

**DIVISION 2 - GENERAL TECHNICAL REQUIREMENTS
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DIVISION 2 - GENERAL TECHNICAL REQUIREMENTS

201 MOBILIZATION

201.01.00 DESCRIPTION

Mobilization is the work necessary to move sufficient personnel, materials, and equipment onto the job site to commence construction.

201.02.00 CONSTRUCTION

The contractor shall mobilize personnel, materials, and equipment and set up construction facilities within designated or approved areas.

201.03.00 MEASUREMENT AND PAYMENT

201.03.01 LUMP-SUM BASIS

When mobilization is listed as a separate pay item on the proposal, it will be paid for on a lump-sum basis. Progress payments for mobilization will be equal to the percentage of total work completed and accepted by the City.

201.03.02 INCIDENTAL BASIS

When not listed in the proposal, mobilization costs will be considered incidental to other work and no separate payment will be made.

202 TEMPORARY TRAFFIC CONTROL

202.01.00 MATERIALS AND APPLICABLE REGULATIONS

The term "traffic control devices" shall include barricades, detour and warning signs, traffic delineators, flagpersons, and any other devices or personnel of whatever nature or function that are necessary to conduct construction operations in a manner that will protect the public and offer the least possible obstruction and inconvenience to motorists and pedestrians.

Traffic control devices and their application to the work shall conform to the Manual on Uniform Traffic Control Devices (MUTCD), published by the U.S. Department of Transportation, and the Oregon supplements to the Manual published by the Oregon Department of Transportation.

202.02.00 CONSTRUCTION

The fabrication, application, and maintenance of traffic control devices shall conform to provisions in the contract documents and to applicable sections of the MUTCD.

The contractor shall place, relocate, or remove traffic control devices as often as necessary to reflect changing road and traffic conditions. No construction shall commence or continue without required traffic control devices located as required by the contract documents or the MUTCD.

During construction at any location, additional traffic control devices and flagpersons shall be used as necessary, or as directed by the City Engineer, to isolate the portion of public right-of-way under construction and to advise motorists or pedestrians of available detours.

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

202.02.01 ACCESS TO PUBLIC AND PRIVATE PROPERTY

When access to private, public, or commercial property will be denied or impaired, the contractor shall give agencies providing emergency services and occupants of affected properties advance notice of such restricted access in accordance with applicable requirements in Section 105 CONTROL OF WORK.

For commercial properties, in addition to required notifications, the contractor shall provide and maintain appropriate signing to advise potential customers and commercial traffic of alternate routes to the property.

202.02.02 DETOURS

The contractor shall construct and maintain temporary detours for protection of the work and the safe passage of traffic around the work area as required in the contract documents, the MUTCD, or as directed by the City Engineer.

When detours are not available, the contractor shall confine operations to a width that provides for safe passage of traffic. If, in the judgment of the City Engineer, one-way piloted traffic is necessary, the contractor shall provide at least two flagpersons to control traffic, one flagperson being stationed at each end of the roadway being limited to restricted use, and furnish a pilot car and driver to lead traffic. At the end of each day, the project area shall be left in such condition that it can be traveled without damage to the work and without danger to pedestrians and motor vehicle traffic.

202.02.03 NONCOMPLIANCE WITH SPECIFIED REQUIREMENTS

Partial compliance or failure on the part of the contractor to provide and maintain temporary traffic control as specified in the contract documents, or as directed by the City Engineer, will result in a suspension of work or a reduction in payment for traffic control, or both, until such time the contractor is in compliance with specified requirements.

In situations involving an immediate hazard to traffic, the City Engineer may, at the her/her discretion, have the necessary traffic control established by others with the costs thereof deducted from any payment due the contractor.

202.03.00 MEASUREMENT AND PAYMENT

202.03.01 LUMP-SUM BASIS

When listed in the proposal as a separate pay item, payment for temporary traffic control will be made on a lump sum basis and shall include the provision, fabrication, installation, placement, and maintenance of all traffic control devices used during the course of the work.

Payment for this bid item will include compensation for additional traffic control, including access signing for commercial or other properties, not called for in the contract documents but required by the MUTCD or as directed by the City Engineer as a result of unforeseen circumstances affecting the protection of the work or the public, and no additional payment will be made.

Progress payments for temporary traffic control will be equal to the percentage of total work completed and accepted by the City.

202.03.02 INCIDENTAL BASIS

When not listed in the proposal for separate payment, temporary traffic control shall conform to provisions of Section 202 TEMPORARY TRAFFIC CONTROL and will be considered incidental to other work and no separate payment will be made.

203 CLEARING AND GRUBBING

203.01.00 DEFINITION

Clearing and grubbing is work necessary to remove and dispose of debris and vegetation within the designated limits and to protect structures, objects, and vegetation that are designated to remain in place.

203.02.00 MATERIALS

203.02.01 EXPLOSIVES

Explosives shall be supplied, stored, and used in conformance with Subsection 107.18.00 USE OF EXPLOSIVES.

203.03.00 CONSTRUCTION

Trees, shrubs, plant growth, sod, topsoil, and organic earth shall be removed within designated areas. The work area shall be cleared above and below the natural ground surface of all debris and other objectionable materials. Tree stumps shall be completely removed to a depth not less than 24 inches below any subgrade within the designated excavation area.

Grass and sod on areas to be occupied by fills shall be removed to a depth not less than 18 inches below subgrade or the slope surface on which the fill is to be constructed.

Trees, shrubbery, and other vegetation, not designated for removal shall be protected from damage caused by the work. The contractor shall cut and remove trees and branches only where approved by the City Engineer. When directed by the City Engineer, the contractor shall remove additional branches to provide a balanced appearance of any tree.

Mail boxes in the work area shall be temporarily relocated to allow clearing and excavation as well as easy access by mail carriers and residents. Upon completion of excavation, mail boxes shall be permanently restored to original locations or as specified in the contract documents.

203.03.01 EXCAVATION

Excavation shall be in conformance with applicable requirements in Section 204 EXCAVATION, BACKFILL, AND OTHER SITE WORK.

203.03.02 SALVAGEABLE MATERIALS

Owners of property adjacent to the work shall have salvage rights to plants, trees, shrubs, fences and other improvements in the right-of-way.

Owner reserves the right to merchantable timber as designated in the contract documents and as marked at the project site by the City Engineer. Designated merchantable timber shall be cut, trimmed, and handled as directed in the contract documents. Contractor shall assume ownership and remove and dispose of all other timber and waste materials.

203.04.00 MEASUREMENT AND PAYMENT

203.04.01 LUMP-SUM BASIS

When shown in the proposal, payment for clearing and grubbing will be made on a lump-sum basis for all clearing and grubbing within the limits specified in the contract documents and as herein before described.

Progress payments for clearing and grubbing will be equal to the percentage of work completed under this bid item.

203.04.02 INCIDENTAL BASIS

When not listed in the proposal, clearing and grubbing will be considered incidental to other work and no separate payment will be made.

204 EXCAVATION, BACKFILL, AND OTHER SITE WORK

204.01.00 DEFINITIONS

204.01.01 UNCLASSIFIED EXCAVATION

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.

204.01.02 TRENCH EXCAVATION

Excavation encountered in the trench to the depths and widths as shown and shall be considered unclassified excavation.

204.01.03 BORROW MATERIAL

Material obtained from sources lying outside of, separated from, or independent of planned excavation occurring within the project limits.

204.01.04 FILL

The furnishing, placing, and compacting of specified materials to the depth and configuration specified in the contract documents.

204.01.05 FOUNDATION STABILIZATION

The removal of unsuitable material in the bottom of an excavation and replacement with specified material for support of a roadbed, pipe, structure, or appurtenances thereto.

204.01.06 PIPE BEDDING

Material supplied and placed under and partially around the pipe in accordance with the appropriate standard detail.

204.01.07 PIPE ZONE

The full width of trench from subgrade to a point 10 inches above the top outside surface of the barrel of pipe.

204.01.08 TRENCH BACKFILL

Material supplied and placed in the trench between the pipe zone and the base course for surface improvements or restoration.

204.01.09 BASE COURSE

Material supplied and placed between the trench backfill and the bottom of pavement surface or other structures constructed over the trench.

204.01.10 OVERBREAK

Any material that is excavated, displaced, or loosened outside and beyond slopes, lines, or grades as staked or reestablished, regardless of whether overbreak is due to blasting, to inherent character of any formation encountered, or to any other cause.

204.02.00 MATERIALS

204.02.01 BORROW AND FILL MATERIALS

Fill and borrow materials shall be of a type specified in the contract documents. Generally, fill and borrow material shall be bank-run or river-run gravel, or crushed aggregate depending upon the intended application. Fill materials shall be free of organic matter, clay, or other materials or conditions detrimental to construction of firm, dense, and sound fills.

204.02.02 FOUNDATION STABILIZATION

Foundation stabilization materials shall conform to requirements of Subsection 205.03.03 FOUNDATION STABILIZATION MATERIAL.

204.02.03 PIPE ZONE MATERIAL

Bedding and backfill in the pipe zone for the installation of rigid and flexible pipes and conduits shall conform to applicable requirements in Subsection 205.03.02 TRENCH BACKFILL.

204.02.04 NATIVE BACKFILL MATERIAL

Native backfill material shall not be used unless such material is specified in the contract documents or approved by the City Engineer.

Native material excavated from within limits of the project and imported native-type materials shall be free of organic matter, clay, or other materials or conditions detrimental to meeting specified compaction requirements.

Maximum particle size for trench backfill shall not exceed four inches in any dimension.

204.02.05 SELECT BACKFILL MATERIAL

Materials for select backfill shall conform to applicable requirements in Subsection 205.03.02 TRENCH BACKFILL.

204.02.06 TOPSOIL

Imported topsoil shall be used. The contractor shall provide natural, fertile, friable topsoil, representative of local productive soil that is free of rocks, clay, or other foreign matter. Topsoil shall have a pH of 5.0 to 7.0, and not less than three percent humus as determined by loss on ignition of moisture-free samples dried at 100° C. Topsoil shall be free of noxious vegetation and their seeds. Should such regenerative material be present in the soil, resultant growth, both surface and root, shall be removed and replaced to original specifications at the contractor's expense within one year of acceptance of the work.

Existing topsoil may be reused only where specified in the contract documents or authorized by the City Engineer.

204.02.07 EXPLOSIVES

Explosives shall be supplied, stored, and used in conformance with Subsection 107.18.00 USE OF EXPLOSIVES.

204.03.00 GENERAL CONDITIONS

204.03.01 CONSTRUCTION STAKING

The contractor shall give notice to the City Engineer not less than five working days in advance of when City provided survey services will be required in connection with any portion of the work.

The City Engineer will furnish and set construction stakes or marks establishing appropriate offset lines and grades as determined necessary for work under the contract. The contractor shall be responsible for the transfer of the lines and grade to the work. The City Engineer will not transfer the offset lines or grades for trenching operations, into the work area for any phases of street construction, to batterboards, or any other point within the work.

The contractor shall preserve construction stakes and marks for the duration of their usefulness during construction.

Upon completion, all work shall conform to the lines, elevations, and grades referenced by construction staking established by the City Engineer.

204.03.01A REPLACEMENT OF CONSTRUCTION STAKES AND MARKS

Disturbed, damaged, or lost construction stakes and marks will be replaced or restored by the City Engineer.

If any construction stakes or marks are disturbed, damaged, or lost through negligence of the contractor, and in the judgment of the City Engineer need to be replaced, the actual replacement cost of the construction stake or marker will be deducted from payments due the contractor.

204.03.02 PROTECTION OF SURVEY MARKERS AND MONUMENTS

The contractor shall notify the City Engineer not less than three working days prior to starting work of precautions the contractor will take to ensure the preservation of survey monuments, property pins, and bench marks, and other permanent survey markers. Permanent survey markers shall not be disturbed without the consent of the City Engineer.

Where permanent survey markers are at risk of construction related damage, the contractor, at the contractor's expense, shall provide and maintain appropriate protection for the marker in a manner approved by the City Engineer.

204.03.02A REPLACEMENT OF SURVEY MARKERS AND MONUMENTS

The contractor shall bear the expense of restoring or replacing any permanent survey markers and monuments that are disturbed without consent of the City Engineer.

Restoration or replacement of permanent survey markers and monuments will be performed by the City. The actual cost to replace or restore survey markers or monuments will be deducted from payments due the contractor.

204.03.03 PROTECTION OF PROPERTY

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

The contractor shall be responsible for the restoration or replacement of any public or private improvement, facility, or structure that is visibly evident or correctly shown in the contract documents and is damaged directly or indirectly by any act, omission, or neglect in the execution of the work. The contractor shall restore to a condition equivalent to that existing before such damage occurred, by repairing, rebuilding, replacing, or otherwise effecting restoration thereof. Costs associated with such restoration work shall be borne by the contractor.

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

The contractor shall protect designated trees and planted areas within the right-of-way or easements. The contractor shall exercise care and conduct operations so as to minimize damages to other planted areas.

204.03.04 EXISTING UTILITIES AND IMPROVEMENTS

204.03.04A LOCATION OF UTILITIES

The approximate location of known underground utilities and other structures expected to be adjacent to or encountered in the work are shown in the contract documents. The information shown is not guaranteed to be precise and complete. Data previously gathered in connection with other public improvements may not be included in the utility information presented.

204.03.04B EXCAVATION

The contractor shall conduct operations in such a manner that existing streets, surface and subsurface utilities, railroad tracks, structures, and other facilities that are to remain in place will not be damaged. The contractor shall be responsible for excavating far enough ahead of the work to determine the exact location of interfering utilities or underground structures.

Hand methods shall be used for excavation that cannot be accomplished without endangering existing or new structures or other facilities. When the approximate location of subsurface structures is known, the contractor shall locate such structures by hand excavation prior to utilizing mechanical excavation equipment.

The contractor shall be responsible for costs associated with the repair of any and all damage to contract work or to any utility, whether previously known or disclosed during the work, as may be caused by contractor's operations.

204.03.04C PROTECTION AND MAINTENANCE

The contractor shall protect and maintain existing utilities until they can be relocated or altered by others. The contractor shall protect and maintain utilities that have been relocated by others until the project work has progressed through the location and the utility can be permanently set in place.

Protective measures shall include the installation of cribbing, shoring, or whatever means necessary to support adjacent material containing temporary and permanent facilities, or to support the facilities themselves, and maintain such supports until no longer needed.

The contractor shall provide for the flow of sewers, storm drains, or water lines interrupted during the progress of the work and restore such utilities as directed by the City Engineer or shown in the contract documents.

204.03.04D REPAIR OF UTILITIES DAMAGED DURING CONSTRUCTION

The contractor shall assume responsibility for the repair of utilities damaged during the course of the work. Costs associated with the repair of such damaged utilities shall be borne entirely by the contractor.

Water, storm drain, and sanitary sewer pipe shall be sawcut or removed to the nearest joint and replaced with pipe and mechanical couplers of a type specified in the appropriate section of the Standard Construction Specifications.

The contractor shall install and compact underlying backfill to the density specified herein prior to repairing the utility.

The repair of other utilities shall be as directed by the City Engineer or the owner of the utility.

204.03.04E OWNER MAINTENANCE AND REPAIR

The owner and/or representatives of other utilities shall have the right to enter upon the right-of-way and upon any structure therein for the purpose of making new installations, changes, or repairs required during the course of the work. The contractor shall conduct operations so as to provide the time needed for such work to be accomplished during the progress of the improvement. The cost of waiting or "down" time necessary to accomplish such work shall be borne entirely by the contractor.

204.03.05 SALVAGED MATERIALS

Frame and cover sets, gratings, water system components, and other reusable materials from removed or abandoned structures and systems shall remain the property of the City and shall be salvaged as directed by the City Engineer and delivered to the City's storage area by the contractor.

Other salvageable materials shall become the property of the contractor and shall be disposed of by the contractor away from the site of the work.

204.03.05A REUSE OF SALVAGED MATERIALS

Salvaged materials of any kind shall not be reused in new work without the written approval of the City Engineer.

204.03.06 GENERAL CLEANUP

The contractor shall maintain a clean and orderly appearance of the work area at all times. Maintenance shall be continuous and without further order from the City Engineer. As the work progresses, the contractor shall remove all dirt, gravel, unused construction materials, refuse, and other debris from areas

open to the general public and all roadways are open to traffic.

Failure to maintain the cleanliness of the work area continuously, or at the direction of the City Engineer, will result in the City Engineer having the work done, without further notice to the contractor or the contractor's surety, and the costs thereof will be deducted from any payment due the contractor.

204.04.00 CONSTRUCTION

204.04.01 GENERAL EXCAVATION

Excavation shall include the excavation, removal, and disposal of all natural or manmade materials encountered within limits of excavation specified in the contract documents, including surface and subsurface improvements and fill materials, irrespective of nature or condition. The method of excavation used is optional. Overbreak shall be removed at the contractor's expense.

The contractor shall excavate to the depths and widths designated, allowing for forms, shoring, working space, and surface improvements. Excavation shall not be extended deeper than the elevation specified in the contract documents.

Remaining ends of abandoned pipes, or portions of other items partially removed under this work and that would be left exposed after final excavation, shall be removed to a minimum of 12 inches below the finished grade or elevation. Ends of abandoned pipes in backfill or fill areas shall be plugged with concrete. The contractor shall notify the City Engineer prior to filling or capping any pipes that are encountered during the course of the work. The contractor shall allow the City Engineer sufficient time to determine whether such pipes should be abandoned or maintained in serviceable condition. The costs of waiting or "down" time to determine serviceability and the subsequent abandonment or repair of such pipes shall be borne by the contractor.

Suitable barricades shall be erected and maintained around all unattended, open excavations, regardless of depth.

The use of steel sheets to cover excavations shall be limited to locations where there is daily, ongoing work. Other excavations shall be backfilled and temporarily resurfaced the day they are excavated.

204.04.01A OVEREXCAVATION AND FOUNDATION STABILIZATION

If, in the judgment of the City Engineer, material at the bottom of an excavation is unsuitable for supporting the structure or utility for which it was intended, the unstable material shall be removed and replaced with compacted foundation stabilization material.

Voids caused by overexcavation under footings shall be filled with concrete of strength equal to that of the footing.

Excavation carried below grade lines without approval of the City Engineer shall be replaced with the specified foundation stabilization material at the contractor's expense.

204.04.02 SAWCUTTING AND SURFACE REMOVAL FOR TRENCHES

Concrete and asphalt surfaces shall be cut to full depth with a pavement saw or other suitable pavement cutter prior to excavation of trenches. The method of removal shall preclude or minimize damage to pavement adjacent to the trench.

Portland cement concrete pavement, curbs, and sidewalks shall be sawcut to a minimum depth of four inches or one-half the concrete thickness, whichever is greater. During removal of concrete structures, care shall be taken not to damage adjacent concrete. Use of a jackhammer or backhoe to remove concrete shall be limited to areas isolated by sawcutting or existing cold joints. Edges that are spalled or cracked during removal of adjacent material shall be recut. The contractor shall be responsible for recutting edges damaged during surface removal and no payment will be made for additional sawcutting or surface replacement.

Width of cut shall be at least equal to the required width of trench at ground surface and shall follow lines parallel to pipe or conduit centerline. Remove loose, undermined, or damaged pavement.

When the distance between the final sawcut pavement edge and a curb, gutter, pavement edge, construction joint, or other concrete structure or improvement will be less than 24 inches, the contractor shall remove the intervening pavement and include that area in the pavement restoration. This requirement is intended to prevent subsequent settlement, displacement, or premature breakup of narrow, noncontiguous sections of pavement.

Pavement, concrete, and other excavated materials shall be removed from the site and not used for trench backfill.

204.04.02A REMOVAL AND REPLACEMENT OF EXISTING TOPSOIL

Existing topsoil shall be reused only when specified in the contract documents or approved by the City Engineer. When specified or approved for reuse, existing topsoil shall be removed to a depth of at least 18 inches for the full width of the trench to be excavated. Topsoil shall be stockpiled within the construction easement and not mixed with other excavated materials. Topsoil shall be protected from weather conditions or other situations that may render the topsoil unsuitable for reuse. Stockpiled topsoil shall be placed in the top of the backfilled trench to the depth removed and lightly compacted. Finished grade of topsoil shall conform to the area adjacent to the trench. Damage to adjacent topsoil caused by work operations shall be repaired. Rock, gravel, clay, and any other foreign materials shall be removed from the surface of the ground, the area regraded, and additional topsoil added as required.

204.04.03 TRENCH EXCAVATION AND SHORING

The contractor shall excavate the trench to the lines and grades specified in the contract documents with proper allowance for pipe thickness, pipe bedding, and foundation stabilization.

The subgrade upon which bedding is to be placed shall be firm, undisturbed, and true to grade. If the trench is overexcavated, the proper grade shall be restored with approved material at the contractor's expense. The material shall be placed over the full width of the trench in compacted layers to established grade.

Length of trench excavated in advance of the pipe laying shall be kept to a minimum, and in no case shall it exceed 100 feet unless authorized by the City Engineer.

Suitable barricades shall be erected and maintained around unattended, open excavations, regardless of depth.

The use of steel sheets to cover excavations shall be limited to locations where there is daily, ongoing work. Other excavations shall be backfilled and temporarily resurfaced the day they are excavated.

204.04.03A TRENCHING MACHINES

Trenching machines, earth saws, and other similar types of equipment designed to excavate trenches that are less than 12 inches in width shall not be used unless the use of such equipment is specified in the contract documents or approved by the City Engineer.

204.04.03B TRENCH WIDTH

The trench width at the ground surface shall be limited to a width that will preclude the possibility of damage to adjacent structures or property. The contractor shall confine the top width of the trench to dedicated rights-of-way or construction easements. Trenches shall be of sufficient width to allow for shoring and permit proper joining of pipe and compaction of the backfill material along sides of the pipe.

Minimum trench width of sheeted and unsheeted trenches shall be such that a clear working space of at least six inches on each side of the outside diameter of the pipe bell is maintained.

Trench width at the top of pipe shall be limited to a width that will preclude the possibility of damage to the pipe in the form of increased loads or damage to adjacent structures. If the maximum trench width for a given class of pipe, as recommended by the pipe manufacturer, is exceeded by the contractor, the contractor shall provide pipe of a higher strength designation, a higher class of bedding, or both, as approved by the City Engineer.

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

204.04.03C SHEETING AND SHORING OF TRENCHES

During trenching operations, the contractor shall provide ladders, bracing, sheeting, shoring, and other equipment and materials as necessary to protect adjacent earth banks and structures, property, personnel working in the excavation, and the public.

Sheeting shall be installed and secured such that the bottom edges of the sheets are positioned and maintained above the top of the bedding.

When using a moveable trench shield or box and similar types of equipment, the sides of the trench at the bottom of the excavation shall be formed such that the bottom edges of the trench shield will be supported above the top of the bedding. Trench boxes shall be placed and moved in a manner that will preclude the possibility of displacing or disturbing the bedding under the pipe.

Sheeting and shoring shall be maintained until pipe has been placed and backfilled through the pipe zone. Sheeting and shoring shall be removed as backfilling is accomplished, in a manner that will not damage the pipe or permit voids in the backfill.

Ladders, sheeting, shoring, trench boxes, and related materials and equipment shall conform to the latest revision of the Occupational Safety and Health Administration (OSHA) regulations governing the equipment and the application of the equipment to the particular work being undertaken.

204.04.04 PIPE ZONE MATERIAL

Bedding shall be installed in conformance with the appropriate standard detail. Bedding shall be considered to include full width of excavated trench from the bottom of trench, or the top of any required foundation stabilization material, to the top of bedding.

Bedding material shall be spread smoothly to proper grade so that the pipe is uniformly supported along the barrel.

Bedding shall be fully compacted before placement of pipe or concrete cradle and shall provide a firm, unyielding support along the entire pipe length.

Bell holes shall be formed in the bedding at each joint to permit proper assembly and inspection of the entire joint.

Attention shall be given to the area from the flow line to the horizontal centerline of the pipe to ensure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of pipe zone. The remainder of the pipe zone material shall be carefully placed and compacted around the pipe in six-inch layers. Care shall be taken to prevent lateral or upward movement of the pipe during placement and compaction of pipe zone material.

In the absence of a specific requirement, granular foundation bedding shall be used with all flexible and rigid conduits. Concrete cradle bedding shall be used only when specified in the contract documents or by the City Engineer.

204.04.04A CONCRETE CRADLE BEDDING

Concrete cradle bedding consists of a pipe cradle of portland cement concrete as specified on the appropriate standard detail. Concrete shall be placed in such a manner that no dirt or foreign material becomes mixed with the concrete. Concrete shall be allowed sufficient time to reach initial set before overlying backfill material is compacted.

204.04.04B GRANULAR FOUNDATION BEDDING

Granular foundation bedding consists of leveling the bottom of trench or top of foundation material and placing pipe bedding material to the horizontal centerline of pipe.

Bedding material shall be placed in at least two lifts. The first lift shall be placed to the minimum depth shown on the appropriate standard detail before pipe is installed. Subsequent lifts of not more than six-inch thickness shall be placed up to the horizontal centerline of the pipe. The lifts shall be brought up together on both sides of pipe and carefully worked under pipe haunches by slicing with a shovel. Care shall be taken to preclude upward movement of the pipe during placement and compaction of the bedding material in this area.

204.04.05 TRENCH BACKFILL

When backfill is placed mechanically, the backfill material shall be pushed onto the slope of the backfill previously placed and allowed to slide down into the trench. Native backfill shall not be pushed into the trench in such a way as to permit free fall of the material until at least two feet of cover is provided over the top of the pipe. Under no circumstances shall sharp or heavy pieces of material be allowed to drop directly onto the pipe or the tamped material around the pipe. Backfill material containing consolidated masses larger than four inches in any dimension shall not be used in the work.

204.04.05A SELECT BACKFILL

The trench shall be backfilled above the pipe zone and to within eight feet of the surface with compacted, imported, granular backfill material of a type specified in the contract documents.

The top eight feet of the trench shall be backfilled with compacted 1-inch minus or 3/4-inch minus crushed gravel or crushed aggregate.

204.04.05B NATIVE BACKFILL

Where called for in the contract documents, the trench above the pipe zone and to within 18 inches of the surface, shall be backfilled with excavated trench material. Native backfill material shall be temporarily stored only within the construction easement, right-of-way, or specified working area. The material shall be stored in such a manner that it will cause a minimum of inconvenience to the public and will permit free access to all fire hydrants, water valves, meters, and mailboxes and will leave adequate clearance for the free flow of storm water in gutters, conduits, and natural watercourses. The contractor shall estimate and install sufficient native backfill material so that, after normal settlement, the finished surface will meet the existing grade. The contractor shall neatly windrow the material over the trench and remove all excess. Any excess or shortage of backfill material that becomes apparent after settlement and within the warranty period shall be corrected by regrading, disposing of excess material, or adding additional material where required. Rocks larger than two inches in any dimension shall be removed from the upper eight inches of the backfill.

The contractor shall take reasonable precautions to prevent excavated native material designated to be used for backfill from becoming unsuitable for reuse as a result of contractor's operations. If native material becomes unsuitable for reuse due to the contractor's operations, as determined by the City Engineer, the backfill shall be replaced with imported native type materials or granular material at the contractor's expenses.

In areas where topsoil existed or is required, the top 18 inches of trench shall be backfilled with native or imported topsoil. Topsoil, regardless of source, shall meet minimum requirements in Subsection 204.02.06. Topsoil shall be lightly compacted to resist settlement.

204.04.05C WATER COURSE UNDERCROSSINGS

The type of backfill material, dimensions, and installation requirements will be specified in the contract documents.

204.04.06 SURFACE MAINTENANCE OF TRENCHES AND OTHER EXCAVATIONS

Loose rock and debris shall be removed daily from the roadway, sidewalks, driveways, pedestrian crossings, and other areas accessible by the public.

Areas exposed to the movement of vehicular traffic and construction equipment shall be washed or treated with water as often as necessary to control dust.

Backfilled trenches and other excavations shall be maintained on a daily basis in conformance with the following requirements:

204.04.06A GRAVELED AREAS

In graveled areas, 1-inch minus or 3/4-inch minus crushed gravel or crushed aggregate shall be placed on all trenches and excavations and maintained level with adjacent, existing surfaces.

Crushed gravel and/or crushed aggregate shall conform to requirements in Subsection 205.03.01 AGGREGATE BASE.

204.04.06B IMPROVED SURFACES

In paved areas, cold mix asphalt shall be placed immediately after backfill operations on all trenches and excavations that are exposed to the movement of traffic and on trenches and excavations, regardless of location, that are located in intersections. Cold mix asphalt shall be placed in conformance with Section 208 RESURFACING.

In sidewalks and driveways, 1-inch minus or 3/4 -inch minus crushed gravel or crushed aggregate shall be placed over all trenches and excavations and maintained level with existing surfaces until final surface restoration.

Crushed gravel and/or crushed aggregate shall conform to requirements in Subsection 205.03.01 AGGREGATE BASE.

204.04.07 TEMPORARY SURFACE RESTORATION

The contractor shall temporarily restore and maintain the construction area such that not more than a combined total of 800 linear feet of unrestored trench surface or other excavation exists at any given time. Temporary restoration shall be performed to the extent necessary to permit the area to be returned to normal public use pending final restoration.

No trenches or excavations of any kind shall be left open, regardless of any precautionary safety measures that may have been taken, unless such situations are required for the contractor to conduct construction operations in conformance with the contract documents.

Loose rock and debris shall be removed from the roadway, sidewalks, driveways, and pedestrian crossings.

Trenches and other excavations shall be temporarily restored in conformance with the following requirements:

204.04.07A GRAVELED SURFACES

In graveled areas, the surfaces of backfilled trenches and other excavations shall be maintained level with the adjacent and existing grade with compacted 1-inch minus or 3/4-inch minus crushed gravel or crushed aggregate.

Crushed gravel and/or crushed aggregate shall conform to requirements in Subsection 205.03.01 AGGREGATE BASE.

204.04.07B IMPROVED SURFACES

Cold mix asphalt shall be placed, compacted, and maintained over trenches and excavations in improved surfaces within the project area, regardless of location. The cold mix asphalt shall be maintained level with the adjacent existing surface.

Cold mix asphalt shall be placed in conformance with Section 208 RESURFACING.

204.04.08 COMPACTION REQUIREMENTS

204.04.08A COMPACTION SPECIFICATIONS

Compaction specifications for materials and their various applications shall meet the minimum requirements specified herein. Minimum compaction or density requirements for materials and applications not shown will be specified in the contract documents.

TRENCH BACKFILL

Compaction requirements shall be per modified proctor test method ASTM D 1557.

Select backfill in the pipe zone shall be compacted to a minimum density equal to 90 percent of the maximum dry density. Select backfill above the pipe zone to surface grade shall be compacted to a minimum density equal to 93 percent of the maximum dry density.

Native backfill shall be compacted to a minimum density equal to 90 percent of the maximum dry density.

ROADWAY AND STRUCTURAL FOUNDATION FILL

Each lift of roadway and structural foundation fill materials shall be compacted to a minimum of 95 percent of maximum dry density as determined by ASTM D 1557.

IMPERVIOUS BACKFILL

Materials specified in the contract documents for use as impervious backfill for water course undercrossings and other similar applications shall be compacted to a minimum of 90 percent of maximum dry density as determined by ASTM D 1557.

AGGREGATE BASES

Minimum density requirements for aggregate bases shall conform to requirements in Subsection 302.02.04 DENSITY REQUIREMENTS.

CONCRETE TREATED BASE

Minimum density requirements for concrete treated base materials shall conform to requirements in Subsection 303.02.06 DENSITY REQUIREMENTS.

ASPHALT CEMENT CONCRETE

Minimum density requirements for asphalt cement concrete shall conform to requirements in Subsection 304.02.07 DENSITY REQUIREMENTS.

PORTLAND CEMENT CONCRETE PAVEMENT AND OTHER CONCRETE STRUCTURES

Portland cement concrete with a minimum compressive strength of 4,000 psi in conformance with Subsection 205.01.02 PORTLAND CEMENT CONCRETE shall be used when a minimum compressive strength or class of concrete is not specified in the contract documents.

204.04.08B COMPACTION METHODS AND EQUIPMENT

Compaction shall be by mechanical means for all types of materials. Compaction equipment for

granular materials shall be vibratory plate or vibratory drum compactors and shall be 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.

The contractor shall determine the method of placing lifts and the amount of effort required to meet specified compaction requirements and to prevent subsequent settlement.

For trenches, the entire trench depth shall be compacted in lifts not to exceed one foot in depth.

204.04.08C COMPACTION TESTING

Sampling and testing of materials for determination of compliance with the specified compaction requirements will be conducted by the City Engineer at any location and time as the City Engineer may determine.

Compaction testing shall be performed by a testing laboratory approved by the City Engineer. The owner will be responsible for the cost of initial testing for any given area. The contractor shall schedule compaction testing with the City Engineer a minimum of 48 hours in advance of the time of testing.

The contractor shall be responsible for excavation of the test pits and for providing and installing any shoring, ladders, or other equipment necessary to protect the testing personnel. The contractor shall also suspend operations as necessary and at no cost to the owner for the purpose of conducting such testing.

Test pits shall be excavated in the backfill by the contractor as directed by the City Engineer for the purpose of testing the backfill compaction. At the option of City Engineer, density tests may be taken on a lift of compacted backfill immediately before placing the next lift.

Any settlement noted in backfill, fill, or in structures built over the backfill or fill within the one-year warranty period 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.

204.04.08D NONCOMPLIANCE WITH SPECIFIED DENSITY REQUIREMENTS

When initial compaction testing performed by the City Engineer indicates the required density has not been obtained, the contractor shall recompact or replace the backfill as necessary to meet the specified minimum density.

The contractor shall be responsible for rescheduling compaction testing with the City Engineer and shall bear all costs for subsequent retesting in the areas of noncompliance.

Costs associated with retesting and scheduling delays shall be the sole responsibility of the contractor.

204.04.09 SLOPE GRADING

Slopes shall be free of exposed roots, unstable rock, and loose stones exceeding two inches in any dimension. Tops of banks shall be shaped to circular curves with not less than a six-foot radius, unless specific site conditions, as determined by the City Engineer, make such work impractical. Surfaces shall be smoothly graded and shall blend in with existing topography.

204.04.10 DISPOSAL OF EXCESS EXCAVATED MATERIALS

Excavated materials not suitable or not required for backfill or fill shall be deposited on one or both of the following types of waste sites: (1) predesignated waste sites specified in the contract documents, and (2) waste sites that are provided by the contractor and are outside the city limits. If needed, permits will be provided by owner for dumping on sites designated in the contract documents.

Where waste sites are designated in the contract documents, the material shall be placed as directed and the site cleaned and uniformly graded to conform to existing contours upon completion of the work. The natural drainage of the site shall be maintained and under no circumstances will the site be graded such that runoff will be impounded. The contractor shall provide a waste site for the disposal of materials that are in excess of that needed for predesignated sites. Waste sites shall be operated in a manner that will meet all safety and health requirements of federal, state, and local agencies.

Excavated materials shall not be deposited on public property anywhere within the city limits unless directed to do so by the contract documents. The contractor may be liable for the cost of removing excavated materials that are placed on unauthorized locations, whether publicly or privately owned.

204.04.11 DEWATERING

The contractor shall furnish, install, operate, and maintain equipment necessary to continuously remove and dispose of all water entering the excavation during the course of the work. If required, and before construction is started, the contractor shall advise the City Engineer of the method of dewatering that will be used.

Removal and disposal of water shall be in a manner that will prevent damage to public or private property, or inconvenience to the public. Drainage of trench water through a pipeline under construction is prohibited. The contractor shall have sufficient equipment and competent personnel on hand at all times to accommodate emergencies, including power outage.

Surface runoff and ground water shall be controlled in a manner that will prevent softening of the bottom of excavations. Dewatering systems shall be designed and operated in a manner that will 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.

The contractor shall prevent disturbance of compacted backfill and flotation or movement of structures, water mains, sewers, and other utilities.

204.04.12 FILL

204.04.12A ROADWAY AND STRUCTURAL FOUNDATION FILL

Unstable material or unsuitable foundation material shall be excavated and disposed of prior to construction of fills. Basements, trenches, and holes that occur within fill limits shall be backfilled with compacted material specified in the contract documents. Cleared and grubbed ground surfaces underlying areas to be filled shall be compacted to a minimum depth of 12 inches to the density specified in the contract documents.

The contractor shall place and compact fill material in continuous horizontal layers not exceeding eight inches deep across the full width of the fill. If the surface of the prepared subgrade or the compacted surface of a preceding lift is too dry or too smooth to bond properly with the next layer of material, the surface shall be moistened or scarified, or both, before the next layer of material is placed. Slopes of fills shall be compacted.

Fill material shall not be placed when the fill material, subgrade, or previously placed fill material is frozen or has an excessive water content as determined by the City Engineer. Water settling of fills will not be permitted.

204.04.12B PIPELINE FILL

Where pipelines are to be placed within a fill area, the fill shall be constructed and compacted to a minimum depth of six feet prior to trench excavation for the pipeline.

In locations where insufficient pipe cover exists, the contractor shall place and compact native material or material specified in the contract documents over the pipe to provide a minimum cover of three feet

with a slope radius as specified in the contract documents.

204.05.00 MEASUREMENT AND PAYMENT

204.05.01 UNCLASSIFIED EXCAVATION AND BACKFILL

204.05.01A UNCLASSIFIED EXCAVATION

Unclassified excavation, with the exception of trench excavation, will be measured and paid for on a cubic yard basis. Volume of material actually removed will be determined using measurements from established construction staking. The quantity measured for payment will include only material excavated from within the limits defined in the contract documents.

Excavation required for the volume displaced by new concrete curbs, driveways, sidewalks, steps, and pathways will be considered incidental to those items of work and no additional payment will be made for the excavation of this material.

The unit cost per cubic yard will be considered full compensation for the excavation and the disposal or temporary storage of excavated materials, removal of interfering sections of existing surface and subsurface utilities and structures, the control of ground and surface waters, the preparation and compaction of the subgrade, and all other materials, labor, and equipment of whatsoever nature that is necessary to complete the work as defined in the contract documents and to begin placement of the backfill or base materials.

204.05.01B SELECT BACKFILL

Select backfill will be measured and paid for on a cubic-yard basis. Volume of backfill will be determined using measurements from established construction staking. The quantity measured for payment will include only material supplied within the limits defined in the contract documents.

The unit cost per cubic yard shall be considered full compensation for materials, labor, and equipment necessary to provide, place, and compact the specified backfill in conformance with the contract documents.

204.05.01C NATIVE BACKFILL

Native backfill will be measured and paid for as stated in the contract documents.

204.05.02 TRENCH EXCAVATION AND BACKFILL

Measurement and payment for items of work, including trench excavation, trench backfill, pipe zone material, and incidental work is included in the unit price for the conduit or utility being installed in the trench and will be paid for in conformance with applicable provisions in Division 4 or 5, depending upon the type of construction.

204.05.02A IMPROVED SURFACE REMOVAL FOR TRENCHES

Measurement and payment for the removal of improved surfaces will be included in the unit price for the conduit or utility being installed in the trench and will be paid for in conformance with applicable provisions in Division 4 or 5, depending upon the type of construction.

204.05.03 FILL

Measurement and payment for compacted fill, in place, will be made on a cubic-yard basis. Volume of fill will be determined using measurements from established construction staking. The quantity measured for payment will include only material supplied within the limits defined in the contract documents.

The unit cost per cubic yard will constitute full compensation for all materials, labor, and equipment necessary for providing specified fill materials, whether obtained from the site of work or imported, and for placing and compacting the fill in conformance with the contract documents.

No payment will be made for additional fill required due to settlement of the subgrade, fill, or of materials within the fill or other loss, regardless of cause.

No deduction in computed volume will be made for piers, columns, pipes, or miscellaneous construction features constructed within fill limits.

204.05.04 OVEREXCAVATION AND FOUNDATION STABILIZATION

Measurement and payment for overexcavation and foundation stabilization will be made on a cubic-yard basis. Volume of foundation stabilization will be determined using measurements from established construction staking or other methods as determined by the City Engineer. The quantity measured for payment will include only material supplied within the limits defined in the contract documents.

Payment for this item will constitute full compensation for all materials, labor, equipment, and incidentals necessary to furnish stabilization materials at the site and for placing and compacting the materials in conformance with the contract documents or as directed by the City Engineer.

204.05.05 IMPORTED TOPSOIL

Measurement and payment for imported topsoil will be made on a cubic-yard basis. Volume of imported topsoil will be determined by actual truck measure as delivered to the site. The quantity measured for payment will include only material supplied within the limits defined in the contract documents.

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

When not listed as a separate bid item in the contract documents, provision and installation of imported topsoil shall be considered incidental to other items of work.

204.05.06 INCIDENTALS

Other materials, labor, and equipment required to complete the work in conformance with the contract documents and not listed as separate pay items in the proposal will be considered incidental to other items of work and no separate payment will be made.

205 CONCRETE, ASPHALT, AND AGGREGATE MATERIALS

205.01.00 PORTLAND CEMENT CONCRETE PRODUCTS

205.01.01 PORTLAND CEMENT

205.01.01A TYPES

The various types of portland cement and associated properties or characteristics are as follows:

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

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.

205.01.01B SPECIFICATIONS

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

0.8 percent.

- (2) Types I, IA, III, or IIIA must contain a maximum of 10 percent tricalcium aluminate.
- (3) Time-of-setting tests shall be by either the Gillmore Test or the Vicat Test, or both, as the City Engineer may elect.

205.01.01C APPLICATIONS

High, early strength concrete (Type III cement) shall be used when patching trenches in portland cement concrete pavement.

Type II cement concrete shall be used for all sewer and water main construction and appurtenances thereto.

Type I portland cement shall be used when a type is not specified in the contract documents.

205.01.02 PORTLAND CEMENT CONCRETE

205.01.02A MIX DESIGN

Before beginning any concrete work, the contractor shall submit a concrete mix design to the City Engineer for approval. Concrete used in the work shall conform to the approved mix design.

Any requested and authorized alteration to proportions of any of the concrete materials in the mix shall be made at the contractor's sole expense.

The mix design shall meet the following requirements:

- (1) Entrained air range three percent to six percent (percent by volume). AASHTO T 152
- (2) Slump range - two inches to four inches. AASHTO T 119
- (3) When using $\frac{3}{4}$ -inch maximum size aggregate, the fine aggregate shall be between 40 percent and 48 percent of the total aggregate used.
- (4) When using $1\frac{1}{2}$ -inch maximum size aggregate, the fine aggregate shall be between 35 percent and 45 percent of the total aggregate used.

COMPRESSIVE STRENGTH

Portland cement concrete shall have a compressive strength of 4,000 psi, a maximum aggregate size of $1\frac{1}{2}$ inches, a slump of between two inches and four inches, and a minimum of 658 pounds of portland cement per cubic yard.

FLEXURAL STRENGTH

Flexural strength requirements will be specified in the contract documents.

When a minimum flexural strength is specified, the contractor shall conduct such sampling and testing as is necessary to establish a correlation between the compressive and flexural strength for each mix design used in the work.

Prior to commencement of work, the contractor shall submit sufficient written documentation to the City Engineer to demonstrate that the concrete will meet the specified requirements.

205.01.02B AGGREGATES

Aggregates used in the production of portland cement concrete shall conform to requirements in Section 02690 - PCC AGGREGATES of the Oregon Standard Specifications for Construction.

205.01.02C WATER

Potable water shall be used in all work.

205.01.02D ADMIXTURES

AIR-ENTRAINING ADMIXTURES

Air-entraining admixtures shall conform to AASHTO M 154 (ASTM C 260). Chloride content of admixture must not exceed 0.5 percent by weight.

WATER-REDUCING, RETARDING, AND ACCELERATING ADMIXTURES

Water reducing, retarding, and accelerating admixtures shall conform to AASHTO M 194 (ASTM C 494) using one or more of several tests as the City Engineer may direct.

Chloride content of admixture must not exceed 0.5 percent by weight.

MINERAL ADMIXTURES

The use of fly ash requires approval of the City Engineer. Where approved, the weight of fly ash shall not exceed 20 percent of the weight requirement for portland cement. Fly ash shall conform to applicable requirements in ASTM C 141, 595, and 618.

205.01.02E SAMPLING AND TESTING

During progress of work, if concrete strength and quality as determined by sampling and testing conducted by the City Engineer fail to attain the requirements specified, the contractor shall suspend all concrete work and make necessary adjustments to obtain required results.

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

(1)	Sampling Fresh Concrete	C172
(2)	Obtaining Drilled Cores	C42
(3)	Molding and Curing Specimens	C31 or AASHTO T 23
(4)	Compressive Strength	C39 or AASHTO T 22
(5)	Flexural Strength	C78
(6)	Slump	C143
(7)	Air Content	C173 or C231
(8)	Unit Weight Yield	C138
(9)	Setting of Mortar	C191 or C266

205.01.03 PORTLAND CEMENT MORTAR

Portland cement used in portland cement mortar shall be Type I or Type II conforming to Subsection 205.01.01 PORTLAND CEMENT.

Use either standard premixed mortar conforming to ASTM C 387, or mortar proportioned with one part portland cement to two parts clean, well-graded sand that passes 1/8-inch screen and which conforms to AASHTO M 45.

Admixtures may be used, but shall not exceed the following percentages of cement by weight: hydrated lime, 10 percent; and diatomaceous earth or other inert materials, five percent. Testing shall conform to the OSHD test for mortar strength.

205.01.04 PORTLAND CEMENT GROUT

Portland cement used in portland cement grout shall be Type I or Type II conforming to Subsection 205.01.01 PORTLAND CEMENT.

205.01.04A TYPE A GROUT

Type A grout shall consist of one part portland cement and three parts of clean and well-graded sand. A minimum amount of water shall be used to produce a grout with a thick, creamy consistency.

205.01.04B TYPE B GROUT

Type B grout shall consist of one part portland cement, five parts of clean and well-graded sand, and seven parts pea gravel, by volume.

205.01.04C NON-SHRINK GROUT

Non-shrink grout shall be a non-metallic, cementitious commercial grout exhibiting zero shrinkage in conformance with ASTM C 827 and CRD C 621.

205.01.05 PORTLAND CEMENT TREATED BASE (CTB)

205.01.05A MIX DESIGN

The contractor shall furnish the City Engineer a complete mix design showing the proportions of all constituents proposed for use and strength test results of samples prepared using the proposed proportions and constituents for a minimum of 7-day, 14-day, and 28-day curing periods.

205.01.05B COMPOSITION OF MIXTURE

The CTB mixture shall be comprised of aggregate, portland cement, and water in the proportions and amounts established by the mix design. The cement content shall be between 4.5 percent and 5.5 percent of the dry weight of the aggregate. The mixture shall be proportioned to provide for a minimum 28-day compressive strength of 1,000 psi. The proportions of the materials will be subject to change as required to meet these specifications.

In all plants, the weight or rates of feed of aggregates and water shall be within five percent of the amounts of the materials specified. The weights or rates of feed of cement shall be such that the variations in cement content in samples, taken from any part of a mixed batch or from different batches, or from time to time from the product of continuous mixers, or from mixtures spread on the roadbed, shall not have variations above or below the cement content designated by the City Engineer of more than 0.5 of a percentage point.

205.01.05C AGGREGATE

Aggregates used in the production of plant-mixed CTB shall conform to requirements in Section 02630 of the Oregon Standard specifications for Construction.

Aggregate size will be specified in the contract documents.

205.01.05D PORTLAND CEMENT

Portland cement to be used shall be Type I or Type II conforming to Subsection 205.01.01 PORTLAND CEMENT.

205.01.05E WATER

Water used in mixing shall conform to Subsection 205.1.02C WATER.

205.01.05F ASPHALT MATERIALS

The asphalt used for the curing seal shall conform to Subsection 205.2.01 ASPHALT CEMENT.

205.01.06 PORTLAND CEMENT CONCRETE FOR EXTRUSIONS

205.01.06A AGGREGATE

Aggregates used in the production of portland cement concrete for extrusion methods of construction shall conform to applicable requirements of Section 02690 of the Oregon Standard Specifications for Construction.

Maximum aggregate size shall not exceed 1/2 inch.

205.01.06B PORTLAND CEMENT

Portland cement to be used shall be Type I conforming to Subsection 205.01.01 PORTLAND CEMENT, and shall have a maximum slump of 2 inches.

205.01.06C WATER

Water used in mixing shall conform to Subsection 205.1.02C WATER.

205.02.00 ASPHALT CEMENT PRODUCTS

205.02.01 ASPHALT CEMENT

Asphalt cements, liquid asphalts, and emulsified asphalts shall conform to the requirements of the ODOT's annual publication titled "Specifications for Asphalt Materials." Copies of this publication are available through the ODOT Pavement Services Engineer.

Asphalt cement types and applications shall conform to the following:

205.02.01A HOT MIX ASPHALT

For hot mix applications, use PG 64-22 or PG 70-22 asphalt cement.

205.02.01B TACK COAT

For tack coat applications, use CRS-1 or CSS-1 cationic emulsified asphalt.

205.02.01C JOINT SEALER

For joint seal applications, use either hot asphalt (PG 64-22) or CRS-1, CRS-2, or CSS-1 cationic emulsified asphalt.

205.02.01D CURING SEAL

For curing seal applications, use CRS-1 or CRS-2 emulsified asphalt.

205.02.02 ASPHALT CONCRETE PAVEMENT

205.02.02A APPLICATIONS

Asphalt concrete pavement shall conform to Section 00745 - Hot Mixed Asphalt Concrete (HMAC) of the Oregon Standard Specifications for Construction. HMAC used in the work shall be Level 2 or Level 3 dense graded mixture. The type of mix shall be 3/4-inch (B-mix), 1/2-inch (C-mix) or 3/8-inch (D-mix) as specified in the contract documents. Where the type of HMAC is not specified a Level 2, dense graded 1/2-inch mix shall be used for the top lift, or wearing course, and Level 2, dense graded 3/4-inch mix shall be used for base lifts. Level 2, dense graded 3/8-inch mix shall be used where the compacted thickness of the top lift, or wearing course, will be less than 1½ inches.

205.02.02B MIX FORMULA

When required by the City Engineer, the contractor shall submit a job-mix formula conforming to Subsection 00745.13 of the Oregon Standard Specification for Construction.

The job-mix formula shall indicate the gradation and proportion of each of the several aggregate constituents to be used in the mixture. The job-mix formula shall also indicate the ASTM bulk specific gravity of each aggregate constituent, the measured maximum specific gravity of the mix at the optimum asphalt content determined in accordance with ASTM D 2041, the percent of asphalt lost due to absorption by the aggregate, and any other information pertinent to the design of the mix.

The contractor shall submit a new job mix formula to the City Engineer for approval should conditions, as determined by the City Engineer, justify a change in materials.

205.02.02C MATERIALS

Asphalt cement shall conform to requirements in Subsection 205.02.01 ASPHALT CEMENT.

Aggregates, mineral fillers, and anti-stripping additives used in the production of asphalt concrete shall conform to applicable requirements of Subsection 00745.11 of the Oregon Standard Specifications for Construction.

205.02.02D PROPORTIONS OF MATERIALS

Proportions of materials that comprise the various classes of asphalt concrete shall be within the range of proportions and tolerances specified in Subsections 00745.12, 00745.13, and 00745.14 of the Oregon Standard Specifications for Construction.

205.02.02E ACCEPTANCE OF MATERIALS

Asphalt and aggregate shall be subject to approval preceding mixing. Mixtures will be subject to final approval after blending and mixing, either at the plant or at the place of delivery prior to rolling. Approval will be based on periodic sampling and testing of the materials at the discretion of the City Engineer.

The contractor shall collect and analyze as many samples as the City Engineer determines necessary to confirm that the mixture, and the materials that comprise the mixture, is in conformance with the mix design and all other applicable requirements specified herein.

Costs associated with the collection and testing of samples shall be borne by the contractor.

205.03.00 AGGREGATES

205.03.01 AGGREGATE BASE

Aggregate for aggregate base shall be uniformly graded 1-inch minus or 3/4-inch minus crushed gravel or crushed aggregate meeting all appropriate requirements for aggregate shoulder and base materials as specified in the Oregon Standard Specifications for Construction.

205.03.02 TRENCH BACKFILL

205.03.02A PIPE ZONE MATERIAL

One-inch minus or 3/4-inch minus crushed gravel or crushed aggregate shall be used for bedding and backfill in the pipe zone for the installation of all rigid and flexible pipes and conduits.

Pipe zone backfill shall conform to requirements specified for aggregate base material.

205.03.02B SELECT BACKFILL MATERIAL

Material for select backfill shall be imported bank-run or river-run gravel, crushed gravel, or crushed aggregate.

BANK-RUN AND RIVER-RUN GRAVEL

Imported bank-run or river-run gravel shall be from a source approved by the City Engineer. Approval of material from a location does not mean approval of the entire site, but only as material continues to meet specification.

Material shall be well-graded sandy gravel free from organic matter, clay, or other deleterious material and debris. No more than five percent by weight shall pass the No. 200 sieve.

Materials excavated on site during the course of the work may not be used as select backfill until testing by a firm approved by the City has determined that the material is in conformance with the requirements specified above and has been approved for use by the City Engineer. If approved for use, the contractor shall stockpile reusable excavated materials prior to reuse until the materials

are examined by the City Engineer and approved for use to ensure the materials continue to meet the specified requirements.

For trench backfill the maximum particle size shall not exceed three inches in any dimension.

CRUSHED AGGREGATE

One-inch minus or $\frac{3}{4}$ -inch minus crushed gravel or crushed aggregate shall be used for select backfill.

Crushed gravel and crushed aggregate shall conform to requirements specified for aggregate base material.

205.03.03 FOUNDATION STABILIZATION MATERIAL

Foundation stabilization materials shall consist of bank- and river-run gravel, crushed gravel, or crushed aggregate, all conforming to requirements for select backfill.

205.03.04 ACCEPTANCE OF MATERIALS

Aggregate shall be subject to approval after mixing and prior to compaction. Approval will be based on periodic sampling and testing of the materials at the discretion of the City Engineer.

The contractor shall collect and analyze as many samples as the City Engineer determines necessary to confirm the aggregate is in conformance with all of applicable requirements specified herein. Aggregate samples shall be taken from the actual stockpiles from which the aggregate will be taken for use in the work.

Costs associated with the collection and testing of samples shall be borne by the contractor.

205.04.00 MEASUREMENT AND PAYMENT

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

206 CONCRETE STRUCTURES

206.01.00 APPLICABILITY OF SECTION

This section contains requirements that pertain to the mixing, delivery, handling, placing, finishing, and curing of plain and reinforced portland cement concrete.

Additional requirements applicable to specific types of concrete structures are contained in other sections of these specifications.

206.02.00 MATERIALS

206.02.01 PORTLAND CEMENT CONCRETE

Portland cement concrete, grout, and mortar shall conform to Section 205 CONCRETE AND ASPHALT MATERIALS.

206.02.02 JOINT MATERIALS

206.02.02A PREFORMED EXPANSION JOINT FILLERS

Preformed expansion joint fillers for concrete shall conform to AASHTO M 153 or AASHTO M 213 except that those furnished under AASHTO M 213 shall be tested in conformance to ASTM D 1751.

206.02.03 EPOXY CEMENT

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

206.02.04 STEEL REINFORCEMENT

The contractor shall furnish mill certification that will substantiate that the reinforcing bars delivered to the project site are as specified in the contract documents.

206.02.04A BAR REINFORCEMENT

Steel deformed bars shall conform to ASTM A 615, Grade 40.

Longitudinal bars used in continuously reinforced concrete pavement and in high strength bar reinforcement applications shall be Grade 60.

206.02.04B DOWELS

Dowels for concrete pavement, slab or wall load transfer devices at joints and other elements, shall conform to ASTM A 615, Grade 60, unless otherwise specified.

206.02.04C BAR MATS

Bar and rod mats shall be of the clipped type and shall conform to ASTM A 184.

206.02.04D SPIRAL REINFORCEMENT

Plain wire for spiral reinforcement shall conform to ASTM A 82, except that F_y shall be the stress corresponding to a strain of 0.35 percent if design yield strength exceeds 60,000 psi.

206.02.04E WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185.

206.02.04F TIES AND SUPPORTS

Ties shall be fabricated from 16-gauge, black, soft-annealed wire. Bar supports in beams and slabs that will be exposed after stripping shall be galvanized or plastic coated. Concrete supports shall be used for reinforcing in concrete placed on grade. Galvanizing shall conform to ASTM A 153, Class D.

Plastic shall not chemically react with concrete, shall be impervious, and have a minimum thickness of 3/32 inches at the point of contact with the form.

206.02.05 CURING MATERIALS FOR PORTLAND CEMENT CONCRETE

Curing materials shall conform to the following requirements:

- | | |
|--|--------------|
| (1) Plastic Film | ASTM C 171 |
| (2) Reinforced Paper | ASTM C 171 |
| (3) Liquid Membrane-Forming Curing Compounds | ASTM C 309 |
| (4) Burlap Cloth, Cotton Mats | AASHTO M 182 |
| (5) Water | |
| (6) Other materials approved by the City Engineer. | |

White-pigmented, liquid membrane-forming compound shall be used for curing portland cement concrete pavement.

Other types of materials or methods used for curing concrete will be dependent upon weather and other existing site conditions and shall be subject to the approval of the City Engineer.

206.02.06 FABRICATED METAL ADJUSTMENT RINGS

Fabricated metal rings or plates used in the adjustment of existing frame and cover assemblies over concrete structures shall be equal to characteristics of strength and support required of the covers or grates to be adjusted. Fabricated metal materials shall provide uniform bearing of bearing surfaces and positive

protection against displacement when in service.

Existing frame and cover assemblies on concrete structures may be reused at the discretion of the City Engineer. Salvaged components approved by the City Engineer for reuse shall be cleaned as necessary to return them to a serviceable condition.

Fabricated and/or salvaged metal frame and cover assemblies and other related components shall conform to applicable OSHD requirements pertaining to fabrication, installation, and applicable service limitations of such materials.

206.03.00 CONSTRUCTION

206.03.01 MIXING AND DELIVERY OF CONCRETE

Concrete shall be machine mixed. Concrete shall be transported in transit mixer trucks.

Concrete that has developed an initial set, or is partially hardened, shall not be retempered or remixed and shall be removed from the job site and disposed of by the contractor.

Manufacturing facilities and transportation equipment shall ensure continuous delivery of concrete as required by the type of construction and shall provide for the proper handling and placement of the concrete at the job site.

Methods of delivery and handling concrete shall allow placing with a minimum of rehandling and without damage to the structure or concrete.

206.03.01A MIXING AT SITE

Batch mixers of a size and type that will ensure a uniform distribution of materials throughout the mass shall be used for mixing concrete on site.

Mixers shall be equipped with adequate water storage and a device for accurately measuring and automatically controlling amount of water used in each batch.

206.03.01B TRUCK MIXING

Revolving drum-type truck mixers shall be used for truck mixing concrete. Truck mixers shall be watertight and constructed such that concrete can be mixed to ensure a uniform distribution of materials throughout the mass.

Truck mixers shall have suitable means by which the amount of water added to the mix on-site can be readily verified by the City Engineer.

206.03.01C TIME OF HAULING AND PLACING MIXED CONCRETE

All concrete shall be discharged and placed into the forms within 90 minutes after the introduction of mixing water to cement and aggregate, or cement to aggregate, or before 250 revolutions of the truck drum or blades, whichever comes first.

This time shall be reduced during conditions that contribute to accelerated setting of concrete, or when the temperature of the concrete is 85° F, or above.

Water shall not be added to concrete during hauling or before discharge, unless directed or approved by the City Engineer.

206.03.02 FORMWORK

Concrete shall be contained by the use of forms when constructing any concrete structure. Materials such as rock backfill, earth, and similar materials shall not be used as forms for containing concrete. Adjacent edges of asphalt cement concrete shall not be used as a form for containing concrete in curbs, gutters, and

similar structures.

Forms shall be mortar-tight and sufficiently rigid to prevent distortion due to weight of the concrete and other loads incidental to construction operations. Forms shall be constructed in a manner that will provide for the complete removal of form materials upon completion of the work. Form materials shall be removed from the structure prior to final acceptance of the work.

Wood forms for exposed concrete surfaces shall be constructed of dressed lumber of uniform thickness with a form liner of an approved type. Plywood shall be sufficiently supported if used as a form liner. Formwork for exposed concrete surfaces shall be constructed of materials that are smooth with grain running in the same direction to give a good finished appearance.

Metal ties or anchorages within forms shall be installed in a manner that will permit their removal to a depth of at least one inch from face without injury to concrete. Cavities shall be patched with cement mortar in a manner that will leave the finished surface sound, smooth, and uniform in color.

In order to ensure easy form removal without damage to the concrete, the contractor shall fillet or bevel forms at all sharp corners or projections.

Forms shall be treated with a release agent immediately before placing concrete. The contractor shall use release agents that will not adhere to or discolor the concrete.

206.03.02A FALSEWORK

For structures requiring poured-in-place concrete superstructures, working drawings and calculations for falsework prepared and stamped by an Engineer registered to practice in the state of Oregon shall be submitted to the City Engineer for review.

Falsework shall be designed and constructed to support the total applied loads with a deflection/span ratio not to exceed 1/500 in any falsework span. Falsework for post-tensioned structures shall be designed to carry full dead load and any additional vertical or horizontal loads caused by the prestressing operation. Post-tensioned structures shall not be considered self-supporting until post-tensioning is complete.

Deck forms for concrete box girder spans shall be supported by girder stems. Posts or other supports for deck forms shall not come in contact with bottom slab of box girder.

206.03.02B REMOVAL OF FORMWORK

The contractor shall be responsible for all damage resulting from removal of forms.

Earth backfill shall not be placed against walls below grade. Forms and shoring shall not be removed from structural slabs or beams until concrete has reached an actual field strength equal to 75 percent of the specified 28-day design field strength. Actual field strength shall be determined from field-cured test cylinders that shall be cured under conditions equivalent to the most unfavorable conditions for the portions of concrete which the cylinders represent. Formwork shall be removed prior to final acceptance of the work.

206.03.03 REINFORCEMENT

Bar reinforcement shall be fabricated, shipped, and marked in conformance with Manual of Standard Practice for Reinforced Concrete Construction of the Western Concrete Reinforcing Steel Institute.

Steel reinforcement bars shall be deformed when cold.

Steel reinforcement shall be delivered with suitable hauling and handling equipment. Steel reinforcement shall be kept free from dirt, detrimental rust or scale, paint, oil, or other foreign substance.

206.03.03A PLACING

Reinforcing steel shall be accurately placed in the position shown in the contract documents. Bars shall be tied at all intersections except where spacing is less than one foot in each direction, in which case, alternate intersections shall be tied. Tack welding of reinforcing steel shall not be permitted. If bundled reinforcing bars are required, the bars shall be securely tied together with wire ties at not more than six-foot centers.

Reinforcing steel shall be securely blocked from the forms by means of small mortar blocks not more than two inches square so the reinforcement does not vary from the position shown in the contract documents by more than 1/4 inch. The blocks shall have a compressive strength equal to that of the concrete in which the mortar blocks are embedded. Mortar blocks for supporting reinforcing steel in slabs shall have either a tie wire embedded with the protruding ends tied to the reinforcing steel or a grooved top designed to hold the mortar blocks in place.

If metal chair supports are used as supports for steel reinforcing bars, all surfaces of the chair supports not covered by a minimum of 1/2 inch of concrete shall be treated by one of the following methods:

- (1) Hot-dipped galvanized after fabrication in conformance with ASTM A 153, Class D.
- (2) Plastic or epoxy coating provided that the coating is bonded to the metal, has a minimum thickness of 3/32 inch, and is not chemically reactive with the concrete.
- (3) Constructed of stainless steel in conformance with ASTM A 493, Type 302.

Installation of steel reinforcement will be inspected by the City Engineer before placing of concrete begins.

If fabric reinforcement is shipped in rolls, the fabric shall be straightened into flat sheets before being placed. For fabric reinforcement, fabric shall be extended to within two inches of edges of slab, and lap splices at least 1½ courses of fabric with a minimum of six inches. Laps and splices in fabric shall be tied securely at ends and at least every 24 inches.

206.03.03B SPLICING

Steel bars for concrete reinforcement shall be furnished in the full lengths indicated in the contract documents. No changes in the number of splices, their type, or location shall be permitted without the written approval of the City Engineer. Splices shall be well distributed and/or located at points of low tensile stress. Splices will not be permitted at points where the section is not sufficient to provide a minimum distance of two inches between the splice and the nearest adjacent bar or the surface of the concrete. The bars shall be rigidly clamped or wired at all splices. Bars that are lapped for splicing shall be placed in contact for the length of the splice and tied together near each end.

Number 11 bars and smaller shall be lap spliced. Splicing of No. 14 and No. 18 bars shall be in conformance with the following requirements:

- (1) Splices shall be made by a mechanical butt splicing method utilizing a ferrous filler metal and an enclosing steel sleeve.
- (2) Splices shall develop in tension or compression, as required, at least 125 percent of specified yield strength (fy) of the bar.

206.03.03C WELDING REINFORCING STEEL

Welding of steel reinforcing bars shall conform to the requirements of the AWS 12.1, Reinforcing Steel Welding Code.

206.03.04 WEATHER LIMITATIONS

The contractor shall be solely responsible for taking whatever precautions necessary to protect concrete

work performed during unusual or inclement weather conditions.

The contractor shall take appropriate precautions in placing, finishing, and curing concrete when the ambient temperature reaches 85° F or higher or whenever relative humidity, wind velocity, or exposure to sun is expected to cause adverse conditions for concrete work.

Concrete shall not be placed when the ambient temperature is below 32° F. The surface temperature of fresh concrete shall be maintained at no less than 50° F for a period of seven days after finishing.

Insulated formwork, plastic sheeting, straw, temporary enclosures, portable heat sources, or combinations thereof, shall be used as applicable to maintain the minimum required temperature. When using portable heating sources, a means of providing and maintaining sufficient atmospheric moisture for curing shall be provided.

206.03.05 HANDLING AND PLACING

Construction debris shall be removed from the formwork prior to placing concrete. Temporary bracing shall be removed from within formwork as the concrete is being placed. Temporary braces and other formwork shall not be left buried in the concrete.

Prior to placing concrete, the base rock, leveling course, or other underlying material shall be thoroughly moistened.

Concrete shall be placed so as to avoid segregation of material and displacement of reinforcement. Concrete shall not be allowed to "free fall" more than six feet.

The concrete shall be thoroughly consolidated as it is being placed. The concrete shall be consolidated by mechanical vibration in conformance with the following provisions:

- (1) Vibrating devices shall be capable of transmitting vibration to concrete at frequencies of not less than 4,500 impulses per minute. Intensity of vibration shall be such that a concrete mass of one-inch slump is visibly affected over a radius of at least 18 inches.
- (2) A sufficient number of vibrating devices shall be used to properly compact each batch as it is being placed in the forms.
- (3) Vibrating devices shall be manipulated in a manner that will thoroughly consolidate concrete around reinforcement and embedded fixtures and into corners and angles of forms without causing segregation of the mixture.
- (4) Vibrating devices shall not be applied directly to reinforcing steel or to layers of concrete that have hardened to the degree that concrete ceases to be plastic under vibration.
- (5) Mechanical vibration methods shall be supplemented by hand work as necessary to ensure smooth surfaces and dense concrete.

206.03.06 JOINTS IN PORTLAND CEMENT CONCRETE

Joints in concrete structures will be designated as construction joints, contraction joints, and cold joints and shall be constructed as specified herein and in other sections of these specifications applicable to specific structures.

206.03.06A CONSTRUCTION JOINTS

Wherever possible, the placing of concrete shall be continuous and without the use of intermediate construction joints.

The contractor shall install a construction joint at the termination point of each day's work, at the

beginning of temporary work stoppages, and at any other time where the concrete will be allowed to harden or take its initial set prior to resumption of work.

Construction joints shall be formed by shaping the leading edge of the concrete as necessary to form a vertical face with an edge thickness of not less than four inches. Construction joints shall be constructed transverse to the longitudinal axis of these structures.

Where a construction joint is required in the sloped top surface of a retaining wall, or similar type work, additional formwork shall be used to produce a blocked out portion in the preceding layer that will produce an edge thickness of not less than six inches in the succeeding layer. Placing of concrete shall not be discontinued within 18 inches of the top of any face during wall construction.

Before placing fresh concrete against concrete that has hardened or attained initial set, the surface of the previously placed concrete shall be roughened in a manner that will not leave loosened particles of aggregate or damaged concrete at the surface. The surface shall be thoroughly cleaned and saturated with water prior to resumption of work.

206.03.06B CONTRACTION JOINTS

Contraction joints shall be of the weakened plane type in the exposed surfaces of concrete structures at such locations required to confine the contraction joint spacing to a maximum of 15 feet.

Contraction joints shall be constructed by pushing a thin steel sheet, or similar tool, vertically into the fresh concrete to separate the coarse aggregate at the joint. Contraction joints shall be formed to a minimum depth of $1/3$ of the thickness of concrete and to a width of $1/8$ inch.

Contraction joints shall be installed in a straight line, transverse to the longitudinal axis of the structure. The edges of the joint shall be tooled.

Contraction joints shall coincide with existing joints in adjacent concrete structures.

206.03.06C COLD JOINTS

Cold joints shall be formed between adjacent structures by placing fresh concrete against a previously formed concrete surface that has been allowed to harden or obtain its initial set.

Cold joints shall be located and constructed such that one of two or more adjacent concrete structures can be removed without damage to the structures that are to remain in place.

206.03.06D KEYWAY JOINTS

Keyway joints in walls, slabs, and other structures shall be located and formed/installed as specified in the contract documents or as directed by the City Engineer.

206.03.07 SURFACE FINISHING

Details relative to wall and slab finishes will be specified in the contract documents.

Details relative to concrete street, sidewalk, driveway, and curb finishes are included under applicable sections of Division 3.

206.03.08 CURING

Concrete surfaces shall be cured by covering with materials conforming to Subsection 206.02.05. The contractor shall use curing materials consistent with the weather and other existing site conditions.

Slab concrete structures, such as pavement, sidewalks, curbs, and similar work, that are exposed to conditions causing premature drying during placing operations shall be protected by wind breaks, fog spray, or by other suitable methods.

The curing process shall be maintained for a time period of not less than 72 hours from the time the curing process commenced.

206.03.08A SHEET COVERINGS

Sheet-type curing materials, including burlap, cotton mats, plastic film, and similar coverings shall be placed as soon as the concrete has hardened sufficiently to support installation of the covering without marring the surface of the concrete.

Plastic film and similar non-absorbent sealing materials shall extend over and beyond the sides or edges of the concrete and shall be installed and secured as necessary to hold the covering in position as a moisture proof covering.

Burlap cloth, cotton mats, and other absorbent materials shall be saturated with water and kept fully wetted during the curing period.

206.03.08B LIQUID, MEMBRANE-FORMING COMPOUNDS

Liquid, membrane-forming compounds shall be applied uniformly to damp concrete by pressure-spray methods at a rate that will form an impervious membrane in accordance with ASTM C 309.

206.03.08C WATER CURING

If the use of other curing materials is impractical or not required, the surfaces shall be kept moist by flushing or sprinkling with water in a manner approved by the City Engineer.

The application of water shall be such that the concrete and surfaces of all forms will be kept damp for a period of seven days after placing of concrete. Curing and finishing shall be coordinated when both requirements are to be met at same time.

Water used for curing shall be free of harmful amounts of deleterious materials that will stain, discolor, or adversely affect the physical properties of the concrete. Care shall be taken to avoid thermal shock due to the use of cold water or high rates of evaporative cooling.

206.03.08D OTHER MATERIALS

The use of straw, earth, sand, sawdust, or other similar materials that have been saturated with water shall be used only when approved by the City Engineer.

206.03.09 PROTECTION OF CONCRETE

The contractor shall erect and maintain suitable barriers to protect the concrete from traffic or other detrimental trespass until the concrete has attained the specified compressive strength.

Wherever traffic, of any type, is to be permitted to move over the surface of the concrete, the contractor shall construct and maintain suitable bridges over the concrete.

The contractor shall repair or replace, as determined by the City Engineer, any concrete that has been damaged prior to its acceptance by the owner. The contractor shall be solely responsible for costs associated with the repair or replacement of work that is damaged prior to final acceptance.

206.03.10 ADJUSTMENT OF EXISTING CONCRETE STRUCTURES TO GRADE

Wherever possible, existing concrete structures shall be adjusted to a new elevation by the addition or removal of precast concrete adjustment rings or extensions. Final adjustment to grade shall be made by seating the frame in fresh mortar and adjusting the assembly to finish elevation. Mortar shall not be placed to a depth in excess of one inch.

Concrete reinforcement maybe required by the City Engineer depending on the type and location of the structure and the amount of adjustment required.

Portions of existing structures to be removed shall be isolated by sawcuts or other suitable means prior to removal to preclude spalling, cracking, or other damage to sections of the structure that are to remain in place.

206.03.10A EXCAVATION AND BACKFILL

Excavation shall be unclassified and shall include removal and disposal of whatever materials are encountered to the depths required to conduct the work.

If the structure is located in an improved area, the contractor shall sawcut and remove the asphalt or concrete from around the structure and excavate sufficient underlying material to conduct the work. The contractor shall not remove more material than is necessary to perform the required work.

Backfill shall be provided, placed, and compacted in conformance with the contract documents.

206.03.10B RAISING TOPS OF CONCRETE STRUCTURES

If the structure has no provision for the use of precast concrete extensions, fresh concrete shall be used to extend the structure to the new grade. The existing concrete surface shall be cleaned by brushing or with compressed air and moistened with water prior to placing the new concrete. New concrete shall be contained within suitable formwork and placed to a minimum depth of four inches in non-traffic areas and six inches in traffic areas. New concrete shall be cured at least three days, after which the frame shall be seated in fresh mortar and brought to proper grade.

If the required adjustment exceeds one inch but is less than the specified minimum thickness for the new concrete, existing shells or walls of structures to be raised shall be cut down as necessary to provide space for the new construction.

206.03.10C LOWERING TOPS OF CONCRETE STRUCTURES

Where the tops of manholes and similar structures are to be lowered and there is no provision for the removal of precast adjustment rings or extensions, the manhole cone shall be removed and the standard manhole sections removed and replaced with appropriate heights to accommodate the new finish grade. On shallow manholes and similar structures, it may be necessary to replace the cone section with a flat top section to achieve the new finish grade. Manhole cones and similar components shall not be modified.

Where curb inlets, catch basins, and similar structures are to be lowered and there is no provision for the removal of precast extensions, the walls of the structure shall be removed to an elevation that will locate the frame and cover assembly at finish grade. Final adjustment to grade shall be made by seating the frame in fresh mortar and adjusting the assembly to finish elevation.

206.04.00 MEASUREMENT AND PAYMENT

206.04.01 CONCRETE STRUCTURES

Measurement and payment for concrete structures will conform to the specific section within these specifications that is applicable to the type of work specified.

206.04.02 ADJUSTMENT OF EXISTING CONCRETE STRUCTURES TO GRADE

The adjustment or reconstruction of existing concrete structures, including manholes, storm drain inlets and catch basins, concrete valve boxes, and other similar structures will be paid for at the contract unit price per each structure adjusted or reconstructed.

Compensation for this work will include all materials, labor, and equipment necessary for the excavation and removal of surface improvements and sufficient underlying material to conduct the work, removal and disposal of portions of the structure necessary to adjust or reconstruct the structure, adjustment or reconstruction of the structure, providing and installing backfill materials, restoration of the ground surface,

and any other miscellaneous work or materials required to complete the work in conformance with the contract documents.

206.04.03 INCIDENTALS

Materials, labor, and equipment required to complete the work in conformance with the contract documents and not listed as separate pay items in the proposal will be considered incidental to other items of work and no separate payment will be made.

207 BORING AND JACKING

207.01.00 LEGAL RESPONSIBILITIES

In addition to the requirements contained herein and elsewhere in the contract documents, the contractor shall comply with all other applicable federal, state, and local laws and regulations pertaining to this type of work.

The term "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.

207.01.01 PIPELINE CROSSING AGREEMENT

Work conducted under or across permitter's right-of-way shall conform to the requirements of the permitter as outlined in a pipeline crossing agreement made between the permitter and the City. The contractor shall comply with all requirements of the pipeline crossing agreement.

207.01.02 INSURANCE

The contractor shall obtain and deliver to the permitter a public liability and property damage insurance policy in the amount required in the pipeline crossing agreement. The insurance company writing the policy shall be authorized to do business in the state of Oregon and shall be satisfactory to the permitter.

Any other special agreements required between the contractor and the permitter shall be completed and signed by both parties before the contractor enters upon or commences work on the permitter's property.

The contractor shall provide the City Engineer with copies of all required documentation prior to beginning work.

Written authorization to proceed from the permitter shall be submitted to the City Engineer by the contractor prior to beginning work.

207.01.03 SAFETY

The contractor shall conform to 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.

207.02.00 MATERIALS

207.02.01 PIPE ZONE AND BACKFILL MATERIAL

Pipe zone and backfill material shall conform to the requirements of Section 205.03.00 AGGREGATES.

207.02.02 CARRIER PIPE

Carrier pipe shall conform to Section 401 PIPE AND FITTINGS (SANITARY SEWERS AND STORM DRAINS) or Section 501 WATER PIPE AND FITTINGS for the strength, class, and type of pipe required for the work.

Uncased, jacked concrete pipe shall conform to ASTM C 76 as modified in Section 401. The pipe shall

have tongue-and-groove joints designed to provide a minimum 3/4-inch wide annular space on the interior of the joint for grouting after jacking is completed. The pipe shall have double circular cage reinforcement with additional longitudinal reinforcing steel as necessary for jacking operations.

207.02.03 CASING PIPE

Casing pipe shall be smooth steel pipe conforming to AWWA C 201 with a minimum wall thickness of $\frac{5}{16}$ inch. The contractor, however, shall be ultimately responsible for providing and installing materials consistent with the method of installation and the specified requirements of the permitter.

207.03.00 CONSTRUCTION

207.03.01 EXCAVATION

Excavation shall be unclassified and shall include removal of all materials that are encountered.

207.03.02 JACKING AND BORING

Jacking and boring equipment shall be in serviceable condition and of a type that will maintain correct alignment and grade of the pipe during installation.

In jacking operations, excavation shall be carried out entirely within the jacking head assembly or lead pipe. No excavation shall be made in advance of the jacking head. The contractor shall take whatever precautions are necessary to prevent loss of earth and the subsequent formation of voids outside the jacking head. Should there be an appreciable loss of earth, as determined by the City Engineer, the contractor shall promptly fill the resultant voids, as they occur, with materials specified in the contract documents.

Once the jacking operation has commenced, it shall be continued uninterrupted around the clock until the pipe has been installed to the limits specified in the contract documents.

The contractor shall be responsible for any increase in pipe strength necessary to withstand jacking or boring loads and grouting operations.

207.03.03 CONCRETE PIPE

Protection shall be provided for the driving end of concrete pipe to preclude spalling and other damage. Intermediate joints shall be protected by the installation of bearing shims or other materials to properly distribute the bearing stresses.

207.03.04 STEEL CASING

Sections of steel casing to be jacked or bored shall be joined by welding the joints with a continuous weld for the full circumference. The contractor shall provide joints that are capable of resisting the jacking and boring forces without failure.

Welding of steel pipe used in jacking or boring operations shall conform to applicable American Welding Society specifications. Welders performing this type of work shall meet American Welding Society certification requirements and shall be prepared to present proof of such certification upon demand.

207.03.05 FILLING VOIDS BETWEEN CARRIER PIPE AND CASING

The annular space between the casing and the carrier pipe shall be filled $\frac{2}{3}$ full with sand unless specified otherwise by the permitter or the contract documents.

207.03.06 FILLING VOIDS OUTSIDE CARRIER PIPE OR CASING

After the casing, or carrier pipe where no casing is specified, has been jacked or bored into position, all voids outside the casing shall be filled with materials specified in the contract documents.

If grout is specified as a filler, the grouting operation, once commenced at any one point, shall be completed without stopping. Nipples installed in carrier or casing pipes for the purpose of filling voids with

grout shall be removed and the holes grouted flush with the pipe wall upon completion of the grouting operation.

207.03.07 CARRIER PIPE INSULATORS

The carrier pipe shall be supported within the casing with Calpico brand Model "M" Series pipe insulators or approved equal. The length, configuration, and location of the pipe insulators are dependent on the size and type of carrier pipe. These requirements vary by application and will be determined by the City Engineer, permitter, or the contract documents.

207.04.00 MEASUREMENT AND PAYMENT

207.04.01 BORING AND JACKING

Measurement and payment for bored and jacked carrier or casing pipe will be made on a linear-foot basis along the centerline of the pipe or conduit between the limits specified in the contract documents and shall include full compensation for all excavation, construction of the jacking or boring pits, pipe, casing, backfill, filling the annular space between the pipe and the casing, and any other labor, equipment, and materials of whatever nature that are required to complete the work and place the improvement into service. Where a casing is installed at the option of the contractor, the casing, pipe skids, backfill of the annular space between the pipe and the casing, and all other labor, equipment, and material requirements associated with the installation of the casing shall be included in the pay item for boring or jacking, or as applicable, and no separate or additional payment will be made.

Jacking and boring extended beyond the limits shown in the contract documents without written authorization from the City Engineer shall be considered to be for the contractor's convenience and measurement and payment for said extension shall be made through the pay item for pipe work adjacent to the jacked or bored section.

Final payment for each crossing will be made after the contractor furnishes the City Engineer with a satisfactory release from the permitter stating that the work across the permitter's right-of-way has been completed to the satisfaction of the permitter.

208 RESURFACING

208.01.00 APPLICABILITY OF SECTION

This section covers work necessary to replace all pavement base, pavement, curbs, sidewalks, and other surface features, with the exception of landscaping, damaged during the construction of public improvement projects.

208.02.00 MATERIALS

208.02.01 HOT MIX ASPHALT CONCRETE

Class B hot mix asphalt concrete shall be used for the base lift and Class C hot mix asphalt concrete shall be used for the top lift for the restoration of asphalt surfaces.

Hot mix asphalt concrete shall conform to requirements for hot mix asphalt concrete in Section 205 CONCRETE, ASPHALT, AND AGGREGATE MATERIALS.

208.02.02 COLD MIX ASPHALT CONCRETE

Cold mix asphalt concrete with an aggregate gradation of ½-inch minus shall be used for temporary resurfacing of hard-surface areas.

208.02.03 TACK COAT

Liquid asphalt shall conform to requirements for tack coat in Section 205 CONCRETE, ASPHALT, AND AGGREGATE MATERIALS.

208.02.04 JOINT SEALER

Liquid asphalt shall conform to requirements for joint sealer in Section 205 CONCRETE, ASPHALT, AND AGGREGATE MATERIALS.

208.02.05 PAVEMENT BASE

Pavement base material for resurfacing trenches shall be 1-inch minus or 3/4-inch minus crushed gravel or crushed aggregate conforming to requirements in Subsection 205.03.01 AGGREGATE BASE.

208.02.06 FORMS

Formwork shall conform to requirements in Section 206 CONCRETE STRUCTURES.

208.02.07 ROCK SURFACING

Rock surfacing shall be 1-inch minus or 3/4-inch minus crushed gravel or crushed aggregate conforming to requirements in Subsection 205.03.01 AGGREGATE BASE.

208.03.00 CONSTRUCTION

208.03.01 PAVEMENT RESTORATION

208.03.01A SAWCUTTING AND SURFACE REMOVAL

The existing pavement shall be sawcut a minimum of 12 inches from the edge of the existing pavement at the side of the trench or excavation. Earth saws and similar types of equipment shall not be used for cutting the pavement for final surface restoration.

Sawcutting of the final pavement edge shall occur after backfill and compaction operations are completed and as close to the actual time of final pavement restoration as possible.

The sawcut shall be a straight line, parallel to the pipe centerline, and shall provide a smooth, sound edge for joining the new pavement.

When the pavement edge at the side of the trench has been damaged beyond the 12-inch cutback, the final sawcut shall be moved out far enough to remove all damaged or undermined pavement and remain parallel to the trench. The pavement shall be cut in a manner that will provide a smooth transition back to the 12-inch cutback to allow effective use of compaction equipment along the edge.

When the distance between the final sawcut pavement edge and a curb, gutter, pavement edge, construction joint, or other concrete structure or improvement will be less than 24 inches, the contractor shall remove the intervening pavement and include that area in the pavement restoration. This requirement is intended to prevent subsequent settlement, displacement, or premature breakup of narrow, non-contiguous sections of pavement.

The material immediately below the cutback areas shall be replaced with 1-inch minus compacted, crushed gravel base.

208.03.01B PAVEMENT BASE

Pavement base shall be placed to a depth of 24 inches. The contractor shall bring the top of the pavement base to a smooth, even grade allowing for the thickness of paving material specified herein. The contractor shall compact the pavement base as specified in Section 204 EXCAVATION, BACKFILL, AND OTHER SITE WORK.

Compaction tests shall be required on the finish rock grade prior to any final trench restoration.

208.03.01C SURFACE SMOOTHNESS AND WORKMANSHIP

Surface characteristics and workmanship of pavement restoration, including driveways, sidewalks, and

curbs, as applicable, shall meet the following minimum requirements:

- (1) When checked with a 12-foot straightedge, longitudinal deviation in surface smoothness for asphalt and concrete structures, including pavement, curbs, sidewalks, and driveways, shall not exceed .01 foot within 12 feet. Only one such deviation is permitted within 12 feet.
- (2) The surfaces of the new pavement shall be flush with the existing street.
- (3) Crown in the resurfaced areas shall be consistent with the existing crown and the position of the patch on the street.
- (4) Completed pavement restoration shall not impound water or block existing means of drainage.

Pavement restoration that does not meet the above requirements shall be removed and replaced by the contractor at the contractor's expense.

Heating and reworking of asphalt surfaces, "skin" patches, grinding, surface applications (binders or sealers), or other like methods of improving surface characteristics of rejected pavement restoration will not be permitted.

Surface irregularities or other detrimental aspects of the existing roadway and other surfaces adjacent to the new work shall not be used by the contractor as a basis of evaluating the acceptability of the restored pavement.

208.03.01D WEATHER LIMITATIONS

Pavement restoration shall not be performed when the atmospheric temperature is lower than 40° F, during rainfall, or when the surface upon which the paving material is to be placed is frozen or has impounded water unless precautionary measures have been taken and are approved by the City Engineer.

208.03.01E PROTECTION OF ADJACENT STRUCTURES AND PROPERTY

The contractor shall take necessary precautionary measures to protect exposed structures and any other adjacent property, including motor vehicles and surface improvements, from paving materials and paving operations. Paving materials and other undesirable matter that may be deposited on adjacent structures or property as a result of paving operations shall be removed by the contractor upon completion of the work.

Manhole covers, metal valve boxes, and like structures shall be protected with diesel oil, paper, or other suitable materials prior to placing paving materials.

208.03.01F RESTORATION OF PAVEMENT MARKINGS

The contractor shall be responsible for the restoration of pavement striping, directional marking, crosswalk marking, and curb marking damaged by construction. Appropriate equipment operated by personnel qualified in its use shall be used to perform this work. Restored markings shall have sharp, clearly defined edges and shall be neat and uniform in appearance. Striping placed on existing pavement or on new pavement restoration shall be of a material approved by the City Engineer.

208.03.02 TEMPORARY COLD MIX ASPHALT

Temporary cold mix asphalt shall be placed and compacted over the backfilled and compacted trench areas to a minimum depth of two inches. After compaction, the temporary cold mix asphalt shall match the adjacent existing grade.

208.03.03 ASPHALT CONCRETE PAVEMENT

208.03.03A TACK COAT

Tack coat shall be applied in conformance with applicable requirements in Section 304 ASPHALT CONCRETE PAVEMENT.

208.03.03B ASPHALT CONCRETE PLACEMENT

Asphalt concrete shall be placed on the prepared base over the trench to a compacted depth of not less than four inches, or the depth of the adjacent pavement, whichever is greater.

Asphalt concrete shall be placed in a minimum of two lifts. Maximum thickness for any one lift of pavement shall not exceed three inches for class B mix and two inches for class C mix. The minimum thickness for placement of pavement shall not be less than 1½ inches.

Asphalt shall be roller compacted with equipment capable of providing compression of 200 to 300 pounds per linear inch. Compaction equipment shall be operated in a manner that will remove all roller marks and produce a smooth, uniform surface. Density requirements for asphalt concrete pavement shall conform to those in Section 304 ASPHALT CONCRETE PAVEMENT.

208.03.03C JOINT SEALER

A seal coat of liquid asphalt shall be applied to joints between the new and original asphalt pavement immediately after the new paving is completed. The seal coat shall be a minimum of 12 inches 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 gallons per 100 linear feet.

The seal coat shall be covered with clean sand immediately after the liquid asphalt has been applied and before the asphalt has solidified. The sand shall be applied in a layer thick enough to prevent tracking of seal coat.

208.03.04 PORTLAND CEMENT CONCRETE PAVEMENT

Pavement restoration shall be the same thickness as that removed, or a minimum of eight inches thick, whichever is greater.

Concrete shall have a minimum compressive strength of 4,000 psi. Requirements for the provision and installation of dowels, tie bars, and load transfer devices will be specified in the contract documents.

The contractor shall provide, transport, place, finish, cure, and protect concrete pavement in conformance with applicable provisions of Section 206 CONCRETE STRUCTURES.

208.03.05 CONCRETE DRIVEWAYS, SIDEWALKS, AND CURBS

Concrete driveways, sidewalks, and curbs shall be replaced to the same section, width, depth, line, and grade as that removed or damaged. The contractor shall replace concrete driveways, sidewalks, and curbing between scored joints. The contractor shall provide a minimum 3-inch thick compacted leveling course of 1-inch minus crushed aggregate.

Concrete edges adjacent to the work that were damaged during construction shall be recut. The contractor shall be responsible for recutting edges damaged during concrete removal or construction operations and no payment will be made for additional sawcutting or concrete removal.

Concrete replacement work shall be completed a minimum of seven days prior to the placement of adjacent asphalt concrete.

Sidewalks, driveways, and curbs damaged outside the limits of construction shall be replaced at the expense of the contractor.

The handling, placing, finishing, curing, and protection of concrete shall be in conformance with the applicable provisions of Section 206 CONCRETE STRUCTURES and Section 306 CURBS, GUTTERS,

SIDEWALKS, DRIVEWAY APPROACHES, AND WHEELCHAIR RAMPS.

208.04.00 MEASUREMENT AND PAYMENT

208.04.01 TEMPORARY COLD MIX ASPHALT

Payment for temporary cold mix asphalt pavement placed in street crossings to be maintained over trench backfill will be considered incidental to the work and included in the unit price for pavement replacement.

208.04.02 ASPHALT AND PORTLAND CEMENT CONCRETE PAVEMENT REPLACEMENT

The basis of measurement and payment for asphalt cement concrete and portland cement concrete pavement will be made on a linear-foot or square-yard basis as stated in the contract documents. When measurement is made on a linear-foot basis, the total length will include the full width of the restored surface.

Payment for asphalt cement concrete and portland cement concrete will include compensation for labor, equipment, and materials necessary for sawcutting the existing pavement; excavation and removal of sufficient material to provide space for the surfacing; supplying, placing, and compacting the base and leveling course materials; supplying and placing specified surfacing materials, including tack coat and joint sealer; restoration of pavement markings; disposal of excess excavated materials, including temporary cold mix asphalt; and all other labor, materials, and equipment of whatsoever nature required to complete pavement restoration.

208.04.03 SIDEWALK AND DRIVEWAY REPLACEMENT

Measurement and payment for concrete sidewalk and driveway replacement will be made on a linear-foot or square-yard basis as stated in the contract documents.

Payment for sidewalk and driveway replacement will include compensation for labor, equipment, and materials necessary for additional sawcutting of the existing sidewalk and driveway materials; excavation and removal of sufficient material to provide space for the restoration; supplying, placing, and compacting the base and leveling course materials; supplying and placing concrete, including curing and joint materials; formwork; and restoration of markings; disposal of excess excavated materials, including temporary surfacing materials; and all other labor, materials, and equipment of whatever nature required to complete restoration of the sidewalks and driveways.

208.04.04 CURB REPLACEMENT

Measurement and payment for the replacement of concrete curbs, curb and gutter, or gutter sections will be made on a linear-foot basis.

No differentiation in measurement or payment will be made between curb and monolithic curb and gutter sections.

Payment for concrete curbs, curb and gutter, or gutter sections will include compensation for labor, equipment, and materials necessary for additional sawcutting of the existing curb; excavation and removal of sufficient material to provide space for the restoration; supplying, placing, and compacting the base and leveling course materials; supplying and placing concrete, including formwork, curing materials, and joint materials; restoration of markings; disposal of excess excavated materials; and all other labor, materials, and equipment of whatever nature required to complete restoration of the concrete curbs.

208.04.05 INCIDENTALS

Other materials, labor, and equipment required to complete the work in conformance with the contract documents and not listed as separate pay items in the proposal will be considered incidental to other items of work and no separate payment will be made.

209 CLEANUP AND SITE RESTORATION

209.01.00 GENERAL

Satisfactory completion of all requirements described herein will be a condition precedent to final acceptance of the project.

209.02.00 CONSTRUCTION

209.02.01 RESTORATION OF PLANTED AREAS

Planted areas, including grassy areas, shall be raked by hand as necessary to remove gravel, clay, construction debris, and deleterious materials.

Areas where the sod has been damaged shall be leveled and raked as necessary to conform to the original surface and shall be free of holes, rough spots, or other surface features detrimental to seeding or placement of sod.

Grassy and planted areas damaged by oil, gasoline, or other hazardous and/or poisonous materials shall be excavated and the contaminated soil removed and replaced with suitable topsoil to the satisfaction of the City Engineer.

Grass and other plantings shall be replaced in kind. Grass shall be restored by seeding or with sod as required by the City Engineer.

Shrubs and trees located outside the limits of construction that have been disturbed or damaged shall be removed and replaced, in kind, as directed by the City Engineer and at the contractor's sole expense. Adequate drainage shall be maintained in all restored areas.

209.02.02 REMOVAL OF EQUIPMENT AND MATERIALS

Construction materials, equipment, and debris of whatever nature resulting from construction operations shall be removed from the project site.

209.02.03 CLEANING DRAINS

Drainage facilities such as inlets, catch basins, culverts, manholes, open ditches, storm drainage and sanitary sewer lines, and similar structures shall be cleaned of all debris that is the result of construction operations.

209.02.04 CLEANING PAVED SURFACES AND APPURTENANCES

Pavement surfaces, gutters, sidewalks, manhole and valve box castings, and other similar structures and installations, whether new or existing, within the limits of the project, shall be cleaned as necessary to remove gravel, dirt, oil, asphalt, concrete, and other materials that are a result of the contractor's operations.

After gravel and larger debris have been cleaned up as much as is practicable by other methods, paved areas shall be flushed with a pressure-type flusher. Sidewalks shall be hand broomed or flushed with water, taking care not to further damage planted areas with the water.

209.02.05 RESTORING MOBILIZATION, BORROW, AND DISPOSAL AREAS

Properties that were used for storage or mobilization during construction of the project shall be cleaned up, all equipment and supplies removed, and the area restored to a condition equal to or better than that existing before mobilization.

For borrow and disposal areas, cleanup shall include the disposal of all uprooted stumps, felled trees, brush, excess excavation, rock, discarded materials, rubbish, and debris.

209.03.00 MEASUREMENT AND PAYMENT

209.03.01 INCIDENTAL BASIS

Materials, labor, and equipment required for cleanup and site restoration will be considered incidental to other work and no separate payment will be made.

210 STREET TREE STANDARDS

210.01.00 APPLICATION OF STANDARDS

Selection, provision, planting, and maintenance of street trees shall comply with the standards contained in this section and in the Sutherlin Development Code section 3.3. Requirements contained in these sections shall be used in the development of Street Tree Planting Plans as required for publicly or privately funded public works projects. These standards are intended to ensure that new trees planted within the public right-of-way are of the highest quality, require low maintenance, and will not compromise public safety.

210.02.00 STREET TREE SELECTION

The species of trees to be planted shall be selected from the Sutherlin Development Code, section 3.3.130.

210.03.00 STREET TREE QUALITY AT TIME OF PLANTING

The tree shall have a straight trunk perpendicular to the ground with a minimum branching height of four feet above the ground for trees 1½-inch in caliper to a minimum of six feet above the ground for trees two inches in caliper.

Plant material shall be grown to the current standards and specifications of the American Association of Nurserymen, American Standard for Nursery Stock. Plant material shall be of standard quality or better, true to name and type of their species or cultivar.

Tree material originating within the state shall have the Oregon inspection certificate attached. Nursery stock imported from other states shall be accompanied by a certificate of inspection from the place of origin as required by Oregon law. Certificates shall be given to the City's Representative prior to tree approval. The Contractor shall be responsible for making all arrangements with the State Department of Agriculture for inspection of tree materials shipped from out of state.

Trees shall be provided reasonably free, as defined by nursery industry standards for street trees, from insects and disease, decay, major structural defects, and damage to the trunk, branches, and root system.

Trees' structural scaffold branches shall be well proportioned where they attach to the main trunk, with an average spacing of at least six inches.

Plant materials that have been pruned immediately before or during the time of planting will be rejected.

The City shall be notified and will have the right to inspect all trees and shrubs before they are planted. The City reserves the right to reject any materials at any time. The Contractor will replace materials with specified plants at the Contractor's expense.

210.04.00 STREET TREE SIZE AT TIME OF PLANTING

Trees for residential classed streets shall be a minimum of 1½ inches in caliper, measured six inches above mean ground level, 8 - 10 feet in height.

Trees for collector or arterial streets and abutting commercially zoned properties shall be a minimum of two inches in caliper, measured six inches above mean ground level, 10 - 12 feet in height.

210.05.00 STREET TREE CONDITION AT TIME OF PLANTING

210.05.01 BALLED AND BURLAPPED AND IN WIRE BASKETS

Trees shall have a sound ball with a firm attachment of the trunk with the root ball. The trunk shall not be

loose, but firmly held within the root ball.

The size and condition of root balls shall conform to the current standards and specifications of the American Association of Nurserymen and the American Standard for Nursery Stock.

Root balls of trees shall not be allowed to dry out at any time from the nursery to final planting. Trees shall have a well developed root system and not be root bound or have circling/girdling roots.

210.05.02 IN A CONTAINER

The trees shall be free of circling, girdling roots.

The trees shall have been grown in the container for a maximum period of one year.

210.05.03 BARE ROOT

Trees in a bare root condition shall not exceed 1½ inches in caliper, measured six feet above mean ground level.

The roots shall not be allowed to dry out and shall be kept moist at all times from the nursery to final planting. The roots shall be well-established and full of live and vigorous fibrous roots along with the larger structural roots.

210.06.00 STREET TREE PLANTING LOCATION

210.06.01 GENERAL

On public streets without sidewalks, trees shall be located so as to accommodate future sidewalk placement and with regard to current and future utility line corridors. Trees and shrubs (which attain a height of eighteen inches (18") or more) that may form a hedge or screen shall not be allowed within the "Clear Vision Zone" of a street or alley intersection so as to obscure required traffic sight distances. The clear vision area consists of a triangular area, two sides of which are lot lines or a driveway and a lot line for a distance specified in this section, or, where the lot lines have rounded corners, the lot lines extended in a straight line to a point of intersection and so measured, and the third side of which is a line across the corner of the lot joining the non-intersecting ends of the other two sides. The following measurements shall establish the clear vision areas:

<u>Type of Intersection</u>	<u>Measurement Along Each Lot Line</u>
Controlled Intersection (stop sign or signal)	20 feet
Uncontrolled Intersection (60' right-of-way)	30 feet
Uncontrolled Intersection (less than 60' right-of-way)	30 feet
Commercial and Industrial District driveways	20 feet

210.06.02 MINIMUM STREET TREE PLANTING CLEARANCES

Minimum Recommended Distances from Feature:

Feature	Small Tree (up to 35' height)	Medium Tree (up to 60' height)	Large Tree over 60' height)
Sidewalks	2 feet	3 feet	4 feet
Driveways	5 feet	5 feet	10 feet
Fire Hydrants	5 feet	5 feet	5 feet
Intersections	35 feet	35 feet	35 feet
Water Meters	5 feet	5 feet	5 feet
Utility Boxes	5 feet	5 feet	5 feet
Utility Poles	5 feet	10 feet	10 feet
Street Lights	10 feet	20 feet	30 feet
Stop Signs	35 feet	35 feet	35 feet
Regulatory Signs	Not to block sign		

210.06.03 MINIMUM DISTANCE FROM SIDEWALKS AND CURBS

Trees shall be centered in the planting strip between the sidewalk and the street curb. If centering within the planting strip is not possible or desirable due to design considerations, the tree must be located at least two feet from the sidewalk edge or the curb edge.

210.06.04 MINIMUM DISTANCE FROM BURIED UTILITY LINES THAT TRAVERSE THE PLANTING STRIP

8"-10" water and sewer line	10 feet
12"-16" water and sewer line	15 feet
18" + water and sewer line	20 feet
All other services	10 feet

210.06.05 OVERHEAD UTILITY LINES

No tree with the potential of reaching a mature height of more than thirty-five feet (35') shall be planted in the right-of-way under "primary" overhead wires.

210.06.06 MINIMUM RECOMMENDED DISTANCE FROM BUILDINGS

Small trees (potential growth of up to 35' height)	10 feet
Medium trees (potential growth of up to 60' height)	10 feet
Large trees (potential growth of over 60' height)	15 feet
Shrubs	3 feet

Any tree planted ten feet (10') or closer to a building shall have an impenetrable root barrier installed near the building. The root barrier shall run the length of the planting area or the structure, and reach a depth of at least eighteen inches (18").

210.06.07 VEHICULAR AREA

Provisions shall be made to prevent any parts of the vehicles from touching trees.

210.06.08 SHRUBS PLANTED IN THE STREET-SIDE RIGHT-OF-WAY

Shrubs shall follow the minimum distance requirements for trees for curbs, sidewalks, and utilities. No shrub shall be planted within three feet (3') of a building.

210.06.09 LINEAR SPACING

Trees shall be placed an average of every thirty feet (30'). Depending on the size, species, and variety, the City Engineer may approve planting distances which may be as close as ten feet (10') and as far as forty feet (40') to fifty feet (50') based on the size and growth habit of the tree.

210.06.10 WIDTH OF PLANTING AREA WITHIN CITY RIGHTS-OF-WAY (I.E., DISTANCE BETWEEN THE CURB AND SIDEWALK)

Trees shall not be planted where the rooting space is less than four feet (4') in width without prior approval of the City Engineer.

The minimum width of a planting site for each tree will be governed by the approved street tree list.

Trees that commonly produce a large-buttress root system shall be planted in a site greater than eight feet (8') wide (i.e., *Quercus phellos*, *Acer macrophyllum*, *Liquidambar styraciflua*).

210.06.11 WIDTH OF MEDIANS

No tree shall be planted in any median that is less than ten feet (10') in width. On state rights-of-way, Oregon Department of Transportation's "Guidelines for Planting Within Highway Right-of-Way" apply.

210.06.12 EXEMPTIONS TO THE TREE LOCATION STANDARDS

Where special conditions exist, the City Engineer may waive these tree planting location standards. Such a

waiver will be on a case-by-case basis and will require written approval of the City Engineer.

210.07.00 STREET TREE PLANTING PROCEDURES

210.07.01 Planting Season

Bare root trees may be planted only between October 15th and March 15th unless otherwise approved by the City Engineer. Balled and burlapped or container grown trees may be planted only between September 15th and April 15th unless otherwise approved by the City Engineer.

210.07.02 PREPARATION OF TREE PLANTING HOLES

210.07.02A BALLED AND BURLAPPED AND CONTAINER GROWN TREES

A shallow, broad, tree planting hole at least 1½ times the diameter of the root ball shall be excavated to a depth that will position the trunk flare level with finish grade.

The inner surfaces of the excavation shall be scored or roughened to the extent necessary to encourage rooting in the existing native soil.

210.07.02B BARE-ROOT STOCK

Tree-planting holes shall be one foot wider than the spread of the roots. Holes shall have sufficient depth to position the trunk flare level with finish grade.

A mound of native soil shall be left in the center of the hole to support the roots. The roots shall be draped and spread in their natural position over the mound.

210.07.03 PLANTING CONDITIONS

210.07.03A BALLED AND BURLAPPED TREES

Trees shall have a sound root ball that has not been allowed to dry out at any time. The root ball shall be firmly attached to the trunk.

Tree planting materials that are untreated and biodegradable may be left around the root ball after planting. Other debris shall be removed from the tree planting hole prior to backfilling with soil.

Tie material shall be removed and the burlap peeled back as necessary to expose the top 1/3 of the root ball prior to planting.

Wire baskets shall be cut off to a minimum depth of 18" from the top of the root ball.

210.07.03B CONTAINER GROWN TREE

The tree shall be carefully removed from the container and the root mass gently loosened.

The roots shall be inspected for a girdling or circling condition. Trees found to have girdling or circling roots shall not be planted.

Container grown trees shall not exceed 12 months in the container prior to planting.

210.07.03C BARE ROOT TREES

Roots shall not be exposed to sunlight or otherwise allowed to dry out at any time.

Dead, damaged, broken, or frayed roots shall be pruned off prior to planting.

210.07.04 SEATING OF TREES

Trees shall be set plumb, upright, and faced for best appearance. Broken branches shall be pruned after planting.

The hole shall be backfilled one-half full with original soil and the hole flooded with water to remove any

air pockets. After backfilling is complete, the entire planting area shall be thoroughly saturated with water to remove any remaining air pockets.

Mulch shall be applied to a depth of two - four inches around the tree. Mulch shall be kept free of an area within two inches of trunk.

A continuous three-inch high raised berm shall be constructed around the planting hole to direct water to roots. The berm shall be removed after one year.

210.07.05 STAKING

Hardwood stakes shall be driven firmly into the ground outside of the hole. Care shall be taken to avoid driving the stakes through the root structure.

Trees shall be attached to the stakes at knee height using nonbinding tree ties or tree ties that are at least one inch wide to prevent damage to the tree trunk. Ties shall be attached to the tree in a manner that will allow the tree to move but still be held firmly in place.

210.08.00 ESTABLISHMENT STANDARDS

210.08.01 ESTABLISHMENT PERIOD

The establishment period for an original tree or replacement tree shall begin on the date the tree is initially installed, or the date it is replaced, and extend for a two-year period from that date.

210.08.02 MAINTENANCE

210.08.02A GENERAL

During the establishment period, and until final inspection, the Contractor shall be responsible for care of the planting to maintain a vigorous growing condition by watering, cultivating, repairing, adjusting tree stakes, spraying for pest control, removing dead trees or trees not showing vigorous growth, and replacing missing or damaged plants.

A watering schedule will be required. The schedule shall be submitted to the City Engineer for review.

210.08.02B MULCHING

During the establishment period a minimum three-foot by three-foot planting area around each tree shall be maintained with a layer of bark mulch two - four inches in depth. The mulch shall be kept at least two inches away from the trunk of the tree, and the mulched planting area around the tree shall be kept free of weeds.

210.08.02C PRUNING REQUIREMENTS

Dead, broken, or split branches shall be pruned at the time of planting.

Trees shall be pruned to remove branches that are crossing, damaged, diseased, broken, or have included bark.

Trees shall not be topped or reduced in height without specific approval of the City Engineer.

Trees shall be pruned so at least two thirds of the tree's height is canopy with one third of the height being the trunk.

The lower limbs shall be pruned off or tipped back to comply with clearance requirements for sidewalks and streets.

Initial structural pruning shall be performed at the end of the three-year establishment period. A strong scaffold branch structure shall be developed by pruning to select the primary scaffold branches.

Pruning shall be performed according to the approved urban forestry pruning standards and specifications.

210.08.03 TREE REPLACEMENT

Any tree that falls under one or more of the following conditions shall be replaced by the developer during the next approved planting season after receipt of the corrective notice.

210.08.03A DEAD TREE

Trees that have no live growth originating in the scaffolding branches.

210.08.03B STRESSED TREE

Trees that have lost a minimum of 50 percent of its total foliage or have a reduction of 50 percent of normal leaf size for that species.

210.08.03C NON-APPROVED TREE

Trees that are not listed on the Approved Street Tree Species List or that have not been approved by the City Engineer.

210.08.04 TREE PROTECTION

Trees shall be protected during the establishment period by the use of the following measures:

210.08.04A MULCH

Installation of bark mulch in the drip line, which is the area directly below the tree's branches, two - four inches in depth and a minimum of three feet by three feet.

210.08.04B ROOT ZONE PROTECTION

No construction or human activity shall take place within the tree's critical root zone. The critical root zone for trees three inches or smaller in caliper shall be an area with a radius of at least three feet from the trunk.

The critical root zone for trees over three inches in caliper shall be an area with a radius of at least one and one-half feet from the trunk for every one inch of caliper size.

No soil grade changes shall take place within the critical root zone.

No storage of material shall be allowed within the critical root zone or protected area of the tree.

210.08.04C PROTECTIVE FENCING

Protective fencing shall be constructed if construction or landscaping has not been completed on the abutting property.

Where required, the critical root zone or tree protection zone shall have a protective fence installed at its perimeter. The protective fence shall be at least four feet in height and made of orange plastic material or approved equivalent.

The protective fencing shall be installed prior to any construction/landscaping activity around the tree and be maintained in place during the construction/landscaping activities and removed only when the final construction is completed.

**** END OF DIVISION ****

