

City of West Linn
Public Works Standard Construction Specifications

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DIVISION TWO – GENERAL TECHNICAL REQUIREMENTS

201 MOBILIZATION

201.01 DESCRIPTION

This section covers, but is not limited to, work necessary to obtain all bonds, insurance, licenses, and permits; move in personnel and equipment; set up all offices, buildings, and facilities; provide all required light, power, and water; install project information signs if required; prepare for construction complete; demobilize, including removal of all facilities and clean up; and all other work to successfully complete the project which is not covered in other bid items.

201.02 MATERIALS

Provide all materials required to accomplish the work as specified.

201.03 CONSTRUCTION

201.03.01 General

- A. Set up construction facilities in a neat and orderly manner within designated or approved work area.
- B. Provide for an acceptable material and equipment storage area. Supply all labor and equipment necessary to accomplish the work as specified.
- C. Conform to applicable requirements of **Section 105, CONTROL OF WORK**, 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
 - 6. Water and air pollution
 - 7. Noise
 - 8. Tree protection

202 TEMPORARY TRAFFIC CONTROL

202.01 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.

202.02 MATERIALS

202.02.01 Uniform Traffic Control Devices

Provide barricades, signs, and traffic control devices built in conformance with the Manual on Uniform Traffic Control Devices (current edition), published by the U.S. Department of Transportation, and the Oregon supplements to the Manual published by the Oregon Department of Transportation.

202.03 CONSTRUCTION

202.03.01 General

- A. Use flag persons and provide and maintain such signs, barricades, warning lights, and other traffic control devices in conformance with the manuals referenced in **Subsection 202.02.01, Uniform Traffic Control Devices**. Adequately warn the public at all times of existing conditions on all streets affected by work operation.
- B. Patrol the construction area at least twice daily and reset all disturbed signs and traffic control devices immediately. Remove or cover non applicable signs when not needed. Prior to closing or partial closing of any street, conform to **Subsection 105.04, NOTIFICATION OF UTILITIES AND AGENCIES**.

202.03.02 Traffic Control within the Project

- A. Formulate and submit a traffic control plan and a work schedule to minimize the disruption of traffic. Plan shall be submitted at the pre-construction conference. If no conference is held, plan shall be submitted at least 10 days in advance of beginning work. Obtain approval of plan and schedule from the City Engineer before commencing work. Allow traffic to pass through the work with as little inconvenience and delay as possible.
- B. The traffic control plan shall contain a complete signing plan for semi-permanent and portable signs, barricades, and other traffic controls, provisions to keep the signs or devices current with the construction activities and the illumination of all detours and obstructions during hours of darkness. Be responsible for furnishing, installing, and maintaining all traffic control devices. Maintain these devices at all times including non-working hours.
- C. Provide approved access to private properties at all times, except during stages of construction when it is impractical to perform construction and maintain access to private property simultaneously, as determined by the City Engineer. When access is to be denied notify occupants of affected properties at least 24 hours in advance.
- D. When, in the judgment of the City 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.
- E. Only one intersection will be closed at a time without prior approval by the City Engineer. The Contractor will notify Police and Fire departments in the jurisdiction of the closing and opening of streets. Pedestrian detours shall not exceed one block in length and all foot bridges will be provided with adequate handrails.

202.03.03 Construction and Maintenance of Detours

Construct and maintain temporary detours for protection of the work and the safe passage of traffic around work area. Conform to requirements for detours in **Subsection 107.12, SAFETY**.

202.03.04 Flagging Requirements

- A. The Contractor shall provide and maintain such signs, barricades and warning lights as are necessary to warn and protect the public at all times on highways, roads or streets affected by work operations.

- B. In addition, the Contractor shall also provide all necessary ODOT certified flag persons and guards necessary to warn and protect the public. Each flagger on duty shall wear an orange or yellow colored hard hat and an orange colored or fluorescent red-orange or fluorescent yellow-orange colored vest and shall be equipped with a highly visible, reflectorized "Stop-Slow" hand sign conforming to current standards for daylight use; and with illuminated stand area, of high visibility for night use.

202.03.05 Dust Control

- A. Contractor shall be responsible for maintaining adequate dust control during and after construction and prior to acceptance by the Owner.
- B. The contractor shall apply a fine spray of water or other approved dust palliative to unpaved surfaces. Paved surfaces shall be broomed with power brooms (i.e., street sweepers) to control dust.

203 CLEARING AND GRUBBING

203.01 DESCRIPTION

- A. 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.
- B. 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.
- C. Grubbing shall consist of the elimination of wooden and vegetative matter occurring at or below ground surface including, but not limited to, stumps, trunks, roots, canes, stems, debris remaining from clearing work, and sticks having a diameter of 1 in. or more.
- D. Review with the City Engineer the location, limits, and methods to be used prior to commencing work under this section.
- E. 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 204.03.04, Excavation of Existing Improvements and Miscellaneous**, and will not be included in **Section 203, CLEARING AND GRUBBING**.
- F. As indicated in **Subsection 105.08, PROTECTION OF PROPERTY**, occupants of buildings adjacent to the work shall have salvage rights to plants, trees, shrubs, fences, and other improvements in the right-of-way. Contractor shall notify adjacent property owners. Contractor does not assume ownership of clearing and grubbing items until after fulfilling the requirements of **Subsection 105.08, PROTECTION OF PROPERTY**, and **Subsection 203.03.02, Timber Salvage**.

203.02 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 Chapter 476 and 480.

203.03 CONSTRUCTION

203.03.01 General

- A. Obtain the required permits as specified in **Subsection 105.08, PROTECTION OF PROPERTY**, and perform clearing work in conformance thereto.

- B. Remove trees and plants as designated within the area of work, and remove all sod, topsoil, and organic earth within designated areas.
- C. Remove and stockpile as directed, all topsoil that is free of roots, rocks, and other objectionable material and is determined by the City Engineer to be suitable for future use. Take reasonable care to prevent topsoil from becoming mixed with subsoil. Contractor shall provide imported topsoil per **Subsection 206.02.04, Topsoil**, at its sole expense if existing topsoil is not adequately segregated as determined by the City Engineer.

203.03.02 Timber Salvage

203.03.02.01 Trees in Street Right-of-Way

- A. The adjacent property owner shall have the right to any trees felled in the right-of-way adjacent to owner's property.
- B. Contractor shall notify adjacent property owners by mail or doorhanger at least 48 hrs. prior to felling trees. Trees shall be stacked and decked on owner's property or removed from the construction site if the owner does not reserve the right of ownership.

203.03.02.02 Trees on City-Owned Property

- A. Owner reserves the right to merchant timber as designated in the Contract Documents and as marked at the project site by the City Engineer.
- B. 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.

203.03.03 Protection of Existing Vegetation

- A. Protect all trees, shrubbery, and other vegetation, not designated for removal, from damage caused by the work as directed by the West Linn Tree Technical Manual. Cut and remove trees and branches only where approved.
- B. When directed, remove branches other than those required to provide a balanced appearance of any tree. Contractor will provide adequate protection for trees, shrubbery, and other vegetation adjacent to the work area which is to remain, as indicated on the plans and as directed by the West Linn Tree Technical Manual. No roots projecting into the excavation will be cut except in the presence of the Project inspector and the City Arborist.
- C. All roots authorized to be cut will be cut neatly, with a sharp tool to avoid torn root endings. Remove branches only as directed by the City Arborist.

203.03.04 Clearing

Clear the area above the natural ground surface of all vegetation and objectionable materials. Cut timber and timber growth so that no stump extends above ground surface more than 6 in. Prune all limbs over paved streets to an elevation 14 ft. above the pavement on arterial and collector streets, and 11 ft. above the pavement on residential streets. Prune all limbs over sidewalks to an elevation 7 ft., 6 in. above the sidewalk. All such pruning shall be done in accordance with accepted arboricultural standards, and shall be approved by the City Arborist.

203.03.05 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.

203.03.06 *Grubbing and Stripping*

- A. Completely remove all stumps and roots within the limits of required excavations and fill areas. No stumps or portion thereof shall come within 3 ft. of fill subgrades or slope surfaces. Use of explosives for stump removal shall conform to requirements of **Subsection 203.02, MATERIALS**. Obtain any and all permits required for use of explosives from controlling jurisdiction.
- B. On areas to be occupied by fills, remove all grass, roots, and embedded wood to a depth not less than 3 ft. below subgrade or slope surface on which the fill is to be constructed.
- C. On excavation areas, remove all roots and embedded wood to a depth not less than 1 ft. below subgrade or slope surface through which excavation is required.

203.03.07 *Disposal of Waste Material*

Remove and dispose of all waste material or debris from the site. Obtain all necessary permits for disposing of waste materials. Copies of such permits shall be provided the City Engineer prior to disposal.

203.03.08 *Backfilling and Clean-up*

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

203.03.09 *Removal and Replacement of Signs, Mailboxes, Posts, etc.*

- A. Contractor will be responsible for the removal and replacement of all signs, mailboxes, posts, etc. when not specifically designated otherwise by the City Engineer.
- B. Contractor to contact property owner prior to removal and reinstallation of mailbox. Mail boxes in work area must be temporarily moved to allow clearing and excavation as well as easy access by mailman and residents. Upon completion of excavation, mail boxes shall be permanently replaced behind curb to postal service regulations.

204 EXCAVATION, EMBANKMENT, BEDDING, AND BACKFILL

204.01 *DESCRIPTION*

204.01.01 *General*

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

204.01.02 *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.

204.01.03 *Rock Excavation*

- A. Rock excavation is defined as the removal of all material which by actual demonstration cannot, in the City Engineer's judgment, be reasonably excavated with equipment comparable to types listed in the table below and equipped with rippers or similar approved equipment and which is, in fact, systematically drilled

and blasted or broken by power-operated tools designed for rock excavation. The City Engineer may waive the demonstration if material encountered is well-defined rock. The term Rock Excavation shall be understood to indicate a method of removal and not a geological formation.

Manufacturer	Model	Minimum Net Horse Power	Type of Excavation
Caterpillar	225	125	Trench
John Deere	690	125	Trench
Case	125B/980B	125	Trench
Caterpillar	D8	300	Grading and Structural

- B. In trenches, boulders or pieces of concrete below grade larger than 1/2 cu. yd. will be classified as rock if drilling and blasting or other approved methods are actually used for their removal from the trench. If material which would be classified as rock by the above definition is mechanically removed without blasting, breaking, or splitting, it will be considered unclassified excavation and will be paid for as such at the unit price bid, or if larger equipment is specifically brought in for the sole purpose of rock removal, as defined above, then such removal will be considered rock excavation and will be paid for as such at the unit price bid.

204.01.04 Trench Excavation

Trench Excavation is defined as removal of all material encountered in the trench to the depths and widths as shown and, unless otherwise classified by the City Engineer, shall be considered unclassified or rock excavation.

204.01.05 Embankment

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

204.01.06 Foundation Stabilization

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

204.01.07 Vacant

204.01.08 Pipe Zone

Pipe zone is defined as the full width of the trench from 6 in. below outside of the pipe barrel to a point 12 in. above the top outside surface of the pipe barrel as shown on the appropriate Standard Drawing.

204.01.09 Trench Backfill

Trench backfill is defined as furnishing, placing, and compacting backfill material in the trench between the top of the pipe zone and the bottom of the pavement base or ground surface. Trench backfill will be classified as either native or select backfill.

204.02 MATERIALS

204.02.01 Embankment Materials

Provide embankment materials of approved earth, sand, bank-run or river-run gravel or combinations thereof, which can be compacted to the densities specified free of peat, humus, muck, frozen ground, organic matter, or other materials detrimental to construction of firm, dense, and sound embankments.

204.02.02 Foundation Stabilization

Use foundation stabilization consisting of gravel or crushed aggregate ranging in size from 6"-0 to 3/4"-0 as specified. Material shall be well graded from coarse to fine, and free from excessive clay or organic material.

204.02.03 Vacant

204.02.04 Pipe Zone Material

- A. Use pipe zone material consisting of 3/4"-0 crushed aggregate or sand, as noted on the plans or in the special provisions.
- B. Pipe zone material shall be as specified for crushed aggregate material in **Subsection 204.02.06, Class B Backfill, 3/4"-0 Crushed Aggregate**.

204.02.05 Class A Backfill, Native Backfill Material

- A. Use native material excavated from within limits of the project that can be compacted to the density specified and free from vegetation and other deleterious material containing no frozen ground.
- B. Maximum particle size shall be as shown, except for trench backfill, wherein the particle size shall not exceed 6 in. in diameter.

204.02.06 Class B Backfill, 3/4"-0 Crushed Aggregate

- A. Coarse and fine aggregates shall conform to requirements of **Section 205, TYPES AND USE OF MATERIALS** and to additional requirements contained herein.
- B. Crushed aggregates to be incorporated in the work shall have a sand equivalent of not less than 35 when tested in conformance with AASHTO T-176. Crushed aggregate shall meet the requirements for Liquid Limit and Plasticity Index of **Subsection 205.02.12.03, Fine Aggregate (Sand)**.
- C. The crushed aggregates shall be uniformly graded from coarse to fine and shall conform to one or another of the following grading requirements as specified in the following table.

	Separated Sizes				
	2-1/2"-0	2"-0	1-1/2"-0	1"-0	3/4"-0
Sieve Size (inches)	Percentages (by weight)				
3	100				
2-1/2	95-100	100			
2		95-100	100		
1-1/2			95-100	100	
1-1/4	55-75				
1		55-75		90-100	100
3/4			55-75		90-100
1/2				55-75	
3/8					55-75
*1/4	30-45	30-45	35-50	40-55	40-60

*Of the fraction passing the 1/4 in. sieve, 40% to 60% shall pass the No. 10 sieve.

For determination of sizes and grading conform to AASHTO T-27.

- D. Where 1"-0 base aggregate is approved for use, at least 70% (by weight) of the material passing through the 1/4 in. sieve but retained on the No. 10 sieve shall have at least one mechanically fractured face.
- E. Crushed aggregate will be sampled for acceptance at one or more of the following times as determined by the City Engineer:
 - 1. In its final state on the roadbed after all processing and prior to the placement of subsequent surfacing materials;
 - 2. In the stockpile after all shaping work has been completed; or,
 - 3. Immediately after crushing.
- F. For trench backfill, the maximum particle size shall not exceed 3/4 in. in pipe zone.

204.02.07 Class C Backfill, Clean Sand

Class C backfill shall be clean sand with no particle size greater than 1/4 in.

204.02.08 Class D Backfill, Pit or Bar-Run Material

Pit or bar-run material shall be well graded from course to fine free from roots, clay balls, organic material and debris. Maximum size of material shall be 6 in. No more than 5% by weight shall pass the No. 200 sieve. The material shall have a minimum uniformity coefficient of 8, and a minimum permeability coefficient of 10-3 cm/sec.

204.02.09 Class E Backfill, Controlled Density Fill

Controlled Density Fill (CDF) shall be a mixture of Portland Cement, fly ash, aggregates, water and admixtures proportioned to provide a non-segregating, self-consolidating, free-flowing and excavatable material that will result in a hardened, dense, non-settling fill. CDF shall conform to the requirements of **Section 205, TYPES AND USE OF MATERIALS**.

204.02.10 Imported Topsoil

- A. Unless specified otherwise, imported topsoil shall be used. Provide natural, fertile, friable topsoil, representative of local productive soil, and 90% free of clay lumps or other foreign matter larger than 2 in.

diameter, not frozen or muddy, with pH 5.0 to 7.0, and not less than 3% humus as determined by loss on ignition of moisture-free samples dried at 100°C.

- B. Gravel portion (particles larger than 2 mm) shall not exceed 15% of total volume. Imported topsoil shall be free of quack grass, horsetail, and other noxious vegetation and their seeds. Should such regenerative material be present in the soil all resultant growth, both surface and root, shall be removed and replaced to original specifications at the Contractor's expense within 2 years of acceptance of the work.

204.02.11 Native Topsoil

When specified, use topsoil from the site, properly stored and protected and free from grass, debris, overburden and roots, sticks, hard clay, and stones which will not pass a 1 in. square opening.

204.02.12 Water

Use water that conforms to requirements of **Section 205, TYPES AND USE OF MATERIALS**. Provide water at the Contractor's sole expense. Contractor shall obtain City water as designated by the City. Whenever City water is to be used, the Contractor shall obtain a meter issued by the City.

204.02.13 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 Chapter 476 and 480.

204.03 CONSTRUCTION

204.03.01 Excavation

- A. 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, necessary for construction of the project. Method of excavation used is optional. Overbreak shall be removed at the Contractor's expense. Use hand methods for excavation that cannot be accomplished without endangering existing or new structures or other facilities.
- B. 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 of all personnel working in the excavation shall be the Contractor's responsibility and shall be considered incidental to the construction.

204.03.02 Rock Excavation and Explosives

204.03.02.01 Depth of Excavation

- A. Excavate to the depths designated or as shown on the Standard Plans or Standard Drawings. Correct over-excavation with compacted material as directed at no additional expense to Owner.
- B. In trenches for sewers, and water mains or conduits, remove all material necessary to provide a minimum clearance of 6 in. under the pipe and replace with bedding material in conformance with **Subsection 204.02.04, Pipe Zone Material**.

204.03.02.02 Methods and Records Required

Before rock removal by systematic drilling and blasting or other methods will be permitted, notify the City Engineer who, with Contractor or its representative, will determine the amount of material to be removed as rock excavation and will record the information. Then drill, blast, or break with power-operated tools specially designed for rock excavation, and excavate the material.

204.03.02.03 Use of Explosives

- A. Obtain any and all permits required for use of explosives required by the City of West Linn, and other governing agencies.
- B. Use of explosives shall be avoided as far as practicable, and in no case shall tunnel blasting methods be used. 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 powder person. 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.
- C. Where excavations in hard, solid rock are to be made to depths of 10 ft. or more, blasting thereof shall be done by the presplitting or preshearing method unless other methods are approved by the City Engineer.

204.03.02.04 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.

204.03.03 Preservation of Existing Improvements

- A. Conduct operations in such a manner that existing streets, utilities, railroad tracks, structures, and other facilities, which are to remain in place, will not be damaged, as specified in **Section 105, CONTROL OF WORK**. Furnish and install cribbing and shoring, or whatever means are necessary to support material carrying existing facilities, or to support the facilities themselves, and maintain such supports until no longer needed.
- B. Protect temporary facilities, until they are no longer required, and remove and dispose of temporary supports and other protective means when they are no longer required.

204.03.04 Excavation of Existing Improvements and Miscellaneous

- A. Unless otherwise specifically provided for, excavation or excavation and backfill includes all excavating, removing, hauling, and depositing, including but not limited to, existing pavements, walks, driveways, surfaces, slabs, curbs, gutters, and similar cement concrete structures, bituminous materials, all rock or gravel road surfacing materials, abandoned sewers, pipes and conduits, logs, piling, footings, foundations, vaults, and chambers, when such materials are within the limits of excavation.
- B. Remove remaining ends of abandoned pipes, or portions of other items partially removed under this work, which would be left exposed after final excavation, to a minimum of 1 ft. below the finished grade or elevation. Plug or seal ends of abandoned pipes in backfill or embankment areas. Storm drain pipe shall be reconnected as directed by the City Engineer.
- C. 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.

204.03.05 Limits of Excavation

- A. Excavate to the depths and widths designated, allowing for forms, shoring, working space, base material, and finish topsoil where required. Do not excavate deeper than elevation shown.
- B. Excavation carried below grade lines shown or established without approval shall be replaced with compacted foundation stabilization material at the Contractor's expense.

- C. Over-excavation 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 the Contractor's expense.
- D. When the precise location of subsurface structures is unknown, locate such structures by hand excavation prior to utilizing mechanical excavation equipment.

204.03.06 *Slope Grading*

Make slopes free of all exposed roots, unstable rock, and loose stones exceeding 3 in. in any dimension. Shape tops of banks to circular curves with, in general, not less than a 6 ft. radius, unless rock makes such work impractical. All surfaces shall be neatly and smoothly trimmed.

204.03.07 *Foundation Stabilization*

If, in the judgment of the City Engineer, material in the bottom of an excavation is unsuitable for supporting foundations, piers, retaining walls, cribbing, sewers, pipes, or similar facilities, over-excavate as directed and backfill to required grade with thoroughly compacted foundation stabilization material conforming to ***Subsection 204.02.02, Foundation Stabilization.***

204.03.08 *Disposal of Excess Material*

- A. Excavated materials not suitable or not required for backfill or embankment shall be deposited at predesignated sites specified or sites supplied by the Contractor. An embankment permit may be necessary within the City of West Linn for embankments exceeding 50 cu. yd. or before the Contractor places excavated material from City projects on any property.
- B. The Contractor shall make all arrangements for disposal of excess material, obtain the necessary permits when not provided by the City at predesignated sites, and bear all cost or retain any profit incidental to such disposal.

204.03.09 *Temporary Location of Excavated Materials*

- A. Place excavated material, specified for embankment or backfills and not excess material, only within the construction easement, right-of-way, or specified working area. Pile in such a manner that it will cause a minimum of inconvenience to the public.
- B. Furnish the City Engineer a copy of written approval from each property owner prior to stockpiling material on private property outside of easements. Conform to all Federal, State, and local codes governing the safe loading of trenches with excavated material.
- C. Provide free access to all fire hydrants, water valves, and meters, and leave clearance to enable free flow of storm water in all gutters, conduits, and natural watercourses.

204.03.10 *Surface Removal and Replacement for Trenches*

204.03.10.01 *Removal and Replacement of Topsoil*

- A. When specified and where trenches within easements cross lawns, garden areas, pasture lands, cultivated fields, or other areas on which topsoil conditions exist, remove all topsoil to a depth of at least 12 in. for the full width of the trench to be excavated. Stockpile topsoil to one side of the easement in a location and do not mix with remaining excavated material. Replace and compact removed topsoil in the top of backfilled trench to the depth removed.
- B. Maintain finished grade of topsoil level with area adjacent to the trench until final acceptance by the City Engineer. Repair damage to adjacent topsoil caused by work operations. Remove all rock, gravel, clay, and any other foreign materials from surface; regrade, and add topsoil as required.

- C. In lieu of stockpiling topsoil, Imported Topsoil as defined in **Subsection 204.02.07, Class C Backfill, Clean Sand**, may be substituted and replaced to the actual depth removed at the Contractor's expense. If, in the opinion of the City Engineer, the Contractor does not take precautions to protect the stockpiled topsoil from contamination by rocks, clay, excess water, etc., the Contractor will import topsoil meeting the requirements of **Subsection 204.02.07, Class C Backfill, Clean Sand**, at his own expense.
- D. Payment for removing, stockpiling, and replacing topsoil in the trench is included in the bid item, Trench Excavation and Backfill.

204.03.10.02 Removal of Pavement, Curbs, Driveways, and Sidewalks

- A. Cut all asphalt pavement to full depth with a pavement saw or other suitable pavement cutter prior to excavation of trenches.
- B. Saw Portland Cement Concrete pavement, curbs, and sidewalks to a minimum depth of 4 in. or half the concrete thickness, whichever is greater. Subsequent removal may be accomplished by using a jackhammer. Full depth cut by pavement saw can be done at the option of the Contractor. Use of any machine utilizing a falling or swinging weight in the form of a "headache ball" will not be permitted.
- C. Width of cut shall be as shown on the Standard Plans or Standard Drawings. Remove all loose, undermined or damaged pavement. Remove all pavement between the trench and curb, pavement edge or construction joint whenever the cut is 3 ft. or less from the curb, pavement edge, or construction joint. Prior to paving, all loose, cracked, sunken or otherwise damaged edges will be saw cut in continuous straight cuts. Straight line saw cut lengths will not be less than 50 ft. Cut angles will not exceed 15°.
- D. Pavement and concrete materials removed shall be hauled from the site and not used for trench backfill. Replacement of pavement, curb, and sidewalk shall conform to the requirements of **Section 209, RESURFACING**. Six inch T-cuts are required as shown in the Standard Drawings.

204.03.11 Trench Excavation and Shoring

204.03.11.01 Maximum Length of Open Trench

- A. Length of trench excavated in advance of the pipe laying shall be kept to a minimum, and in no case shall it exceed 200 ft. unless otherwise authorized. The length of unrestored work area and total unfinished trench construction shall not exceed a length of 800 ft., for each main line pipe laying operation unless otherwise authorized. Trench construction will not be considered completed until all restoration is completed. If the unfinished trench or restoration exceeds 800 ft. in length, the main line construction shall be suspended and shall not be resumed until authorized by the City Engineer.
- B. In no case will any trench be left unfinished or uncovered overnight or outside working hours.
- C. 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 or cold patch, 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 207, RESTORATION AND CLEANUP**.

204.03.11.02 Trench Width

- A. The maximum trench width at the ground surface will be kept to a minimum necessary to install the pipe in a safe manner. Trenches shall be of sufficient width to allow for shoring and permit proper joining of pipe and compaction of the backfill material along the sides of the pipe. Minimum trench

width of unsheeted trenches shall provide a clear working space of at least 6 in. on each side of the outside diameter of the pipe bell. Sheeting requirements shall be independent of trench widths.

- B. Trench width at the top of the pipe will be the pipe inner diameter plus 18 in., except where specifically shown on the Drawings, or specified in the Special Specifications. The pipe will be centered in the trench on line and grade at all times. When authorized by the City Engineer, the Contractor may use pipe of greater strength or install a superior pipe bedding in lieu of maintaining the trench widths shown. If maximum width shown is exceeded by Contractor (without written authorization), the Contractor shall provide pipe of a higher strength designation, a higher class of bedding, or both, as approved by the City Engineer, at no expense to the Owner.
- C. Make the excavation for manholes and other structures wide enough to provide a minimum of 12 in. between sides of structure and sides of excavation.
- D. 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 owners, provided such agreements are approved by the City Engineer.

204.03.11.03 *Grade*

- A. Excavate trench to lines and grades shown or as established by the City 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.
- B. If the trench is over-excavated, restore to grade with thoroughly compacted foundation stabilization material or pipe bedding material at the Contractor's expense. Place material over full width of the trench in compacted layers to established grade with allowance for pipe bedding.

204.03.11.04 *Shoring, Sheeting, and Bracing of Trenches*

- A. Sheet and brace trench when necessary to prevent caving and to protect adjacent structures, property, workers, and the public. Increase trench widths by the thickness of the sheet and maintain sheeting until pipe has been placed and backfilled at the pipe zone.
- B. 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 the safety requirements of the Federal, State, or local agency having jurisdiction. The most stringent of these requirements shall apply.

204.03.12 *Dewatering*

- A. 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 continuously during the time the trench is being prepared for the pipe laying, during the pipe laying, when concrete is being placed, and until the backfill 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.
- B. Drainage of trench water through the pipeline under construction is prohibited unless otherwise approved by the City 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 times competent workers for operation of the pumping equipment. Control surface runoff to prevent entry or collection of water in excavations.
- C. Control ground water such that softening of the bottom of excavations or formation of "quick" conditions or "boils" during excavation shall be prevented. Design and operate dewatering 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.

- D. Before dewatering is started, submit to the City Engineer a statement of the method, installation, and details of the dewatering system proposed to be used. Open and cased sumps shall not be used as primary dewatering for excavations deeper than 3 ft. below static water table.
- E. 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. Dispose of water according to environmental laws.
- F. Dewatering shall be considered as incidental to, and all costs included in, the various contract pay items in the Proposal.

204.03.13 *Compaction*

- A. Compaction shall be by mechanical methods only.
- B. Compaction equipment shall be of suitable type and adequate to obtain the amount of compaction specified. Compaction equipment shall be operated in strict accordance with the manufacturer's instructions and recommendations and shall be maintained in such condition that it will deliver the manufacturer's rated compactive effort. Compaction equipment for granular materials shall be vibratory plate or vibratory drum compactors.
- C. Any settlement noted in backfill, embankment, or in structures built over the backfill or embankment within the 18-month warranty period in accordance with the **DIVISION ONE - GENERAL REQUIREMENTS** will be considered to be caused by improper compaction methods and shall be corrected at the Contractor's expense. Structures damaged by settlement shall be restored to their original condition by the Contractor at the Contractor's expense.

204.03.14 *Embankment*

204.03.14.01 *Roadway Embankment*

A. Preparation of Embankment Foundations

Prior to construction of embankments, excavate and dispose of unstable material or unsuitable foundation material. Limit excavation to lines, grades, and cross sections shown. Backfill basements, trenches, and holes that is located within embankment limits with specified material. Compact natural ground underlying embankments to the depth of grubbing or to a minimum of 12 in. to density specified for the embankment material to be placed.

B. Embankment Construction

- 1. Construct embankments to the lines and grades shown. Place material in continuous horizontal layers with compacted material not exceeding 6 in. lifts. Compact each lift to at least 95% of maximum dry density as determined by ASTM D 1557/AASHTO T-180 and to where it will show no appreciable deflection or adverse reaction under the compacting equipment during compaction.
- 2. If the surface of the prepared foundation or the compacted surface of a preceding lift is too dry or smooth to bond properly with the next layer of material, moisten or scarify, or both, before the next layer of material is placed. Compact slopes of all embankments thoroughly, and true to line and grade.
- 3. Do not place embankment material when the material, foundation, or previously placed embankment material is frozen. Embankment material shall not be placed in final position until moisture in excess of optimum moisture has been removed. Water settling of embankments will not be permitted.

204.03.14.02 Pipeline Embankment

- A. Where pipelines are to be placed within an embankment, construct the embankment to its final specified elevation prior to trench excavation for the pipeline. Place pipe bedding and pipe zone materials in accordance with applicable portions of **Subsection 204.03.16, Pipe Zone Placement** and **204.03.17, Trench Backfill and Compaction**. Place trench backfill material as specified in **Subsection 204.03.17, Trench Backfill and Compaction**.

- B. Additional Pipe Cover

In locations where insufficient pipe cover exists, place excess excavated trench material suitable for embankment over the pipe to provide a minimum cover of 3 ft. Compact as required for underlying trench backfill.

204.03.14.03 Embankment for Structural Foundations

Deposit specified materials free from roots, organic material, trash, and stones larger than 3 in. diameter in uniform lifts across the full width of the embankment. Compact each lift to 95% of maximum dry density as determined by ASTM D 1557/AASHTO T-180.

204.03.15 Pipe or Conduit Pipe Zone Bedding

- A. Construct bedding in conformance with the appropriate Standard Drawings.
- B. Pipe zone bedding consists of leveling the bottom of the trench or top of the foundation material and placing pipe bedding select material to the horizontal centerline (springline) of the pipe. Bedding select material shall be placed in at least two lifts. Place the first lift to provide the minimum depth of bedding select material shown on the appropriate Standard Drawings before the 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 the entire pipe length. Place subsequent lifts of not more than 6 in. thickness up to the horizontal centerline of the pipe. Bring lifts up together on both sides of the pipe and carefully work under pipe haunches.
- C. Pipe zone bedding shall be considered to include full width of excavated trench from the bottom of the trench or top of the foundation stabilization material to the top of the bedding.
- D. Particular attention must be given to the area from the invert to the horizontal centerline of the pipe or top of the bedding to ensure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone.

204.03.16 Pipe Zone Placement

Place pipe zone material carefully around the pipe in 6 in. layers and compact to a minimum of 90% maximum dry density as determined by ASTM D 1557/AASHTO T-180. Pipe zone material for water pipe shall be compacted to a minimum of 95% of maximum dry density as determined by ASTM D 1557/AASHTO T-180. Prevent pipe from movement either horizontally or vertically during placement and compaction of pipe zone material.

204.03.17 Trench Backfill and Compaction

204.03.17.01 General

- A. The right is reserved to modify the use, location, and quantities of the type of backfill during construction as the City Engineer considers to be in the best interest of the Owner.
- B. Class A Backfill will, generally be limited to use in unsurfaced or unimproved areas.

- C. Class B Backfill will, typically, be required for backfill in new roadways (except arterials where Class E is required) under construction, future roadways, gravel roadways or pedestrian and bicycle pathways.
- D. Class C Backfill will, typically, not be allowed.
- E. Class D Backfill will, typically, not be allowed.
- F. Class E Backfill (CDF) shall be required in existing paved streets, new arterial roadways under construction and roadways where subsequent trench settlement must be held to a minimum.
- G. The City Engineer may sample excavated material to determine suitability of the Class A material for use as backfill. The contractor shall take reasonable precautions to prevent excavated material from becoming saturated beyond the critical moisture limits and replace any saturated Class A material with Class B, C, D or E material as specified, at no additional expense to the owner.

204.03.17.02 Class A, B, C or D Backfill

- A. The contractor shall backfill the trench above the pipe zone in successive lifts. Backfill shall not be allowed to free-fall into the trench until at least 3 ft. of cover is provided over the top of the pipe. The method of compaction shall be modified as necessary to protect the pipe.
- B. The contractor shall compact each lift to a minimum of 95% of the maximum dry density as determined by ASTM D 1557/AASHTO T-180. If the specified compaction is not obtained, the contractor may be required to use a modified compaction procedure and/or reduce the thickness of the lifts. If approved materials meeting the specifications cannot be compacted to the required density regardless of the compactive effort or method, the City Engineer may reduce the required density or direct that alternate materials be used. In no case shall excavation and pipe laying operations proceed until the contractor is able to compact the backfill to the satisfaction of the City Engineer.
- C. When the backfilling is complete, the contractor shall finish the surface area as specified. In paved or graveled areas the contractor shall maintain the surface of the trench backfill level with the existing grade with 3/4"-0 crushed aggregate material, or asphalt concrete, if directed, until final pavement replacement is completed and accepted by the owner.

204.03.17.03 Controlled Density Fill

Backfill the trench above the pipe zone with CDF material. If the CDF is to be used as a temporary surfacing, backfill the CDF to the top of the trench and strike it off to provide a smooth surface. If the CDF is not to be used as temporary surfacing, backfill the CDF up to the bottom of the proposed resurfacing. No compaction of CDF is allowed. The CDF shall be steel-plated to protect it from traffic for a minimum of 24 hours. After 24 hours, the CDF may be paved, or opened to traffic until permanent surface restoration is completed, if it has hardened sufficiently to prevent rutting.

204.03.17.04 Compaction Testing

- A. Sampling and testing of materials for determination of compliance with the specified compaction requirements may be taken at any location and time as the City Engineer may determine. Excavate test pits in the backfill as directed by the City Engineer for the purpose of testing the backfill compaction. At the option of the City 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, providing and installing safety shoring as required to protect the testing person, and standby time during field density test shall be considered incidental to backfill and shall be included in unit prices bid for the various items involved.
- B. When compaction testing has been performed by the City Engineer and the required density has not been obtained by the Contractor, the Contractor shall bear all costs for all subsequent retesting in the

areas of non-compliance. All testing shall be performed by the testing laboratory of the City Engineer. The City Engineer shall keep an accurate account of the time spent for the testing laboratory to perform retesting. The Contractor shall be totally responsible for rescheduling compaction testing with the City Engineer. Any and all tests associated with delays due to retesting shall be the sole responsibility of the Contractor.

- C. If required density has not been obtained, remove the backfill from the trench, replace with backfill, and recompact as many times as it is necessary to obtain the required specified minimum densities.

204.03.17.05 Trench Maintenance

- A. In graveled areas, maintain surface of the backfilled trench level with the adjacent and existing grade, before and after the area is opened to traffic, with 1"-0 crushed aggregate material. In paved areas, cold mix asphalt pavement shall be used until the final pavement replacement is completed. The cold mix asphalt or steel plating shall be in place at the end of each workday. City may limit usage of steel plates and conditions under which they are used. Every use of steel plates must have prior approval from the City. Place cold mix asphalt in conformance with **Section 209, RESURFACING**.
- B. Maintain backfilled trench surface between any two successive manholes until the following operations have been completed and accepted by the City Engineer.
 - 1. Service connections installed, backfilled, and compacted.
 - 2. Trench compaction.
 - 3. Construction of manholes and appurtenances.
 - 4. Air testing and mandrel testing.
 - 5. Cleanup and restoration of all physical features, including concrete curbs, gutters, and driveways.
 - 6. Utilities restored to their original condition or better.
 - 7. All work required between the two manholes accomplished.
- C. Maintain backfilled trench surface between any two successive valves until the following operations have been completed and accepted by the City Engineer.
 - 1. Service connections installed, backfilled, and compacted.
 - 2. Valves, valve boxes, and hydrants installed.
 - 3. Hydrostatic testing.
 - 4. Flushing and disinfection.
 - 5. Cleanup and restoration of all physical features, including concrete curbs, gutters, and driveways.
 - 6. Utilities restored to their original condition or better.
 - 7. All work required between the two valves accomplished.
- D. Do not undertake final pavement replacement until all items outlined above have been completed and accepted.
- E. 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 for Excavation and Backfill.

205 MATERIALS - TYPES AND USE

205.01 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.

205.02 MATERIALS

205.02.01 General

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

205.02.02 Portland Cement Concrete

- A. Use concrete having a 28-day design strength of 3,300 psi for curbs, sidewalks, and poured in place manholes and catch basins, and 4,000 psi for PCC pavement per AASHTO T-22 and T-23 with 1-1/2 in. maximum size aggregate.
- B. High early strength concrete (Type III cement) shall be used when patching trenches in Portland Cement Concrete pavement.
- C. Use Type II cement concrete for all sewer and water main construction and appurtenances thereto.
- D. Portland Cement Concrete shall be sampled and tested in accordance to the ASTM test methods in the table below.

Sampling Fresh Concrete	C172
Obtaining Drilled Cores	C42
Molding and Curing Specimens	C31
Compressive Strength	C39
Flexural Strength	C78
Slump	C143
Air Content	C173 or C231
Unit Weight Yield	C138
Setting of Mortar	C191 or C266

205.02.03 Cement Mortar

Use either standard premixed mortar conforming to ASTM C 387, or mortar proportioned with 1 part Portland Cement to 2 parts clean, well-graded sand which passes a 1/8 in. 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% and diatomaceous earth or other inert materials - 5%. Testing shall conform to the OSHD test for mortar strength.

205.02.04 Cement Grout

205.02.04.01 Type "A" Grout

Utilize grout which consists of 1 part Portland Cement, 3 parts of clean and well-graded sand. Use minimum amount of water to produce a thick, creamy consistency.

205.02.04.02 Type "B" Grout

Where type "B" grout is specified, use a mixture consisting of 1 part Portland Cement, 5 parts of clean and well-graded sand, and 7 parts pea gravel, by volume.

205.02.05 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 702, REINFORCEMENT**.

205.02.06 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 702, REINFORCEMENT**.

205.02.07 Structural Joint Material

Use preformed and poured joint fillers conforming to requirements of **Subsection 701.02.06 Joint Materials**. For joints in Portland Cement Concrete pavement, curbs, gutters, driveways, sidewalks, and pathways, refer to **Public Works Design Standards, DIVISION FIVE - STREETS**.

205.02.08 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.

White Burlap – Polyethylene Sheets	AASHTO M-171
Waterproof Paler	AASHTO M-171
White – Pigmented Liquid Membrane-Forming Compound*	AASHTO M-148
White Polyethylene Film	AASHTO M-171
Burlap Cloth (Jute or Kenaf)	AASHTO M-182

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

205.02.09 Epoxy Cement

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

205.02.10 Portland Cement

A. Furnish one or more of the following types as specified:

1. Type I – For general use when special properties of other type cements are not required.
2. Type IA – Air-entraining cement for same uses as Type I, where air-entrainment is desired.
3. Type II – For use when moderate sulfate resistance or moderate heat of hydration is desired.
4. Type IIA – Air-entraining cement for same uses as Type II, where air-entrainment is desired.
5. Type III – For use when high early strength is desired.
6. Type IIIA – Air-entraining cement for same use as Type III, where air-entrainment is desired.

B. 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 $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) shall not exceed 0.6%.
2. Types I, IA, III, or IIIA must contain a maximum of 10% tricalcium aluminate.

3. Time-of-setting tests shall be by either the Gillmore Test or the Vicat Test or both, as the City Engineer may elect.
- C. When not otherwise specified, use Type I. Contractor, at his option, may use Type III Portland Cement (high early strength) in lieu of Type I in the identical quantity specified for the latter.
- D. Differing brands or types of cement, or the same brand or type of cement from different plants shall not be mixed during use nor be used alternately. Cement may be sampled either at the plant or site of work at the option of the City Engineer.

205.02.11 Water

Water used in all work must be reasonably clean and free 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.

205.02.12 Aggregates

205.02.12.01 Description

This work consists of furnishing and placing one or more courses of aggregates, as subbase or base, on an approved subgrade or subbase.

205.02.12.02 Materials

Crushed aggregates shall consist of crushed gravel or rock, including sand.

A. Fracture

Gravel shall have at least one fractured face on 50% of the material retained on each sieve size 1-1/2 in. and above and 70% for the material passing the 1-1/2 in. sieve and retained on each of the sieves down to 1/4 in.

B. Durability

The source material from which aggregate materials are obtained, produced or manufactured, shall meet the qualifying test requirements in the table below.

Test	Test Method	Requirements
Degradation:		
Passing No. 20 sieve	OSHD TM 208	30% Max.
Sediment Height	OSHD TM 208	3 in. Max.
Abrasion:	OSHD TM 211	35% Max.

C. Sand Equivalent

Crushed aggregates to be incorporated in the work shall have a sand equivalent of not less than 35 when tested in conformance with OSHD TM 101.

D. Liquid Limit and Plasticity

Crushed aggregate shall meet the requirements in the table below.

LIQUID LIMIT AND PLASTICITY INDEX VALUES

Percent of Material Passing No. 40 Sieve	Liquid Limit (Maximum) OSHD TM 102	Plasticity Index (Maximum) OSHD TM 103
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.

E. Grading Requirements

Crushed aggregates shall conform to the grading requirements in the table below.

GRADING REQUIREMENTS FOR CRUSHED AGGREGATES

Separated Sizes:	2-1/2"-0	2"-0	1-1/2"-0	1"-0	3/4"-0
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Sieve Size	Percentages Passing (by weight)				
3 in.	100				
2-1/2 in.	95-100	100			
2 in.	-	95-100	100		
1-1/2 in.	-	-	95-100	100	
1-1/4 in.	55-75	-	-	-	
1 in.	-	55-75	-	90-100	100
3/4 in.	-	-	55-75		90-100
1/2 in.	-	-	-	55-75	-
3/8 in.	-	-	-		55-75
1/4 in.	30-45	30-45	35-50	40-55	40-60
No. 10	12-27	12-27	14-30	16-33	16-36
No. 40	0-16	0-16	3-18	8-24	8-24
No. 200	0-9	0-9	0-8	0-8	0-10

The determination of sizes and gradings shall be in conformance with AASHTO T-27.

F. Acceptance

Crushed aggregate will be sampled for acceptance at one or more of the following times as determined by the City Engineer:

- a. In its final state on the roadbed after all processing and prior to the placement of subsequent surfacing materials;
- b. In the stockpile after all shaping work has been completed; or,
- c. Immediately after crushing.

205.02.12.03 Fine Aggregate (Sand)

- A. Use fine aggregate consisting of finely crushed rock or gravel, fine sand, and other finely divided natural and inert mineral matter, thoroughly washed, and free of clay, loam, shale, alkali, vegetable matter, and other deleterious matter. 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.
- B. Portland Cement Concrete shall contain fine aggregate which has a deleterious material content not exceeding the limits shown in the table below.

Friable Particles	1% (by weight)
Lightweight Particles	1% (by weight)
Material Passing No. 200 Sieve	1% (by weight)

- C. When this fine aggregate for Portland Cement Concrete is subject to five alternations of the sodium sulfate soundness test (AASHTO T-104), weighted percentage of loss must not exceed 10% by weight.
- D. 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% by weight.
- E. Use fine aggregates which meet the durability requirements for coarse aggregates contained hereinbefore, and which meet the Liquid Limit and Plasticity Index requirements in the table below.

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

- F. *When tested as specified, both the Liquid Limit and the Plasticity Index test results shall conform with the information shown in the table below.

Percent of Material Passing No. 40 Sieve	AASHTO T-89 Liquid Limit (Maximum)	AASHTO T-90 Plasticity Index (Maximum)
0.0 to 5.5, 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	O or N.P.

- G. Sampling and testing fine aggregate shall conform to the methods shown in the following table.

Sampling	AASHTO T-2
Material Passing No. 200 Sieve	AASHTO T-11
Organic Impurities	AASHTO T-21
Sieve Analysis	AASHTO T-27
Mortar Strength	ASTM C 109
Soundness	AASHTO T 104
Friable Particles	AASHTO T 112
Lightweight Pieces	AASHTO T 113
Sand Equivalent	AASHTO T 176

205.02.13 Asphalt Materials

205.02.13.01 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" for Light Duty AC obtainable from the Engineer of Materials, ODOT, Salem, Oregon 97310.

205.02.13.02 Asphaltic Cement

Use PBA-2 grade asphalt that meets OSHD requirements for Light Duty AC.

205.02.13.03 Tack Coat

Asphalt shall consist of CSS-1 or CSS-1H emulsified asphalts.

205.02.13.04 Slurry Seal

Use CSS-1H cationic emulsified asphalt.

205.02.14 Controlled Density Fill

- A. CDF shall attain unconfined compressive 28-day strengths of approximately 100 psi.
- B. Materials used in CDF mixture shall conform with the following:

Portland Cement	Section 205.02.10
Fly Ash	ASTM C 618 (Class C or F) or ODOT 02010.10
Aggregate	Section 205.02.12
Water	Section 205.02.11
Admixtures	ODOT 02040, AASHTO M-194, ASTM C 494, or ASTM C 260

205.02.15 Geotextiles

205.02.15.01 Description

Geotextiles will be accepted for use in various applications according to the provisions of this section.

205.02.15.02 Definitions

- A. Geotextile - A fabric manufactured specifically for use in civil engineering applications. Fibers used in the manufacture of geotextiles consist of long chain synthetic polymers. At least 85% by weight of the long chain polymers are polyolephins, polyesters, or polyamides.

1. Drainage Geotextile - For installation in subsurface drains or other drainage locations.
 2. Embankment Geotextile - For installation within or under embankments for stabilization.
 3. Riprap Geotextile - For installation behind and beneath riprap, buttresses, inlays, shear keys, and erosion control applications.
 4. Wall Geotextile - For construction of retained earth walls.
 5. Subgrade Geotextile - For installation on subgrades and in other material separation applications.
 6. Pavement Overlay Geotextile - For installation beneath an asphalt concrete overlay.
- B. Machine Direction - The long, or warp, direction of the geotextile. The cross-machine, or fill, direction is perpendicular to the machine direction.
- C. Non-Woven Geotextile - A textile produced by bonding and/or interlocking of fibers by mechanical, heat, or chemical means.
- D. Roll - Unit of continuous geotextile without transverse seams as furnished by the manufacturer. Roll size may vary between manufacturers and types of geotextiles.

205.02.15.03 Acceptance Requirements

- A. The geotextile shall have the components as listed below.
1. Be composed of a polymeric yarn or fiber oriented into a stable network which retains its relative structure during handling, placement, and design service life.
 2. Meet or exceed the properties outlined under Geotextile Property Values.
 3. Be free of any chemical treatment or coating which might significantly reduce permeability.
 4. Have the selvage finished so the outer fibers are prevented from pulling away from the fabric.
 5. Be free of defects or tears.
 6. Be resistant to ambient temperatures, acid and alkaline conditions, micro-organisms and insects.
 7. Be for the intended purpose and have dimensional stability.
- B. Base the actual minimum average roll values furnished by the manufacturer on representative test results from the manufacturing plant which produced the rolls, and shall meet or exceed each of the specified minimum values. Clearly label all rolls as being part of the same production run certified as meeting all applicable requirements.

GEOTEXTILE PROPERTY VALUES

Minimum Value						
Geotextile Property Test Method	Drainage (1) Geotextile Type 1/Type 2	Riprap (1) Geotextile Type 1/Type 2	Subgrade Geotextile	Embankment Geotextile	Wall (1) Geotextile	Pavement (1) Overlay Geotextile
Grab tensile strength minimum in each principal direction - <i>ASTM D 4623</i>	80 lb./180 lb.	200 lb./260 lb.	180 lb.	230 lb.	----	80 lb.
Grab Elongation – <i>ASTM D 4632</i>	15%	15%	----	----	----	50%
Burst Strength, Diaphragm method - <i>ASTM D 3786 Mod.</i> <i>(OSHA TM 814) (TF 25</i> <i>Method 3)</i>	130 psi/290 psi	320 psi/430 psi	290 psi	430 psi	----	----
Puncture Strength - <i>ASTM D 4833 or</i> <i>ASTM D 3787 Mod.</i> <i>(OSHD TM 816)</i>	35 lb./80 lb.	80 lb./110 lb.	80 lb.	110 lb.	----	----
Apparent opening size (AOS), U.S. Std. Sieve - <i>ASTM D 4751</i> <i>(CW-02215 Corps of</i> <i>Engr.)</i>	No. 70 sieve or smaller opening	No. 70 sieve or smaller opening	No. 30 sieve or smaller opening	No. 30 sieve or smaller opening	(2)	----
Water permeability - <i>ASTM D 4491</i>	0.1 cm/sec.	0.1 cm/sec.	0.005 cm/sec.	0.005 cm/sec.	(2)	----
Ultraviolet stability - <i>ASTM D 4355 at</i> <i>500 hours</i>	----	70% strength retained	----	----	70% strength retained	----
Wide strip tensile strength - <i>ASTM D 4595</i>	----	----	----	----	(2)	----
Asphalt retention - <i>OSHD TM 817</i> <i>(TF25 Method 3) (3)</i>	----	----	----	----	----	0.20 gal./ sq. yd.
Melting point - <i>ASTM D 276</i>	----	----	----	----	----	300° F

205.03 CONSTRUCTION

205.03.01 Description

This work consists of furnishing and placing geotextiles in drains, under embankments, for embankment reinforcement, under riprap, buttresses, inlays, shear keys and erosion control applications, behind retaining

structures, over roadbed subgrades, and beneath pavement overlays as shown on the plans and at other locations as directed.

205.03.02 Geotextile Installation Requirements

205.03.02.01 Acquisition and Storage

Provide complete rolls of geotextile as furnished by the manufacturer and protect against damage and deterioration. Store all geotextile rolls in a dry place and off the ground at all times according to ASTM D 4873. Cover all rolls and partial rolls with a dark protective covering when received. The geotextile will be rejected for use if the City Engineer determines it has defects, deterioration, or has been damaged.

205.03.02.02 Placement

A. Surface Preparation

1. 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.
2. 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 top of the lower sheets. When the geotextile is placed on a slope steeper than 6:1, securely anchor the laps to the ground surface with pins or stakes as necessary to prevent 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. 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 ft. ahead of the specified cover material.

205.03.02.03 Overlaps

- A. Minimum overlap requirements for geotextiles shall be as indicated in the table below.

Geo Textile Application	Minimum Overlap Requirements (Inches)
Drains	12
Embankment Stabilization	24
Geotextile Wall Reinforcement	24
Pavement Overlays	*
Riprap and Rock Buttresses	24
Roadbed Subgrade Stabilization	24

* Use sufficient overlap to insure closure, but not more than 6 in.

- B. If the City Engineer determines the specified overlap is not sufficient, increase the overlap to provide adequate coverage or sew the geotextile together in the field.

205.03.02.04 Field Seams

- A. General - Obtain the City Engineer's approval before field seaming and stitching. 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.
- B. 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 inch. The flat, or prayer, seam may be used for repair of damaged in-place geotextile.

205.03.02.05 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 permitted directly on the geotextile except as authorized.
- C. When placed for construction, cover the geotextile with specified cover material as soon as possible. Do not leave in uncovered condition for more than five days, except when used with temporary retained earth walls and asphalt overlays.
- D. Place cover material on the geotextile in a manner that the geotextile is not torn, punctured, or shifted. Use a minimum 6 in. thick cover layer or twice the maximum aggregate size, whichever is thicker. End-dumping cover material directly on the geotextile will not be permitted.
- E. Limit construction vehicles in size and weight so rutting in the initial layer above the geotextile is not more than 3 in. deep or 1/2 the layer thickness, whichever is lesser. Turning of vehicles on the first layer will not be permitted.

205.03.02.06 Repair of Geotextile

Repair or replace all torn, punctured, or contaminated geotextiles during construction at no cost to the Division. Repair by placing a patch of the specified geotextile over the affected area. Overlap the existing geotextile with the patch. 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.

205.03.02.07 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.

205.03.02.08 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.

205.03.02.09 Riprap Geotextile

- A. 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 City Engineer that the combination of the rockfill drop height and the thickness of any aggregate cushion, when

specified or required, are adequate to not puncture or damage the geotextile when placing the riprap or stone embankment material. In addition, limits indicated in the following table shall apply.

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

- B. After placing the riprap, backfill all voids in the riprap face so the geotextile is completely covered and not visible.

205.03.02.10 Wall Geotextile

- A. General - Begin wall construction at the lowest portion of the excavation and place each layer horizontally as shown on the plans. Complete each layer in its entirety before the next layer is started. Seams will be allowed only at the wall face. Either overlap geotextile sheets perpendicular to the wall or sew seams parallel to the wall face. Stretch the geotextile in a perpendicular direction to the wall face to eliminate slack before backfilling.
- B. Forming the Wall - Use a temporary form system at the wall face during construction. A typical temporary form system and a sequence of wall construction required are shown in the plans. Use pegs, pins, or the manufacturer's recommended method as approved by the City Engineer, in combination with the forming system, to hold the geotextile in place until the cover material is placed.
- C. Backfill for Wall Construction - Compact the backfill for the wall within the limits shown or directed. Compact each layer to 95% of maximum density as determined by OSHD TM 109. Maintain the water content to within +/- 3 percent of the optimum moisture content. Sheepsfoot rollers and vibratory rollers or other rollers with protrusions will not be allowed within 3 ft. of the wall face. Compact this area using approved light mechanical tampers, without damaging or distorting the wall facing or reinforcing layers.

205.03.02.11 Subgrade Geotextile

- A. For roadbed subgrade separation, prepare the subgrade according to **Section 501, SUBGRADE**.
- B. 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. The patch shall overlap the exposed geotextile a minimum of 12 in. Cover the patch with the specified cover material and compact before proceeding.

205.03.02.12 Pavement Overlay Geotextile

- A. General - Place geotextile and pavement overlay in four basic steps:
1. Surface preparation
 2. Sealant application
 3. Geotextile placement
 4. Overlay placement
- B. As outlined according to **Section 508, GEOTEXTILE FABRICS**.

206 LANDSCAPING AND LANDSCAPE RESTORATION

206.01 DESCRIPTION

This Section covers the work necessary as indicated below:

- 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.

206.02 MATERIALS

206.02.01 Plants

Names of plants to 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.

206.02.02 Seed

Provide tested grass and legume seed from blue tag stock and from the latest crop available. Deliver each variety or mixture 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 the following: seed variety, percentage of purity, germination, maximum weed content, and date of test (must be within nine months of date of delivery). Seed must be tested 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.

206.02.03 Sod

Provide grass sod from certified or approved source, strongly rooted, and free of pernicious weeds. Sod should be composed of several seed varieties excluding blue and bent grass varieties.

206.02.04 Topsoil

206.02.04.01 Native Topsoil

Save, store, protect, and reuse approved native topsoil taken from the top 12 in. of the excavation. Ensure that topsoil is free from grass, overburden and roots, sticks, hard clay, and any stones which will not pass a 1 in. square opening. Wherever native topsoil cannot be saved or is not satisfactory for reuse, use imported topsoil conforming to **Subsection 204.02.07, Imported Topsoil**, but only with the approval of the City Engineer.

206.02.05 Sand

Conform to the requirements of **Subsection 205.02.12.03, Fine Aggregate**.

206.02.06 *Organic Material for Soil Amendment*

Use a peat consisting of natural residue formed by decomposition of reeds, sedges, or mosses from freshwater site. Peat must be free from lumps, roots, stones, and capable of absorbing at least 4 times its dry weight of water. It must contain organic matter not less than 90% on a dry weight basis, and have a maximum moisture content at time of delivery of 65% by weight.

206.02.07 *Lime*

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

206.02.08 *Subdrains*

Use perforated PVC drain pipe, meeting the requirements of **Subsection 601.02.04, PVC PIPE**, unless otherwise specified, and as approved by the City Engineer.

206.02.09 *Irrigation and Water Systems*

206.02.09.01 *Pipe*

Use Schedule 40 PVC on all mainlines, Class 200 PVC for lateral lines and solvent weld PVC pipe (SDR-21), conforming to ASTM D 2241, and fittings of PVC with deep socket dimensions conforming to ASTM D 2466.

206.02.09.02 *Main Valves*

Install the following main valves: up to and including 3 in., resilient seated ball valve with bronze bodies, 4 in. and larger, gate valves with either bronze or iron bodies, all having bronze stems, bronze seat rings, and bronze disc faces, and conforming to ASTM B 62.

206.02.09.03 *Pressure Reducing Valves*

Use adjustable, heavy duty bronze pressure reducing valves. Must have 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.

206.02.09.04 *Control Valves*

- A. Provide normally open electric control valves of brass or bronze for underground installation. Valves shall have cross or slot type handle for operation with a standard key, a removable bonnet and stem assembly, an adjustable packing gland, a rising stem to assure full opening of the valve, renewable disc-type washer seat, and integral or independent union.
- B. Use electrically operated control valves of bronze, brass, or stainless steel. These shall be of the normally open type, having an open or close time greater than 4 seconds, and capable of manual control during power failure. Provide with a motor assembly or operating parts which are removable without disturbing the valve body. Must be all waterproof for underground burial, and with integral or independent union for supply line connection.

206.02.09.05 *Quick-Coupling Valves*

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

206.02.09.06 Risers

Connect sprinkler heads and quick-coupling valves to plastic pipe water supply lines with Schedule 80 PVC pipe risers. Heads and valves connected to plastic pipe water supply lines shall, in addition, be provided with an approved swing joint. All threaded pieces shall be wrapped with Teflon tape.

206.02.09.07 Backflow Prevention

Use either reduced pressure or double check valve assemblies, as indicated in Contract Documents, of a type and size approved by the Owner.

206.02.10 Fertilizer

Use fertilizer conforming to the recommended content as provided for in **206.03.02 Soil Test**. Furnish fertilizer in moisture-proof bags 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 a uniform granular or palletized 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.

206.02.11 Mulch and Ground Covers

Use one or more of the following types of mulch.

1. Organic mulch of clean ground Douglas fir or hemlock bark graded so that 50% consists of particles larger than 1/4 in., but not exceeding 1 in., and 20% 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. Fiber-glass mulch of approved commercial grade fiber-glass yarn mat.
4. Straw mulch of threshed straw of oats, wheat, or rye, free from seed of noxious weeds or clean salt hay.
5. On steep slopes use approved mesh to reinforce mulch or plantings such as fiber mulch of heavy, twisted jute mesh or other material as approved, with openings between strands approximately 1 in. square.
6. Spray mulch of a verdyol complex, with nontoxic, 100% organic water soluble powder binding agent with silva fiber used in hydraulic seeding operations.

206.02.12 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 in. x 2 in. x 96 in., clear straight cedar, or approved.
3. Wire of 12 gauge, pliable galvanized steel, for guys, or for fastening trees to stakes.
4. Hose for guy wire encasement will be of 2-ply reinforced rubber garden hose, having a minimum 5/8 in. diameter threaded openings fitted with screw eyes.
5. Turnbuckles will be zinc-coated, with a 6-1/2 in. lengthwise opening, and 3/8 in. diameter threaded openings fitted with screw eyes.

206.02.13 *Soil Sterilant*

Soil sterilant shall be as approved by the City Engineer for the purpose specified and shall be applied conforming to manufacturer's recommendations.

206.03 *CONSTRUCTION*

206.03.01 *General*

Conform to the manufacturer's and supplier's recommendations and instructions and to accepted practices in the industry. Planting and maintenance of trees are contained in the West Linn Tree Technical Manual.

206.03.02 *Soil Test*

If directed by the City 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 vegetation to be grown. The recommendations shall be used to select the particular fertilizer and soil improvement materials to be used prior to planting.

206.03.03 *Lawns and Grass*

206.03.03.01 *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

206.03.03.02 *Delivery, Handling, and Storage of Sod*

- A. 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 designated areas.
- B. If sod is not laid within two days of delivery, spread out flat with grass side up in cool place and keep moist. Rolled or stacked sod that becomes yellow will not be accepted.

206.03.03.03 *Preparation of Subgrade*

After rough grading is completed and before topsoil is spread, apply lime and/or super phosphate as determined by soil analysis, and mix to a depth of 4 to 6 in. Conform to manufacturer's recommendations for applying lime and super phosphate simultaneously, and schedule application or applications accordingly.

206.03.03.04 *Subsurface Drainage*

- A. Lay drainage pipe on firm bed of gravel with minimum fall of 0.5% and located as shown on the plans. Place pipe at a minimum depth of 24 in. and not any deeper than required to produce minimum fall. Cover backfill with fiberglass mat to prevent infiltrations of soil. Backfill trenches with gravel to within 4 in. of subgrade.

- B. Place other drain materials in conformance with the applicable requirements in DIVISION 5 - SEWERS. Complete backfilling of trenches with a 4 in. layer of coarse sand and tamp for compaction, as approved.

206.03.03.05 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 a maximum of 3 1/2 tons. Imported topsoil must be incorporated with at least a 2 in. layer of subsoil. Thoroughly mix the applied materials to a depth of 8 in. using a disc or cultivator over the entire area in two directions at right angles. Rake topsoil areas to a uniform grade so that all areas drain, as shown on the plans or as approved. Remove all trash and any stones exceeding 2 in. in diameter from the area to a depth of 2 in. prior to preparation and planting grass.

206.03.03.06 Soil Sterilant

Apply specified soil sterilant at the rate recommended and by the method approved by the manufacturer or as specified.

206.03.03.07 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 the recommended rate and method approved by Oregon Department of Agriculture Extension Service. Method of seeding may be varied, as approved, however, the responsibility to establish a smooth, uniformly grassed area will not be waived. Hydroseeding will be permitted, unless otherwise specified.

206.03.03.08 Sodding

Before sod is laid, correct soft spots and irregularities in grade of the prepared bed, as approved. Lay sod, and tamp or roll so that no voids occur. 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 in. long driven through the sod into the soil, flush with the top of the sod at approved intervals.

206.03.03.09 Mulching and Protection of Slopes

- A. Mulch all areas with a slope from 5% to 20% by spreading a uniform light cover of ryegrass over the seeded area at a rate of 1-1/2 tons per acre.
- B. In areas with a slope steeper than 20%, and up to 25%, install erosion control netting. In non-turf areas, cover netting with fir bark mulch.
- C. Mulch all areas with a slope steeper than 25% with spray mulch applied at a rate of 15 gal. per 1,000 sq. ft. after wetting the ground with water penetrating at least 1 in. deep.
- D. Protect new seeded area from pedestrian traffic. Unless otherwise approved, erect a fence of 2 in. by 2 in. posts 4 ft. high spaced 10 ft. on center and strung with jute, hemp, or a single strand of No. 12 gauge wire marked with cloth strips at 3 ft. intervals between posts.

206.03.03.10 Maintenance

- A. Begin maintenance immediately after each portion of lawn is planted and continue for 8 weeks after all lawn planting is completed.
- B. 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 fencing as needed. Mow to 2 in. after grass reaches 3 in. in height, and mow frequently enough to keep grass from exceeding 2-1/2 in. Weed by local spot application of selective herbicide only after first planting season when grass is established.

206.03.03.11 *Lawn Guarantee*

- A. 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 1st 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.
- B. A satisfactory stand is defined as a lawn or section of lawn that has:
 - 1. No bare spots larger than 3 sq. ft.
 - 2. Not more than 10% of the total area with bare spots larger than 1 sq. ft.
 - 3. Not more than 15% of the total area with bare spots larger than 6 in. square.

206.03.03.12 *Inspection for Acceptance*

Submit a written notice eight weeks after the start of maintenance on the last section of completed lawn. Within 15 days of such written notice the City Engineer will make an inspection of the lawn to determine if a satisfactory stand of grass has been produced.

206.03.04 *Trees, Shrubs and Ground Cover*

206.03.04.01 *Delivery, Preparation and Storage*

- A. 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 the plant. Firmly wrap balls with burlap and bind with twine, cord, or wire mesh. Where necessary to prevent breaking or cracking of the ball during the process of planting, or where the tree exceeds 4 in. in diameter, secure the ball to a platform. Meet or exceed AAN Standards, current edition.
- B. Dig bare root plants during dormant period to remove earth with the least possible injury to the fibrous root system. Cover the roots with thick coating of mud immediately after digging by puddling or wrapping in wet straw, moss, or other suitable packing material for protection until delivery.
- C. Furnish container grown plants with self-established root systems sufficient to hold earth together after removal from the container but not root-bound. Plants shall have grown for at least 3 months in the container with inside diameter specified. Meet or exceed AAN Standards, current edition.
- D. If plants are not in the dormant state, spray with anti-desiccant to cover foliage as recommended by manufacturer, prior to digging the plants. During shipment, protect the plants with tarpaulin or other approved covering to prevent excessive drying from the sun and wind.
- E. 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 delivery. Water plants as necessary to prevent drying until planted. Do pruning only at the time of planting.
- F. Open and separate all bundles of heeled-in bare root plants before the roots are covered. Avoid leaving air pockets among the roots.

206.03.04.02 *Soil Conditioning*

- A. After the specified chemical analysis report for topsoil is received, prepare the topsoil mixture for plant pits and beds by thoroughly mixing the approved topsoil with soil conditioner materials, fertilizer, and lime. Thoroughly mix with rotary mixer or other approved method in the proportions indicated in the following table.

Topsoil Classification by Clay Content	Required Mixture			Parts by Volume	
	Top Soil	Sand	Peat	Fertilizer*	Lime
Clay 5-10%	4	0	1 lb./cu. yd.	1/2 lb./cu. yd.	1
Clay 10-15%	2	2	1 lb./cu. yd.	1/2 lb./cu. yd.	1
Clay 15-25%	2	4	1-1/2 lb./cu. yd.	1/2 lb./cu. yd.	1

*Adjust in accordance with Soil Test chemical analysis report.

- B. 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 6 weeks.

206.03.04.03 Planting Procedures

- A. Within 20 calendar days after receiving the notice to proceed, submit a time schedule for approval indicating dates for commencement and completion of the operations below.
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 and plants to the site
 6. Planting of trees and other plants
 7. Fertilization and application of pre-emergent herbicide
 8. Guying, staking and mulching
 9. Completion of work for start of guarantee period
- B. 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.
- C. Locate new planting where shown on plans, except make approved adjustments where obstructions below ground are encountered or where changes have been made in the construction.
1. Place no planting, except ground cover, closer than 18 in. to pavements and structures.
 2. Dig plant pits and have soil mixture for planting ready before plants are delivered. Excavate circular pits with vertical sides a minimum of 2 ft. 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.
 3. Place 3 in. 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. Remove wire, burlap, and surplus binding from top and sides of balls. Spread roots in normal position. Cut all broken or frayed roots off cleanly.
 4. 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.

5. When directed by the City Engineer, form shallow saucer around plant by placing ridge of topsoil around edge of pit 2 ft. greater than diameter of ball. After ground settles, fill with additional soil to level of finished grade.
- D. Plant trees before surrounding smaller plants and covers are placed. Position trees as shown on plans or, where spacing dimensions or locations are not clear, as approved.
- E. Plant shrubs on centers as shown on plans with spacing adjusted if required to evenly fill bed using specified quantity of plants.
- F. Plant hedges on centers as shown on plans. Excavate trenches a maximum of 4 in. deeper and 12 in. 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 on plans.
- G. Plant ground covers in beds having minimum 8 in. of prepared soil mixture. Treat ground cover beds with soil fumigant, after preparation for planting, but before any plants are installed within bed area, 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 on plans. Mulch and water immediately after planting.
- H. Plant bulbs in ground cover beds to recommended depths for each bulb type as shown on plans.
- I. Provide trees and planting beds with 3 in. layer of fir or hemlock bark mulch within two days after planting and keep at this depth throughout maintenance period. Mulch to entirely cover area of saucer around each tree.
- J. Use four guys equally spaced as shown on plans for all trees greater than 4 in. in diameter.
- K. Use three guys equally spaced as shown on plans for all trees 4 in. in diameter or less.
- L. Where shown on plans, 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.

206.03.04.04 Pruning and Repair

At completion of planting work, prune and repair injuries at 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 to branch collar, leaving no stubs. On all cuts over 3/4 in. 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.

206.03.04.05 Plant Guarantee

- A. Guarantee all plants for a minimum of 1 year to be alive and in vigorous growing condition at the end of guarantee period. Guarantee period shall extend 1 year from date of Acceptance of Work as defined in **Subsection 101.01, DEFINITIONS**. Remove unsatisfactory plants and replace with plants of the same kind, quality and size as originally provided as specified.
- B. Guarantee all plant replacements to be alive and in vigorous growing condition 1 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 immediately, unless during a season unfavorable for planting. When season is unfavorable, plant during the first month of the next favorable planting season.

206.03.04.06 Maintenance

- A. Begin maintenance immediately after each plant is installed and continue to maintain until the end of the guarantee period.

- B. Perform the operations indicated below:
1. Watering as often as required to maintain capillary water within 2 in. of the soil surface around plants
 2. Weeding of plant beds, planting saucers and plantpockets to keep free of weeds, using approved selective herbicide according to the Manufacturer's directions for use, and/or weeding by hand methods
 3. Mulching monthly to replenish mulch and keep at required 2 in. minimum depth
 4. Tightening and repairing guys to keep trees erect and supported without damage to bark
 5. Resetting plants to proper grades or upright position
 6. Restoration of planting saucers
 7. Seasonal spraying to control disease or insect pests that may impair plant vigor
- C. Replace plants required by the plant guarantee on a regular monthly basis, except during the months of December, January and February.

206.03.05 Irrigation Systems

206.03.05.01 General

- A. 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 on plans. Piping beneath paved areas shall have a minimum cover of 30 in. Construct irrigation system in areas to receive topsoil after topsoil is spread, compacted, and rough graded.
- B. Steel pipe or copper tubing may be bedded using excavated material. Bed PVC pipe in sand, as shown on plans and backfill to a minimum of 3 in. above the pipe with sand. Determine the final number and location of sprinkler heads after grading is complete, such that complete coverage of all sprinkled areas is provided. Flush out system thoroughly and pressure test before installing sprinkler heads. Adjust flow on each head for proper coverage.
- C. Lawn areas and shrub areas shall be irrigated separately.
- D. Repair and replace irrigation parts and winterize as necessary.

206.03.05.02 Steel Pipe

Ream, clean, and remove burrs and mill scale from piping before making up. Make joints with approved joint compound.

206.03.05.03 Copper Tubing

Cut tubing square and remove burrs. Clean both inside of fittings and outside of tubings 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.

206.03.05.04 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, 1 cycle per 40 ft. 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 40°F. Sprinklers and valves shall be installed in accordance with the manufacturer's recommendations, as approved.

207 RESTORATION AND CLEANUP

207.01 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.

207.02 MATERIALS

Provide all materials required to accomplish the work as specified.

207.03 CONSTRUCTION

207.03.01 Surface Dressing

- A. 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. Unless specified otherwise, the maximum slope shall be 2 to 1 in cut and fill. Supplement machine dressing by hand work as necessary.
- B. 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. Excavated areas adjoining new walkways and curbs shall be backfilled with top soil. Where the existing ground is below the sidewalk and curb, fill and dress the area to the walk. Wherever fill material is required in the planting area, make finish surface high enough to allow for final settlement. Surface improvements other than topsoil which are adjacent to new walkways or curbs, such as asphalt paving or brickwork, shall be replaced with like materials.

207.03.02 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 have been disturbed, remove and dispose of or restore same as directed by the City Engineer at the Contractor's expense.

207.03.03 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.

207.03.04 Cleaning Paved Surfaces and Appurtenances

Clean all pavement surfaces, whether new or existing within the limits of the project. All haul routes will be kept free of dust, dirt, gravel, and debris at all times. Clean existing improvements such as curbs, gutters, walls, sidewalks, castings for manholes, monuments, water gates, lamp poles, vaults, signs, and other similar installations.

Flush the street with a pressure type flusher and hand broom or flush all sidewalks.

207.03.05 Restoring Planted Areas

Hand-rake and drag all former grasses and/or planted areas leaving disturbed areas free from rocks, gravel, clay, or any other foreign material and ready, in all respects, 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.

207.03.06 *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 restore the property occupied to a neat, clean, and orderly condition, in equal or better condition to that existing before move in.

207.03.07 *Removal of Signs*

Do not remove warning, regulatory, guide, or project signs prior to formal acceptance, except as directed.

207.03.08 *Restoring Curbs, Sidewalks and Driveways*

Repair or replace all curbs, sidewalks, driveways, and other structures damaged during construction of the work. Construct curbs, sidewalks, driveways, and other structures in conformance with the applicable requirements in **DIVISION FIVE - STREET TECHNICAL REQUIREMENTS**.

208 BORING AND JACKING

208.01 *DESCRIPTION*

208.01.01 *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 worker within the pipe or conduit without stopping or removing the excavation equipment.

208.01.02 *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 excavate and assist in keeping the conduit on a straight and true grade and alignment.

208.01.03 *Permits*

- A. Permitter shall designate the owner of railroad tracks or other facilities with prior rights, under which a pipe or conduit must be bored or jacked.
- B. All necessary permits for the undercrossing will be obtained by the City.
- C. The operation across the Permitter's right-of-way must conform to the requirements of the Permitter as outlined in a pipeline crossing agreement made between the Permitter and the City. The Contractor shall conform with all requirements of the pipeline crossing agreement. Before work is commenced, the Contractor shall be solely responsible for obtaining and delivering to the Permitter a public liability and property damage insurance policy in the amount required in the pipeline crossing agreement.
- D. The insurance company writing the policy shall be authorized to do business in the State of Oregon and shall be satisfactory to the Permitter. The insurance policy or policies shall be delivered to and remain in the possession of the Permitter. If any special agreement is required between the Contractor and the Permitter, it shall be completed and signed before the Contractor enters upon or commences work on the Permitter's property.

208.02 MATERIALS

208.02.01 Pipe Bedding and Pipe Zone Material

Conform to the requirements of **Section 204, EXCAVATION, EMBANKMENT, BEDDING AND BACKFILL.**

208.02.02 Pipe

Conform to **Section 301, PIPE AND FITTINGS** or **Section 402, WATERWORKS MATERIALS** for the strength, class, and type as shown or specified.

208.02.03 Casing

- A. Provide casing of size to permit proper construction to the required lines and grades. Casing shall be the type shown in the table below.
- B. Use 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	Smooth Steel Pipe Min. Thickness
12 in. & Under	3/16 ASTM A 53
15-24 in.	1/4 ASTM A 53
30-36 in.	5/16 AWWA C 201
48-78 in.	Not Allowable

- C. Equip jacked casings with nipples at the springline and crown at 10 ft. centers when pressure grouting is specified.

208.02.04 Grout

- A. Grout for filling the annular space between the carrier pipe and casing pipe shall be a mixture of Portland Cement, sand, and pea gravel proportioned to allow complete filling of the annular space. The mixture shall have a creamy consistency which enables it to be pumped with a concrete pump.
- B. Grout for pressure grouting outside jacked carrier or casing pipe shall be a mixture of Portland Cement (Type 1-P) and water proportioned to allow complete filling of all voids. The maximum allowable slump shall be less than 5 in.

208.02.05 Stainless Steel Bands

One-half inch wide by 0.020 in. thick steel bands, or equal.

208.02.06 Supports and Skids

Lumber shall be No. 2 West Coast Douglas fir graded in conformance with WWSA Current Grading Rules for Western Lumber. Material shall be pressure treated with Creosote or pentachlorophenol in mineral spirits in accordance with AWWA C14, C8, C9, and C2 as applicable. Minimum retention shall be as designated for contact with ground. Method of treatment shall be in accordance with the applicable portion of the AWWA standards. Insofar as practicable, all timbers shall be cut to size before the material is given the preservative treatment.

208.03 CONSTRUCTION

208.03.01 General

- A. 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.
- B. Before the start of the work, submit satisfactory evidence to the City Engineer that all insurance coverage requirements called for by the Permittee have been complied with. If required, proposed construction methods and materials shall be submitted to the Permittee before the start of construction. Written authorization to proceed from the Permittee shall be submitted to the City Engineer before the start of construction.
- C. Prior to starting construction, all required labor, materials, and equipment shall be on the site. Notify all Permittees at least 48 hours in advance of working within their right-of-way unless otherwise specified in the permit.

208.03.02 Excavation

Excavation shall be unclassified and shall include whatever materials are encountered to the depths as shown or as required. The boring Contractor or Subcontractor will visit the site and make an estimate of the kind and extent of various materials which may be encountered in the excavation.

208.03.03 Alternate of Jacking or Boring

Jacking or boring may be allowed in lieu of the open trench method. However, written authorization by the City Engineer must first be obtained. The City Engineer retains the right to reject either the jacking or boring method without rejecting the other. Authorization by the City Engineer shall in no way relieve the Contractor of the responsibility for making a satisfactory installation meeting the requirements set forth herein.

208.03.04 Jacking and Boring

- A. 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 in 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.
- B. 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 City Engineer, the Contractor shall correct at no expense to the Owner.
- C. 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.
- D. 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. The Contractor shall be responsible for any increase in pipe strength necessary to withstand jacking or boring loads and grouting.

208.03.05 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 bearing shims to properly distribute the bearing stresses. Remove any section of pipe or conduit showing signs of failure and replace with a new section.

208.03.06 Smooth Steel Casing

- A. 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.
- B. 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.
- C. If not shown on Plans 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 material.

208.03.07 Grouting Voids Outside Casing or Carrier Pipe

- A. After the casing, or carrier pipe where no casing is specified, has been jacked or bored into position, pressure grout to fill all voids outside the casing 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 at the hole in the crown.
- B. Next grout through the hole at the crown 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 pipe has been grouted. Grouting once commenced at any one point shall be completed without stopping.
- C. Nipples installed in grout holes must be removed and the holes grouted flush with the pipe wall or nipples should be cut off flush with pipe wall and grouted over or use flush mount pipe nipples and plugs.

208.03.08 Cased Pipe

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 301, PIPE AND FITTINGS** or **Section 402, WATERWORKS MATERIALS**, including hydrostatic or air testing and line and grade.

208.03.09 Grouting Void Between Carrier Pipe and Casing

Completely fill the annular space between the casing and the carrier pipe with grout (See **Subsection 205.02.04.02, Type "B" Grout**) or as specified. Fill the voids by continuously pumping grout from one end of casing pipe until grout appears at the other open end. When grouting, use low pressure grouting equipment. The grouting pressures shall not be greater than the design loads of the carrier pipe. The Contractor shall, at his sole expense, remove and replace any pipe sections which fail during the grouting process.

208.03.10 Vacant

208.03.11 Contractor's Responsibility

- A. The Contractor shall be fully responsible for settlement or deterioration of the finished crossing until a period of two years after final acceptance by the Owner.
- B. Where casing is not required but 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 Boring or Jacking as applicable, and no separate payment for pipe will be made.

209 RESURFACING

209.01 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, storm drains, water distribution systems, and conduits.

209.02 MATERIALS

209.02.01 Asphalt Concrete

Use hot mix asphalt concrete Class C mix conforming to the requirements for hot mix asphalt concrete in **Section 505, ASPHALT CONCRETE PAVEMENT** and **Section 205, TYPES AND USE OF MATERIALS**.

209.02.02 Vacant

209.02.03 Vacant

209.02.04 Vacant

209.02.05 Pavement Base

Use pavement base material for resurfacing trenches which conform to **Section 503, AGGREGATE BASES**.

209.02.06 Forms

All forms shall conform to requirements for forms in **DIVISION 7 - CONCRETE STRUCTURES**.

209.02.07 Rock Surfacing

Rock surfacing shall be 1"-0 or 1-1/2"-0 crushed aggregate as specified in **Subsection 204.02.06, Class B Backfill, 3/4"-0 Crushed Aggregate**.

209.02.08 Subgrade

Subgrade material shall conform to the requirements for subgrade in **Section 501, SUBGRADE**.

209.02.09 Joint Materials

209.02.09.01 Preformed Elastomeric Joint Seals

Preformed elastomeric joint seals shall conform to the requirements of AASHTO M-220.

209.02.09.02 Poured Filler

Poured filler for concrete joints shall conform to the requirements of AASHTO M-173 (ASTM D 1190).

209.02.09.03 Rubber Gaskets for Concrete Pipe and Precast Section Joints

Rubber gaskets for use in concrete pipe and precast manhole section joints shall conform to the requirements of AASHTO M-198 except that rubber gaskets for use in concrete siphon pipe joints shall conform to the composition and property requirements set forth in ASTM C 361.

209.02.09.04 Joint Mortar for Concrete Pipe Joints and Precast Manhole Section Joints

Joint mortar shall consist of one part Portland Cement and two parts approved sand with water as necessary to obtain the required consistency. Mortar shall be used within 30 minutes after its preparation unless conditions during use necessitate a shorter time.

209.02.09.05 Plastic Compound for Precast Manhole Section Joints

- A. Compound for use in precast manhole section joints shall be a putty-like, preformed homogeneous blend of hydrocarbon resins and rubber or plasticizing materials with not more than 50% by weight of inert mineral filler. The compound shall be specifically manufactured for the intended use and shall be pliable at temperatures between 32°F and 135°F.
- B. A specimen at 77°F and 1/2 in. square in cross section shall stretch at least 1-1/2 in. before rupture when tested with the apparatus described in ASTM D 113. It shall adhere firmly and cohesively to the precast manhole sections when the compound-sealed joint is flexed to its maximum extent. The compound shall be accompanied by and used with such primer solution as the manufacturer of the compound may recommend. Compound conforming to Federal Specification SS-S-00210 (GSA-FSS) is representative of an acceptable material.

209.02.09.06 Water Stop

Water stop shall be either plastic or rubber as the Contractor may elect conforming to the following:

A. Plastic Water Stop

- 1. Polyvinylchloride water stop shall be manufactured to the dimensions called for on the plans from virgin polyvinylchloride (P.V.C.) compound. No reclaimed P.V.C. will be allowed. The water stop shall have the following properties:

	ASTM Test Method	Specification
Tensile, psi	D 412	1800
Elongation %	D 412	350
100% Modulus, psi	D 412	760
Low Brittle Temperature	D 746	50°F
Cold Bend Test*		No Failures

*Samples maintained at -70°F for two hours, then bent quickly around a 1/4 in. mandrel to 180°.

- 2. The supplier shall furnish test samples of the material from which his water stop is to be manufactured. Samples shall be in sheet form having a uniform thickness of from 1/16 to 1/8 in. and having a total area of not less than 2 sq. ft. Each sample shall be comprised of pieces not smaller than 6 in. x 6 in.

B. Rubber Water Stop

- 1. Rubber water stop shall be manufactured to the dimensions shown on the plans in such a manner that the finished product shall have an integral cross section which will be dense, homogeneous, and free from porosity and other imperfections. The water stop shall have the following properties:
 - a. Hardness - The shore A Durometer hardness shall be 60 to 70 when tested in accordance with ASTM D 2240.
 - b. Elongation - Minimum of 450%.
 - c. Tensile strength - Minimum of 3000 psi.

- d. Water absorption - Maximum of 55% by weight after immersion in water for two days at 15 °F.
- e. Tensile strength after aging - The test specimen, after accelerated aging of seven days at 158 °F, shall retain not less than 80% of the original tensile strength. The tensile strength of the test specimen, after accelerated aging of 48 hours in oxygen at 158 °F and tensile stress of 300 psi, shall be not less than 80% of the original tensile strength.
- f. Compression set - After 22 hours at 158°F shall be not more than 30% when tested in accordance with ASTM D 395, method B.
- g. Specific gravity - 1.17 ± 0.03 .
- h. Defects - Minor surface defects such as surface peel covering less than 1 sq. in., surface cavities or bumps less than 1/4 in. in longest lateral dimensions and less than 1/16 in. deep will be acceptable.

209.03 CONSTRUCTION

209.03.01 Street Maintenance

Maintain all trenches as specified under **Section 204, EXCAVATION, EMBANKMENT, BEDDING, AND BACKFILL.**

209.03.02 Temporary Cold Mix Asphalt

- A. All excavations on hard surfaces shall be paved with a temporary cold mix asphalt patch at the end of each workday.
- B. Place and compact temporary cold mix asphalt to a minimum depth of two in. over the backfilled and compacted trench areas as specified **under Section 204, EXCAVATION, EMBANKMENT, BEDDING, AND BACKFILL.** Spread with a mechanical spreading machine, or place by hand methods. Distribute into place by means of shovel or suitable forks and spread with rakes in a loose layer of uniform density.
- C. After spreading, the mixture shall be thoroughly and uniformly compacted with a power-driven roller capable of providing compression of 200 to 300 lbs. per linear inch as soon as raking is complete. Compact areas inaccessible to the roller by tamping. After compaction, the temporary cold mix asphalt shall have the minimum thickness specified and shall match the adjacent existing grade. The temporary cold mix asphalt patch shall be maintained such that a continuous surface will exist without depressions or potholes.

209.03.03 Pavement Base

- A. Place pavement base to the specified depth; when not specified, place to a compacted depth of 12 in. Bring the top of the pavement base to a smooth, even grade at a distance below finished grade equivalent to the required pavement depth.
- B. Compact the pavement base with mechanical vibratory or impact tampers to a density of not less than 95% of the maximum dry density as determined by AST D 1557/AASHTO T-180.

209.03.04 Asphalt Concrete Pavement

209.03.04.01 Tack Coat

Tack coat all edges of existing pavement, manhole and clean-out frames, inlet boxes and like items. Apply an asphalt tack coat to the base lift of asphalt at a rate of 0.05 to 0.15 gal. per sq. yd. prior to placing the second lift when the time between placing the second lift is greater than four hours after placement of the initial lift.

209.03.04.02 Asphalt Concrete Placement

- A. Saw cut the existing pavement a minimum of 6 in. from the edge of the existing pavement at the side of the trench. The saw cut shall be a straight line and shall follow lines parallel to the pipe centerline to remove any pavement which has been damaged or which is broken and unsound. The saw-cut pavement edges shall be free of irregularities. Provide a smooth, sound edge for joining the new pavement. Excavate the material immediately below the cutback area and replace with 3/4 in. compacted crushed gravel base.
- B. Place the asphalt concrete on the prepared subgrade over the trench to the specified depth, 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. Place the asphalt concrete in a minimum of two lifts. Maximum thickness for any one lift of pavement shall not exceed 2 1/2 in. The minimum thickness for placement of compacted pavement shall not be less than 1 in. Spread and level the asphalt concrete with hand tools or by use of a mechanical spreader, 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.
- C. Roll with power rollers capable of providing compression of 200 to 300 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 1/2 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 surfacing at least 1/2 the width of the roller, and progress toward the center of the replacement area. Overlap each preceding track by at least 1/2 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. Density requirements for asphalt concrete pavement shall conform to those in Section 505, ASPHALT CONCRETE PAVEMENT.
- D. Finished surface of the new compacted paving shall be flush with the existing surface and conform to the grade and crown of the adjacent pavement.
- E. After any street has been constructed, reconstructed, paved or improved by any person, the surface of the pavement shall not be thereafter be cut or opened for a period of 2 years. The City Engineer shall make the final determination as to what construction or improvement will be subject to this restriction. The 2 year street cut moratorium shall begin upon the City's acceptance of the completed street improvements.
 - 1. The City Engineer or designee may grant exceptions to the 2 year street cut prohibition, in their sole discretion, in the the following circumstances: (1) in emergency situations, (2) when circular cuts not exceeding eight inches are needed to pot hole and locate existing utilities when boring under a street, and (3) to provide or maintain utility services to a property when no other reasonably practicable alternative exists.
 - 2. In granting an exception, the City Engineer shall impose restoration conditions in addition to the standard six (6) inch T-cut to mitigate the street cut in order to provide equivalent surface quality, durability, structural integrity, and rideability. Conditions may include surface grinding, base and sub-base repairs, extended sawcutting, or similar work, and may include up to a full-width surface paving of the roadway. Applicants will be responsible for the full cost of plan review, construction inspection, material testing, bonding and all other City expenses related to the work.
 - 3. If the City Engineer determines that final repaving of the street is not appropriate due to weather or other short term problems, the City Engineer may grant a delay until conditions allow for repaving in accordance with the City's Public Works Construction Standards.
 - 4. In the event that the City Engineer requires the partial or full repaving of a street segment, the City Engineer may require a financial security in a form acceptable to the City be provided to the

City prior to performing any work in the City's right-of-way in addition to an 18 month maintenance security following completion of work.

209.03.04.03 Seal Coat

- A. Immediately after the new paving is completed, apply a seal coat of liquid asphalt conforming to **Subsection 205.02.13, Asphalt Materials**, to all joints between the new and original asphalt pavement. The seal coat shall be a minimum of 12 in. in width and shall be centered on the joint. The liquid asphalt shall be applied to the point that it begins to run off. The minimum application rate shall be 1.7 gal. per 100 linear ft.
- B. Immediately after the liquid asphalt has been applied and before the asphalt has solidified, cover the seal coat asphalt with clean-dry masonry sand. The sand shall be applied in a layer thick enough to prevent tracking of seal coat. Before opening the street to traffic, the Contractor shall clean up all loose sand.

209.03.04.04 Surface Smoothness

- A. The top surface of the asphalt concrete pavement, when tested with a 12 ft. straightedge furnished and operated by the Contractor, shall not vary by more than 0.02 ft. either parallel to or perpendicular to the centerline. The City Engineer will observe this testing and may require additional testing. The means of correction of a surface that does not meet the smoothness requirements shall have the approval of the City Engineer.
- B. When tests show the pavement is not within the above tolerances, the Contractor shall take immediate action to correct equipment or procedures in his paving operation to eliminate the unacceptable pavement roughness.
- C. Any surface irregularities exceeding the above tolerances shall be corrected by the Contractor using a method or methods listed herein and approved by the City Engineer.
- D. Corrective Action - Corrective measures by the Contractor requiring one or more of the following actions approved by the City Engineer shall be performed on deficient areas:
 - 1. Remove and replace the surface course.
 - 2. Place an overlay of a thickness approved by the City Engineer.
 - 3. Grind the pavement surface utilizing diamond blades up to maximum depth of 0.3 in. and apply an emulsion fog coat as directed by the City Engineer.
- E. All corrective work shall be completed within 10 working days following notification from the City Engineer that the pavement does not meet the specified tolerances, unless otherwise directed by the City Engineer.
- F. All corrective work, including furnishing of materials, shall be performed at the Contractor's expense and no adjustment in contract time will be made for corrective action work.

209.03.04.05 Weather Conditions

- A. Asphalt concrete mixtures shall be placed on dry prepared surfaces when the air temperature in the shade and the surface temperature is not less than those specified in the following table:

SURFACE TEMPERATURE LIMITATIONS

Compacted Thickness of Individual Courses	Travel Lanes/ Wearing Course	All Other Courses
Less than 1-1/2 in.	60°F	55°F
1-1/2 in. to 2-1/2 in.	50°F	45°F Over
2-1/2 in. and other	40°F	35°F

- B. Placing of any mixture during rain or other adverse weather conditions normally will not be permitted, except that mix in transit at the time these adverse conditions occur may be laid if the mix is of proper temperature, if the mix has been covered during transit, if placed on a foundation free of pools, or flow of water and if all other requirements of these specifications are met. Asphalt concrete mixtures shall not be placed when the underlying layer is frozen, or when, in the opinion of the City Engineer, weather conditions either existing or expected will prevent the proper handling, finishing, or compaction of the mixtures.
- C. Do not apply asphalt for tack coat when the surface temperature is less than 50°F.

209.03.04.06 Protection of Structures

- A. 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.
- B. Where existing structures (e.g., 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. The Contractor shall be responsible for adjusting the existing structures as specified in **Section 511, ADJUSTMENT OF EXISTING STRUCTURES TO GRADE**. 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.

209.03.04.07 Excess Materials

Dispose of all excess materials. Make arrangements for the disposal and bear all costs or retain any profit incidental to such disposal.

209.03.05 Portland Cement Concrete Pavement

- A. Pavement replaced shall be the same thickness as that removed, or a minimum of 6 in. Protect the newly placed concrete from traffic for a period of at least seven days.
- B. Saw cut the existing pavement at the nearest construction joints in the existing pavement at the side of the trench. PCC street panels shall be replaced in full. The contractor shall remove any pavement which has been damaged or which is broken and unsound. The saw cut pavement edges shall be free of irregularities. Provide a smooth, sound edge for joining the new pavement.
- C. Handle, place, finish and cure concrete pavement in conformance with the applicable provisions of **Section 506, PORTLAND CEMENT CONCRETE PAVEMENT**.

209.03.06 Rock Surfacing

Place rock surfacing only where shown or directed on streets, driveways, parking areas, street shoulders, and other areas disturbed by the construction. 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.

209.03.07 Concrete Driveways, Sidewalks and Curbs

- A. 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. Prior to replacing the concrete sections properly backfill and compact the backfill to prevent subsequent settlement.
- B. Replace concrete driveways and sidewalks between scored joints unless otherwise directed by the City Engineer. Provide a minimum 2 in. thick compacted leveling course of clean 3/4"-0 crushed aggregate. All concrete replacement work shall be completed prior to the placement of adjacent asphalt concrete. Restoration and clean up shall be as specified under **Section 207, RESTORATION AND CLEANUP**.
- C. Construct forms to match existing. Place concrete and finish exposed surfaces similar to adjacent surface in conformance with **Section 507, CURBS, GUTTERS, DRIVEWAYS, AND SIDEWALKS**.