement—The quantities of durable longitudinal pavement markings will be measured on the length basis. Unless separate items are included in the Schedule of Pay Items, durable longitudinal pavement markings will be based on a nominal line width of 4 inches. In the event no separate item is included, and if the width of the line is other than 4 inches, measurement will be adjusted by converting to an equivalent length of nominal 4-inch line on a proportionate area basis. Measurement will be the actual stripe. Gaps between skip stripes will not be measured.

Payment

865.90 Payment—The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for each item that appears in the Schedule of Pay Items. Payment will be in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

865.91 Incidentals—No separate or additional payment will be made for performance tests.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 865 Standard Pay Items	**Unit of Measure**
Longitudinal Pavement Marking, MMA Profile, <color>	LF
Longitudinal Pavement Marking, MMA Non-Profile, <color>	LF
Longitudinal Pavement Marking, MMA Non-Profile, White, 8-inch wide	LF

Section 867—Pavement Markings – Legends, Bars, and On-Street Parking

Description

867.00 Scope—In addition to the requirements of SCS 850, install pavement markings for legends and bars according to the following Specifications.

867.01 Standards—Refer to City of Salem standard plans for dimensions for various legends, bars, and on-street parking.

Material

867.20 Type B HS—Provide preformed, fused thermoplastic film high skid, that has intermixed reflective elements with factory installed crushed glass or aggregate on the surface as shown.

Construction

867.45 Installation— Place pavement markings only when the pavement is in compliance with manufacturer's standards.

(a) Transverse joints will be allowed with no overlap or gap allowed at the joint.
(b) Minimum initial retroreflectivity shall be 250 mcd/m2/lx.

Measurement

867.80 Pavement Legend—The quantities of pavement legends will be measured on the unit basis, by actual count.

867.81 Pavement Bars—The quantities of pavement bars will be measured on the area basis. No measurement will be made for spaces or gaps between pavement bars.

867.82 On-Street Parking—The quantities of 4-inch wide pavement markings for on-street parking will be measured on a linear basis.

Payment

867.90 Payment—The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for each item that appears in the Schedule of Pay Items. Payment will be in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 867 Standard Pay Items	**Unit of Measure**
Pavement Legend, Type _*_; <**>	
Pavement Legend, Type R, THRU AND TURN LANE	
On-Street Parking Pavement Markings	
Pavement Bar, Type _*_	

* *Insert Material Type*

** *Insert Description (e.g., Arrows, "ONLY", "X-ING", etc.)*

DIVISION 9—TRAFFIC CONTROL AND ILLUMINATION SYSTEMS

Section 970—Street Lighting

Description

970.00 Scope—This section covers work necessary to furnish and install street lighting poles, luminaires, wiring, and other related items.

970.01 Standards

Fuse—Fuses are required for each street light and shall be installed within the adjacent junction box with a 2-Pole fuse holder.

Junction Box—Junction boxes shall be 22" x 12" x 12" minimum size. Place junction boxes in sidewalks whenever possible.

Locate Wire—Install a locate wire in all conduits, even if not shown on plans. Locate wire shall originate at service cabinet and run through all junction boxes in a continuous circuit and terminate in a junction box. Splices are permitted only at branching circuits and where any single locate wire would otherwise exceed 2,500 feet.

Photoelectric Control—All street light circuits shall be controlled by a single photocell mounted on the street light fixture closest to the controller cabinet.

Materials

970.20 Poles and Arms—Furnish street light poles with mast arms designed to produce a luminaire mounting height depicted on plans. Furnish equipment listed in the current edition of the Portland General Electric (PGE) Approved Street Lighting Equipment Outdoor Lighting Services List, or approved equal.

(a) **Mounting Height 30 ft—**Street light poles for luminaire mounting height 30 ft or less shall be fiberglass composite, 2 piece, direct burial type, gray in color with a natural finish.

(b) **Mounting Height 35 ft—**Street light poles for luminaire mounting height 35 ft or greater shall be aluminum, spun, natural finish with concrete base.

(c) **Arms—**Furnish luminaire arms having lengths as shown on plans.

970.21 Junction Boxes and Covers—Junction boxes and covers shall be polymer concrete or fiberglass reinforced polymer. Covers shall have a skid resistant surface marked, "STREET LIGHTING" and bolt to the junction box with recessed stainless steel pent-head bolts. Covers shall be capable of withstanding a load of 15,000 pounds over a 10-inch by 10-inch square surface. All covers shall be recessed and fit the box so that when the cover is set in the box, the top of the cover shall be even with the top of the box. Junction boxes by the following manufacturers are preapproved:

- Quazite (Hubbell)

- Oldcastle / Carson Industries
- Armorcast

970.22 Wiring—Furnish wire in accordance with the following:

(a) **Conductor Wire**

- 120 volt photo electric circuit wires shall be #12 AWG stranded copper wire, type XHHW. A yellow wire from the controller to the photocell, purple wire for the return to the cabinet, and a white grounded conductor.

- 240 volt line distribution wires shall be a minimum of #10 AWG stranded copper wire, type XHHW. One wire shall be black in color; the other wire shall be red in color. When two or more separate circuits are run in the same conduit, the second pair of conductors shall be blue and brown in color. Additional colors for additional circuits may be required with City approval. Wire connection between the junction box and the luminaire may be a utility approved continuous 3–#10 AWG conductors in a common jacket segment.

- Grounded conductors shall be white.

- Grounding conductors shall be green insulated or bare stranded wire.

(b) **Locate Wire—**Furnish #16 AWG THWN orange with blue tracer wire.

970.23 Luminaires—Furnish cobra head style LED luminaires sized accordingly to the roadway illumination requirements. Luminaires by the following manufacturers are preapproved:

- American Electric
- GE
- Leotek
- BETA (Cree)

970.24 Photoelectric Control Relay—Furnish photoelectric control cells having minimum 20 year design life and minimum 10 year manufacturer's guarantee. The photocell shall be NEMA type twist-lock with receptacle adjustable to point north. The following are preapproved photoelectric control relays for LED street lights:

- SELC North Facing One Part Photocell #8483
- DTL #DLL Elite

970.25 Fuse Holder—Fuse holder shall be dual in-line waterproof fuse system with reusable set screw connectors. Fuse holder shall be dual pole designed to detach simultaneously to prevent accidental shocks. Furnish Littlefuse LEY series, Ideal SLK Disconnect fuse kits, or approved equal.

970.27 Service Cabinet—Furnish pad-mounted, unmetered pedestal as follows:

- COOPER B-Line catalog #CUP-4111 configured with a padlock hasp for the disconnect and distribution section, 100 amp 2 pole main breaker, 20 amp 2 pole branch breakers (1 per circuit), 30 amp 2 pole lighting contactor (1 per circuit), and one 15 amp test switch which will activate all lights.
- MB1515 mounting pad including ground rods per code.

970.28 Conduit—Furnish Nonmetallic Conduit meeting the following requirements:

- **Rigid Nonmetallic Conduit—**Heavy wall, extruded, rigid polyvinyl chloride (PVC) conforming to UL 651, Schedule 40 or 80 Rigid PVC Conduit as shown.
- **Rigid Nonmetallic Fiberglass Conduit—**Schedule 40 or Schedule 80 reinforced thermosetting resin conforming to UL1684.

970.29 Wire Connectors—Wire connectors shall be watertight, suitable for underground installation, and configured with reusable set screws. Furnish the following underground tap connector, or approved equal:

- ILSCO PED(N)-350SS-DB Underground Tap Connector

Labor

970.30 Licensed Electricians—According to the OAR 918-282-0120(1), every person engaged in the installation of electrical equipment and wiring systems shall possess a valid Oregon Electrical Supervising or Journeyman's License, or be registered as an Electrical Apprentice. Every person who installs electrical systems on the Project shall, upon request, submit a copy of his/her electrical license or apprentice registration prior to performing any work.

Construction

970.40 General—Street lighting shall be installed after other earthwork and utility installations are completed, including rough grading of the property (lots), to prevent damage to the poles.

970.41 Poles—Street light poles shall be installed according to the manufacturer's specifications. Crushed rock backfill is required around direct bury type with sand or clean soil cushion surrounding the conduit through the rock-backfill zone. Refer to Standard Plan No. 701.

970.42 Excavation—Keep trench excavations to a practical minimum width and provide for 30 inches of cover over conduit. Excavate trenches to lines, grades, and cross sections established or approved. If rock or shale is encountered in the trench, place a 2-inch sand blanket bedding and cover conduit with 2-inch additional sand blanket.

970.43 Underground Conduit

(a) **General—**Place all conduit before paving or landscaping. Conduit run locations may be changed with approval of the inspector if necessary to avoid obstructions. Larger size

conduit than specified may be used at the option and cost of the Contractor. Use the same size conduit for the entire length, outlet to outlet.

(b) **Conduit Installation—**Make conduit runs continuous between any pole, junction box, or cabinet. Do not cover conduit runs until inspected.

(c) **Elbows—**Use a standard factory bend where a conduit bend is required that:

- Has a radius of at least six times the inside diameter of the conduit.
- Is bent without crimping or flattening.
- Is fiberglass conduit.

(d) **Conduit Ends and Couplings—**Ream the ends of all conduits to remove burrs and rough edges. Make cuts square and true so the ends will fit together for their full circumference. Slip joints or running threads will not be allowed for coupling conduit. Plug or cap all conduit ends until wiring is installed. After wiring is installed, install duct seal compound or pre-cut, closed cell polyethylene foam that will prevent debris from entering the conduit system.

(1) **Nonmetallic Conduit—**Connect nonmetallic conduit with solvent welds. Use a nonmetallic female threaded connector to connect nonmetallic conduit to metallic conduit.

(2) **Riser—**Within junction boxes, provide and install PVC conduit risers with fiberglass elbows.

(3) **Bushings—**Provide and install push on PVC end bells with fiberglass elbows, PVC risers, and nonmetallic junction boxes with nonmetallic lids.

(e) **Conduit in Junction Boxes**

(1) **General—**Install conduit in junction boxes according to the following:

- Enter through the bottom of boxes.
- Enter the box from the direction of the run.
- If shown, terminate conduit 1 inch inside the box wall when entering through the side walls.

(2) **Concrete/Polymer Junction Boxes—**Install conduit entrances into concrete junction boxes according to the following:

- Locate conduits near the end walls to leave the major portion of the box clear.
- Orient conduit ends towards the top of the box so that conductors may be pulled out of the conduit from the top of the box without touching the side of the box or other conduits.

(f) **Conduit Installed for Future Use—**Cap all ends of conduit that are noted on the plans for future use.

(g) **Existing Conduit—**Use existing conduit only where shown. Clean existing conduit, without conductors, with a mandrel or cylindrical wire brush, and blow out with compressed air before incorporating into the new system.

(h) **Conduit In or On Structures—**Install conduit in or on structures as shown. Use expansion fittings at all expansion joints in or on a structure.

(i) **Installation by Horizontal Directional Drilling—**If jointed conduit is used, verify the joints have not separated by pulling a mandrel through the conduit after installation.

970.44 Junction Boxes—Install junction boxes as follows:

(a) **Location—**Install junction boxes at the approximate locations shown, or if not shown, no more than 300 feet apart. The Contractor may, at no additional cost to the City, install additional junction boxes to facilitate the work.

(b) **Surrounding Grade—**The tops of junction boxes installed in the ground or in sidewalk areas shall be flush with the surrounding grade or top of curb. If installed outside sidewalk, install a Portland cement concrete apron around the junction box in accordance with Standard Plans.

(c) **Sump—**Construct a sump of reasonably well graded ¾”-0 crushed gravel, 12 inches deep covering the approximate area of the box. Do not install conductors until the sump has been constructed.

970.45 Wiring—Install wiring as follows:

(a) Arrange wiring neatly within junction boxes. Use electrical lubricants when inserting conductors in conduit. Before pulling wires through underground conduit runs, blow the conduit out with 120 cubic feet per minute compressed air.

(b) Before cable and wire installation, clean all existing and new conduit with cylindrical mandrel of the proper size for that conduit and blow out with compressed air. Mechanical pulling methods may be used for conduit cleaning.

(c) Do not use tapes, straps, ties, or other binding materials to bundle single conductors or cables together inside conduits or poles. Bundling of conductors or cables will be allowed at the terminating end points for pulling only.

(d) Pull all wire on a straight line with the conduit opening to prevent damage to wire and cable insulation. If pulls are made with poles or controller cabinet in place, use a pulley device to achieve a straight pull.

970.46 Splicing—All splices shall be located in a junction box and be made in accordance with the following:

(a) **Conductor Wire—**Conductor wire splices shall be accomplished using an approved multi-tap wire connector.

(b) **Locate Wire—**Where approved by SCS 970.01, splice locate wire in accordance with ODOT Standard Drawing TM-475 – Loop Feeder Splices.

970.47 Electrical Energy—Obtain the required permits and have the power service inspected by the utility providing power. Arrange for the utility to make the electrical hookup.

Field Testing

970.70 Field Test—Operate the completed lighting system or subsystem continuously for seven consecutive days. Retest an additional seven days after any defects are corrected.

Measurement

970.80 Measurement—Work covered under this Section will be measured by either a lump sum basis or a unit basis. When listed on the Schedule of Pay Items to be paid on the lump sum basis, no measurement of quantities will be made.

Payment

970.90 Payment—The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for each item that appears in the Schedule of Pay Items. Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

970.91 Incidentals—No separate or additional payment will be made for excavation.

— END OF SECTION —

NOTE: *The standard pay items and explanatory notations contained in this table are not a part of the Specifications and are provided for convenience only.*

Section 970 Standard Pay Items	**Unit of Measure**
Street Light Poles, ___-Ft Mounting Height	LS or EA
Luminaires, ___-Watt	LS or EA
Service Cabinet	EA
Junction Boxes	LS or EA
Conduit and Wiring	LS