

**STANDARD CONSTRUCTION SPECIFICATIONS
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**SECTION 31 23 33
TRENCHING AND BACKFILL**

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PART 1 GENERAL

1.1 Description

Work covered in this Section includes trench excavation for pipe, utility vaults and other utilities, pipe and utility vault bedding, and trench and utility vault backfill. Excavation classifications and backfill materials are specified in Section 31 23 00, Excavation and Backfill, General.

A. Excavation for Utilities Includes

1. The work of making all necessary excavations for the construction of all contract work.
2. Furnishing, placing and use of sheeting, shoring, and sheet piling necessary in excavating for and protecting the work and workmen.
3. Performing all pumping and work necessary to keep the trenches free from water.
4. Providing for uninterrupted flow of existing rivers, treatment plant processes, drains, and sewers and the temporary disposal of water from other sources during the progress of the work.
5. Damming and coffer damming where necessary.
6. Supporting and protecting all structures, pipes, conduits, culverts, railroad tracks, posts, poles, wires, fences, buildings, and other public and private property adjacent to the work.
7. Removing and replacing existing sewers, culverts, pipelines, and bulkheads where necessary.
8. Removing after completion of the work all sheeting and shoring not necessary to support the sides of excavations.
9. Removing all surplus excavated material.
10. Performing all backfilling and rough grading of compacted backfill to limits specified or ordered by the Engineer.
11. Restoring all property damaged as a result of the work involved in this contract.

B. Suitable Fill Material

The work includes obtaining and transporting suitable fill material from off-site when suitable on-site material is not available.

C. Excavated Material Transport

The work includes transporting surplus excavated material not needed for backfill at the location where the excavation is made, to other parts of the work where filling is required, or disposal of all surplus material on other sites provided by the Contractor.

D. Backfill and Fill Compaction

Test consolidated backfill material in trenches around pipes and structures in conformance with "Compaction Tests" specified herein. Where tests indicate insufficient values, perform additional tests as required by the Engineer. Testing shall continue until specified values have been attained by additional compaction effort.

E. Excavation Dewatering

The work includes furnishing and installing temporary facilities to treat and dispose of any water pumped from the trench or utility vault excavations in a proper and approved manner in accordance with all laws and regulations.

1.2 Submittals

A. Submit results of aggregate sieve analysis and T-180 proctor value. Values submitted shall be used for all granular material compaction testing.

B. See Section 01 33 00 for Contractor submittals.

1.3 Protection

A. Utility Notification Center

The Contractor shall contact the Utilities Notification Center at least 48 hours prior to beginning trenching activities. Additional follow-up calls shall be made when necessary as the work progresses to ensure that all utilities within the work zone are located to prevent damage.

B. Exploratory Test Pits

The Contractor shall dig such exploratory test pits as may be necessary in advance of excavation to determine the exact location and elevation of subsurface structures, pipelines, duct banks, conduits, and other obstructions which are likely to be encountered or need to be connected to and shall make acceptable provision for their protection, support, and maintenance of their continued operation.

C. Sheeting, Shoring and Bracing

1. The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all adjacent and neighboring structures from damage by settlement or other ground movement.
2. Bracing shall be arranged so as not to place a strain on portions of completed work until the construction has proceeded far enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built work and adjacent and neighboring structures.

D. Construction Sheeting Left in Place

1. The Contractor shall furnish, install, and leave in place, construction sheeting and bracing when specified or when indicated or shown on the Drawings.
2. Construction sheeting and bracing, placed by the Contractor to protect adjacent and neighboring structures, may be left in place if desired by the Contractor. All such sheeting and bracing left in place shall be included in the cost for excavation.
3. Any construction sheeting and bracing which the Contractor has placed to facilitate its work may be ordered in writing by the Engineer to be left in place. The right of the Engineer to order sheeting and bracing to be left in place shall not be construed as creating an obligation on its part to issue such orders. Failure of the Engineer to order sheeting and bracing to be left in place shall not relieve the Contractor of its responsibility under the contract.

E. Removal of Water

1. The Contractor shall at all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the work and shall keep said excavations dry until the pipelines to be placed therein are completed. In water bearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation dry as specified.
2. The Contractor shall dispose of water from the work in a suitable legal manner without damage to adjacent property or structures.
See section 31 23 19 Dewatering for additional information.

1.4 Definitions

A. Bedding and Pipe Zone Backfill

Bedding and pipe zone backfill is defined as the furnishing, placing and compacting of material below, around, and above the top of the pipe barrel to the dimensions shown on the trench detail on the Drawings. The minimum depth for pipe bedding shall be 4 inches. The compaction requirement for the pipe bedding and pipe zone shall not be less than that required for the trench backfill above the pipe zone.

B. Trench Backfill Zone

Trench backfill is defined as the furnishing, placing and compacting of material in the trench above the pipe zone, up to bottom of the pavement base rock, ground surface, or surface material.

C. Bedding, Pipe Zone, and Backfill Classification

Class A: Backfill with suitable native excavated material. Place the material in lifts with mechanical compaction sufficient to insure that no bridging occurs. Mound the excess material over the trench.

Class B: Backfill with suitable native excavated material. Place the material in lifts and mechanically compact to a relative density as shown on the Drawings or specified herein. Remove and dispose of excess material.

Class C: Backfill with suitable native excavated material. Place the material in the trench and water settle to a relative density as shown on the Drawings or specified herein. Remove and dispose of excess material.

Class D: Backfill with approved imported granular material. Place the material in lifts and mechanically compact to a relative density as shown on the Drawings or specified herein. Remove and dispose of excess material.

Class E: Backfill with controlled low strength material (CLSM).
See Section 31 23 00, Excavation and Backfill, General.

D. Foundation & Street Base Stabilization

Foundation stabilization is defined as removing unsuitable native material below the design grade of the area being excavated and replacing and compacting with crushed rock to the dimensions shown on the trench detail, as approved by the Engineer, or as otherwise directed by the Engineer. Foundation stabilization material shall be placed in lifts not to exceed eight (8) inches and compacted to 95 percent of the maximum density at optimum moisture content.

E. Classification of Excavated Material

Excavated materials are defined within Section 31 23 00, Excavation and Backfill, General.

1.5 Quality Assurance

A. Compaction Requirements

In place dry density of compacted material shall be at the percent of maximum dry density specified or shown at optimum moisture content determined on the basis of the latest edition of AASHTO T-180.

B. Testing Requirements

An independent laboratory retained by the Contractor and approved by the Engineer will perform all soil sampling and testing. Testing locations and frequencies shall be determined by the Engineer. All testing will be paid for by the Contractor.

1.6 References

A. Standard Specifications for Public Works, APWA, current manual, hereinafter called "APWA Standard Specifications".

- B. Oregon Department of Transportation, Standard Specifications for Highway Construction, current manual, hereinafter called “Standard Specifications for Highway Construction”.

PART 2 MATERIALS

2.1 Native Backfill Material

Native backfill material shall be select excavated native material free from roots or other organic material, trash, mud, muck, frozen material, and large stones and shall comply with the select native fill specification within Section 31 23 00, Excavation and Backfill, General. When native excavated material is approved by the Engineer for backfill around the pipe, it shall be free of rocks, cobbles, stones, or other debris having a dimension greater than 1-1/2 inches.

2.2 Granular Backfill Material

Unless otherwise shown on the plans or specified herein, granular backfill material shall be well graded crushed rock with a maximum aggregate size of 3/4-inch in the bedding and pipe zone, and a maximum aggregate size of 1-1/2-inch in the trench backfill zone. All gradations of crushed rock shall comply with Section 31 23 00, Excavation and Backfill, General.

2.3 Foundation Stabilization Material

Foundation stabilization material shall be 6 inch - 2 inch or 4 inch - 2 inch gravel, free from clay balls and organic debris, and being well crushed gravel or crushed rock graded with less than 8 percent by weight passing the 1/4-inch sieve, as approved by the Engineer.

PART 3 EXECUTION

3.1 Preparation

- A. The site of an open cut excavation shall be first cleared of all obstructions preparatory to excavation. Wherever paved or surfaced streets are cut, saw wheel or approved cutting devices shall be used. Width of pavement cut shall not be less than 12 inches greater than trench width. Any cut or broken pavement shall be removed from site during excavation.

- B. The Contractor shall maintain street traffic at all times and erect and maintain barricades, warning signs, traffic cones, and other safety devices during construction in accordance with the latest edition of Manual of Uniform Traffic Control Devices (MUTCD), Part 6, to protect the traveling public in any area applicable. Provide flaggers as required during active work in roadway areas.
- C. The intent of specifications is that all streets, structures, and utilities are be left in a condition equal to or better than their original condition. Where damage occurs and cannot be repaired or replaced, the Contractor shall purchase and install new material, which is satisfactory to the Owner. Plans and/or specifications cover and govern replacement and restoration of foreseeable damage.
- D. Where clearing of the right of way is necessary, it shall be completed in accordance with Section 31 11 00, Clearing and Grubbing prior to the start of the trenching.
- E. The Contractor's operations shall be confined to rights-of-way and easements provided. Avoid encroachment on, or damage to, private property or existing utilities unless prior arrangements have been made with the Owners and a copy of said arrangements submitted to the Engineer.

3.2 Obstructions and Existing Facilities

- A. Obstructions to the construction of the trench which may be encountered and do not require replacement such as tree roots, stumps, abandoned piling, abandoned buildings and concrete structures, logs, rubbish, and debris of all types shall be removed without additional compensation from the Owner. The Engineer may, if requested, make changes in the trench alignment to avoid major obstructions, if such alignment changes can be made within the perpetual easement and right-of-way and without adversely affecting the intended function of the facility or increased costs to the Owner.
- B. Remaining ends of abandoned pipes or portions of other items partially removed under this work, which would be left exposed after final excavation, shall be removed to within a minimum of one (1) foot of the subgrade or elevation. Ends of abandoned pipes in backfill or embankment areas shall be plugged and sealed as approved. Abandoned railroad tracks shall be removed only as directed by the Engineer or the Engineer's representative. Street surfacing, rail ties, bricks, concrete foundations, and all track appurtenances shall be removed by cutting or other approved methods.

3.3 Interfering Structures or Roadways

- A. The Contractor shall remove, replace, and/or repair any damage done by the Contractor during construction to fences, buildings, cultivated fields, drainage crossings, and any other properties at its own expense and without additional compensation from the Owner. The Contractor shall replace or repair these structures to a condition as good as or better than their pre-construction condition prior to commencing work in the area.
- B. Where paved roadways are cut, trench backfill will be Class D as defined herein. New pavement shall be equal to or better than the existing paved surface, and shall not deviate by more than 1/4-inch from the existing finish elevation. In addition, new pavement shall conform to the Standards and Specifications of the agency which has jurisdiction over the roadway being paved.
- C. If the Contractor encounters existing structures, which will prevent construction and are not adequately shown on the plans, the Contractor shall notify the Engineer before continuing with the work in order that the Engineer may make such field revisions as necessary to avoid conflict with the existing conditions. The cost of waiting or “down time” during such field revisions shall be borne by the Contractor without additional cost to the Owner or liability to the Engineer. If the Contractor fails to so notify the Engineer when a conflict of this nature is encountered, but proceeds with construction despite this interference, the Contractor shall do so at the Contractor’s own risk with no additional payment.

3.4 Easements

- A. Where portions of the work are located on private property, easements and permits will be obtained by the Owner. Easements shall provide for the use of property for construction purposes to the extent indicated on the easements. Copies of these easements and permits will be available from the Owner for inspection by the Contractor. It shall be the Contractor’s responsibility to determine the adequacy of the easement obtained in every case. The Contractor shall confine its construction operations to within the easement limits or street right-of-way limits, or make special arrangements with the property owners for the additional area required and notify the Engineer of any such conditions.
- B. Any damage to private property, either inside or outside the limits of the easements provided by the Owner, shall be the responsibility of the Contractor. Before the Engineer will authorize final payment, the Contractor will be required to furnish the Owner with written releases from the property owners,

where the Contractor has obtained special agreements or easements or where the Contractor's operations, for any reason, have not been kept within the construction right-of-way obtained by the Owner. Any such special agreements must be in written form and shall not involve the Owner or Engineer as to liabilities in any way.

3.5 Trench and Utility Vault Excavation

- A. Excavation for trenches in which pipelines are to be installed shall provide adequate space for workers to place and joint the pipe properly and safely, but in every case the trench shall be kept to a minimum width. The width of trench at the top of the pipe shall not exceed the limits specified or as shown on the Drawings. Excavation for manholes and other structures shall be wide enough to provide a minimum of 12 inches between the structure surface and the sides of the excavation.
- B. Unless otherwise permitted by the Engineer, trenching operations shall not be performed beyond the distance which can be backfilled and compacted the same day, or a maximum of 100 linear feet.
- C. In general, backfilling shall begin as soon as the pipe or conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.
- D. Where the excavation activities require the removal of portions of an abandoned concrete pipeline, masonry plugs shall be installed in the open ends of the pipe, unless otherwise noted on the plans or by the Engineer. Coordinate with Engineer prior to plugging. For plugs less than 36 inches in diameter, 8-inch deep masonry units shall be used. For plugs in larger pipelines, 12-inch deep masonry units shall be used.
- E. Excavated material shall be placed at locations and in such a manner that it does not create a hazard to pedestrian or vehicular traffic, or interfere with the function of existing drainage facilities or system operation. The Contractor shall make arrangements for and dispose of all excess material not required elsewhere on the project at no cost to the Owner.
- F. The Contractor shall provide the materials, labor and equipment necessary to protect trenches at all times. The trench protection shall provide safe working conditions in the trench and protect the work, existing property, utilities, pavement, etc. The method of protection shall be according to the Contractor's design. The Contractor may elect to use a combination of shoring, overbreak,

tunneling, boring, sliding trench shields, or other methods of accomplishing the work provided the method meets the approval of all applicable local, state and federal safety codes. Damages resulting from improper shoring, improper removal of shoring or from failure to shore shall be the sole responsibility of the Contractor.

- G. The Contractor shall remove and dispose of existing abandoned infrastructure piping, structures, and other facilities as necessary to construct the improvements. The cost of such removal will be considered incidental to trench excavation and backfill.
- H. Trench excavation for piping, utility vaults and other utilities shall be performed to the alignment and grade as indicated on the plans or as required by the Engineer. Where grades are not shown, pipe or other utilities shall be laid to grade between control elevations shown on the plans. Water mains shall be installed with a minimum cover of 36 inches unless otherwise approved by the Engineer.

Changes in the grade and horizontal alignment of the pipeline as shown on the plans or as provided elsewhere in the specifications may be necessary due to unanticipated interferences or other reasons. No additional compensation will be allowed the Contractor for changes in horizontal alignment unless otherwise provided for within these specifications. No additional compensation will be allowed for changes in grade, which require additional depth of trench excavation and backfill up to 2 feet from those shown on the plans unless provided for within these specifications.

- I. The trench at all times shall be kept free from water to facilitate fine grading, the proper laying and joining of pipe, and prevention of damage to completed joints. Adequate pumping equipment shall be provided to handle and dispose of the water without damage to adjacent property. Water in the trench shall not be allowed to flow through the pipe while construction work is in progress unless special permission to do so has been given by the Engineer. An adequate water tight plug shall be provided to prevent the entrance of objectionable material into the pipe.
- J. For pipe or utility vaults to have bedding material, excavate to a depth of 6 inches minimum below the bottom of the pipe or utility vault. Care shall be taken not to excavate below depths required. If over digging occurs, the trench bottom shall be filled to grade with compacted bedding material. The width of the pipe trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench shall not exceed 12 inches on either side of the pipe. The width of the trench above that level may be as

wide as necessary for sheeting and bracing and the proper performance of the work.

3.6 Excavation Below Grade

If the trench bottom is unsuitable below the depth required for bedding, the Engineer may require additional excavation. This extra excavation shall be backfilled with compacted foundation stabilization material. This backfill shall be placed in lifts not to exceed 8 inches and compacted to 95 percent of the maximum density at optimum moisture content.

3.7 Tunneling

The Contractor may utilize tunneling methods for installation of pipe where ground conditions are favorable and such methods will not disturb foundations under curbs, sidewalks and other structures. The Engineer must approve tunneling methods. Where tunneling is used, payment for the pipe installation will be made for the equivalent trench excavation and backfill as if the open cut method was used. Payment will not be made for surface restoration including pavement, curbs, sidewalks and other surface improvements whose replacement is avoided by the tunneling method.

3.8 Pipe Bedding

All pipe 1-inch nominal diameter and over, all steel pipe, all ductile iron pipe, all plastic pipe (PVC & HDPE), all pipe under existing or future structures or roadways, and all other pipe shall be laid in pipe bedding material, unless otherwise noted on the plans.

Following the excavation of the trench, compacted pipe bedding material shall be placed the full width of the excavated trench to a depth as shown on the trench detail. In lieu of a detail, the depth shall be as specified in Standard Drawing W1.17. The bottom of the trench shall be accurately graded and rounded to fit the bottom quadrant of the pipe to provide uniform bearing and support for each section of pipe. Depressions for jointing shall be only of such length, depth and width necessary for the proper making of the joint.

3.9 Pipe Zone and Trench Backfill

- A. All backfill except CLSM shall be placed and compacted in 6 to 8-inch lifts. Backfill shall be carefully placed around the pipe and thoroughly compacted in 6 to 8-inch lifts or in a manner satisfactory to the Engineer so as to achieve the specified compaction requirements. When placing pipe zone backfill, the Contractor shall prevent pipe from moving either horizontally or vertically

during placement and compaction of pipe zone material. To prevent damage to the new waterline piping no mechanical compaction shall be permitted within 12-inches of the top of pipe.

- B. Backfill Immediately: All trenches and excavations shall be backfilled immediately after pipe is laid therein and necessary testing is complete, unless otherwise directed by the Engineer. Under no circumstances shall water be permitted to rise in open trenches after pipe has been placed.
- C. Where trenches are under existing or future structures, paved areas, road shoulders, driveways or sidewalks, or where designated on the plans or specified elsewhere in these specifications, the trench backfill shall be Class D or Class E and pipe zone backfill shall be Class D. Class D backfill shall be compacted to 95 percent of maximum density at optimum moisture content.
- D. Where trenches are outside existing or future structures, paved areas, road shoulders, driveways or sidewalks, or where designated on plans or specified elsewhere, the trench backfill shall be Class B or Class D and pipe zone backfill in these areas shall be Class D. For these locations, compaction of Class B backfill shall be to not less than 90 percent of maximum density at optimum moisture content. Class D backfill shall be compacted to not less than 95 percent of maximum density at optimum moisture content.

3.10 Compaction Testing

- A. Compaction tests, performed by an independent agency, will be required to show that specified densities of compacted backfill are being achieved by the Contractor's compaction methods.
- B. Tests of pipeline backfill materials shall be made on each lift of fill for every 100 feet of pipeline trench as measured along the pipe centerline. After the Engineer is satisfied that the Contractor's method of compaction consistently meets specified compaction requirements, the testing frequency may be reduced to not less than one test per lift of fill for every 300 feet of pipeline trench. The Engineer may direct testing at a higher frequency at no additional cost to the Owner upon failure to obtain specified densities or if the Contractor changes compaction equipment or methods of compaction. The Engineer shall determine all test locations.

3.11 Utility Crossings

- A. Vertical clearance between the new pipe and existing utilities shall be 12 inches minimum unless otherwise noted on the plans or specified. Where existing utility lines are damaged or broken, the utility shall be repaired or

replaced, care being taken to insure a smooth flow line and absolutely no leakage at the new joints. Unless otherwise specified herein, all expenses involved in the repair or replacement of leaking or broken utility lines that have occurred due to the Contractor's operations shall be borne by the Contractor and the amount thereof shall be absorbed in the unit prices of its bid.

- B. Water Lines Crossing Sanitary Sewer Lines -- Whenever water lines cross sanitary sewer lines, the Contractor shall comply with Oregon Health Authority requirements and the current Oregon Administrative Rule 333-061-0050(9). Wherever possible, the bottom of the water line shall be 18-inches or more above the top of the sanitary sewer pipe and one full length of the water line pipe shall be centered at the crossing. For clearances less than 18-inches or for water lines crossing under sanitary sewer lines, the Contractor shall replace the existing sanitary sewer pipe with ductile iron or PVC pipe of equal size, or shall encase the existing sewer pipe with concrete for a minimum of 10 feet on both sides of crossing, as directed by the Engineer, at no additional cost to the Owner.

3.12 Disposal of Unsuitable and Surplus Material

- A. All excavated materials which are unsuitable for use in backfilling trenches or around structures, and excavated materials that are in excess of that required for backfilling and for constructing fills and embankments as shown on the drawings, shall be disposed of by the Contractor at its own expense and at disposal sites provided by the Contractor as may be required; except that the Owner reserves the right to require the Contractor to deposit such surplus at locations designated by the Owner within a 2-mile radius.
- B. Surplus excavated material shall be disposed of by the Contractor in a legal manner, in full compliance with applicable codes and ordinances.

3.13 Surface Restoration and Clean-Up

- A. At the end of each work day, all open trenches shall be backfilled and all trenches within streets shall be temporarily paved or covered to the satisfaction of the Engineer. Temporary paving shall be replaced with permanent street paving, at completion of construction within street rights-of-way or sooner if deemed necessary by the Engineer. No gravel-filled trenches shall be left open within the street right-of-way at the end of the workday unless specifically addressed in the permit, or as directed by the Engineer.
- B. Where trenches cross lawns, garden areas, pastures, cultivated fields, or other areas on which reasonable topsoil conditions exist, the Contractor shall remove

the topsoil to the specified depth and place the material in a stockpile. The Contractor shall not mix the topsoil with other excavated material. After the trench has been backfilled, the topsoil shall be replaced.

- C. The Contractor shall clean up and remove all excess materials, construction materials, debris from construction, etc. The Contractor shall replace or repair any fences, mailboxes, signs, landscaping, or other facilities removed or damaged during construction. The Contractor shall replace all lawns, topsoil, shrubbery, flowers, etc., damaged or removed during construction. The Contractor shall be responsible for seeing that lawns, shrubs, etc. remain alive and leave the premises in a condition equal to its original condition before construction.

END OF SECTION