

CITY OF UNION, OREGON
TECHNICAL SPECIFICATIONS
SECTION 4

EXCAVATION AND BACKFILL OF TRENCHES

A. GENERAL

These specifications cover excavation and backfill of trenches for the installation of storm sewer, sanitary sewer, water lines, service lines, pressure sewer lines, and other underground utilities.

Items specified in this Technical Specification are intended to be broad in scope and may not always apply to all items of work to be constructed. All applicable sections, as determined by the City Engineer, shall control the work outlined in the Drawings and Specifications.

B. SAFETY

All trench excavation and backfill shall be performed in accordance with the provisions of the Occupational Safety and Health Regulations of the Oregon Occupational Safety and Health Division, and other applicable regulations. It shall be the Contractor's responsibility to meet all requirements of Chapter 437 of the State of Oregon Administrative Rules. In addition, Oregon Revised Statutes (ORS) 757.541 through 757.571 and Oregon Administrative Rules (OAR) 860-24-006 and 860-24-007 administered by the Oregon Public Utilities Commission shall apply.

It shall be the Contractor's sole responsibility to provide a "competent person" as defined in the regulations to be on the project site during all trenching operations. The "competent person" appointed by the Contractor shall fulfill all requirements of the regulations.

Prior to opening an excavation, the Contractor shall arrange for field location of utility installations such as sewer, telephone, fuel, electric, gas, water lines, or any other underground installations that reasonably may be expected to be encountered during the excavation work. When excavation operations approach the estimated location of underground installations, the Contractor shall determine the exact location of the installations by safe and acceptable means. While the excavation is open, underground installations shall be protected, supported, or removed as necessary to safeguard workers.

The Contractor shall ensure that structural ramps that are used by workers as a means of access or egress from an excavation shall be designed by a competent person, in accordance with all requirements of the regulations. A stairway, ladder, ramp, or other safe means of egress shall be located in trench excavations that are four feet or more in depth so as to require no more than 25 feet of lateral travel for workers.

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Workers exposed to public vehicular traffic shall be provided with and shall wear warning vests or other suitable garments marked with, or made of, reflectorized or highly visible material. No worker shall be permitted underneath loads handled by lifting or digging equipment. Workers shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped in accordance with the regulations to provide adequate protection for the operator during loading and unloading operations.

The Contractor shall take adequate precautions, in accordance with the regulations, to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions. These precautions include providing proper respiratory protection or ventilation and, when controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, the Contractor shall provide testing as often as necessary to ensure that the atmosphere remains safe. The Contractor shall provide emergency rescue equipment, such as breathing apparatus, safety harness, etc., where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

The Contractor shall not allow work in excavations in which there is accumulated water or in excavations where water is accumulating, unless adequate precautions have been taken to protect workers against the hazards posed by water accumulations. The precautions necessary to protect workers adequately vary with each situation, but include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and life line. If the Contractor is controlling water or preventing it from accumulating by the use of water removal equipment, the water removal equipment and operation shall be monitored by a competent person to ensure proper operation. If excavation work interrupts the natural drainage of surface water, such as streams, then diversion ditches, dikes or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation.

In situations where the Contractor feels his trench operations pose a risk to the stability of adjoining buildings, walls, or other structures, he shall notify the City Engineer, and shall provide adequate support systems per the requirements of the regulations. Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to workers shall not be permitted except when the Contractor has retained a Registered Professional Engineer and he has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity, or said Registered

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Professional Engineer has approved the determination that such excavation will not pose a hazard to workers.

Sidewalks, pavements, and appurtenant structures shall not be undermined unless a support system or other method of protection is provided to protect workers from the possible collapse of such structures. The Contractor shall provide adequate protection to all persons from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. The Contractor shall also provide protection by placing and keeping excavated materials or equipment at least two feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations or by a combination of both, if necessary.

The Contractor shall ensure that daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person appointed by the Contractor for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspection shall also be made after every rain storm or other hazard increasing occurrence. These inspections are only required when worker exposure can be reasonably anticipated. Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, the Contractor shall remove workers from the hazardous area until the necessary precautions have been taken to ensure their safety.

It shall be the Contractor's responsibility to provide all physical barrier protection at all excavations. All wells, pits, shafts, etc., shall be barricaded or covered. Further, no trenches shall be left open at any time unless guarded with adequate barricades, warning lamps, and signs. Proper traffic and pedestrian control shall be provided by the Contractor.

The Contractor shall ensure that each worker in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with the regulations, except when excavations are made entirely in stable rock, or excavations are less than five feet in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

It shall be the Contractor's responsibility to design the sloping and benching systems for trench excavation in accordance with the requirements of the regulations stated herein. Where the Contractor takes the option to not utilize one of the standard tables

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or trench excavation designs contained in OAR Chapter 437, then it is the Contractor's responsibility to retain a Registered Professional Engineer to design said sloping and benching system. When the Contractor chooses this option, the design shall be in written form and shall include at least the following information:

1. The magnitude of the slopes that were determined to be safe for the particular project.
2. The configurations that would determine to be safe for the particular project.
3. The identity of the Registered Professional Engineer approving the design.

At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available upon request.

Where the design of a support system, shield system, or other protective system is required, it shall be the Contractor's responsibility to meet all requirements of the regulations. It shall be the Contractor's responsibility to have on-site at least one copy of the manufacturer's tabulated data which identifies the Registered Professional Engineer who approved the data or, when a support system or shield system or other protective system is not a standard manufactured item but is designed by a Registered Professional Engineer, at least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available upon request.

C. EXISTING UTILITIES

The Contractor shall work closely with the owner of utilities or structures affected by the work to avoid any damage. The Contractor shall review the requirements in the Special Conditions for the protection and preservation of survey monuments.

The Contractor shall be responsible for the actual locating and protecting of existing utilities. The Contractor, prior to commencement of work, shall contact existing utility companies such as power, telephone, gas, etc., to have the Utility Companies locate all utilities which will be affected by the work to be performed. The Contractor shall give 48-hour notification in accordance with ORS 757-541. The "call before you dig" number is 1-800-332-2344. The Contractor shall perform all necessary coordination work with the utility companies in performing the work and shall be fully responsible for any damage to existing utilities caused by the Contractor's operations. The Contractor

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shall make any advance exploration necessary to protect all existing utilities and to properly plan the installation of pipelines to the design line and grade.

If a conflict develops between the design line and grade of a pipeline and an existing utility, the Contractor may adjust the pipeline grade or have the existing utility relocated, and such changes shall be reviewed with the City Engineer. The existing utility may be relocated by the owner of the utility or its designated representative or by the Contractor upon the approval of the utility owner. The Contractor shall perform all relocation work required.

The owner of the utilities shall normally be responsible for taking the utility out of service if necessary for the performance of the work; i.e., shutting valves, etc. In the case of water valves, the City may operate the valves or request the Contractor to do so. When the Contractor is requested to do so, the Contractor shall operate water valves as a normal part of the work. All water valves shall be operated as instructed by the City. It can be expected that some valves may not fully operate properly which may require that additional valves be operated. This situation shall be considered a normal requirement of the work.

The Contractor shall receive prior approval from the appropriate authority or utility owner before any public or private utility service is interrupted. The Contractor shall give a minimum of 4 hours notice to all utility customers who will be affected by the Contractor's operations. No utility service shall be disconnected or interrupted for more than 9 hours or as required by the utility owner, whichever is less, in any 24-hour period. When disruption of service will be longer than 9 hours in any one day, the Contractor shall provide safe and appropriate temporary service. All temporary service shall be coordinated with the utility owner. When regular utility service interruption is required during the course of the work, the Contractor shall submit a written plan to the City Engineer and utility owner which details proposed work plan notification procedures, and estimated extent of service interruption. The Contractor must obtain written approval of his plan from the utility owner prior to interrupting the utility service. As a minimum, notification shall include door hangers and public notification in the newspaper and radio, as appropriate. Personal contact shall be made where practical. The Contractor shall make every effort possible to provide continuous utility service to all utility customers. When special conditions exist where an interruption of utility service would create an extra hardship on the utility customer or create a hazardous condition, the Contractor shall provide continuous service. Particular care and planning must be arranged to provide continuous service of existing services or temporary services as approved by the utility owner. If the Contractor inadvertently damages or interrupts an existing utility, the Contractor shall immediately notify affected utility users and make arrangements to provide temporary service to the parties affected and shall repair said utility as required by the utility owner.

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The Contractor shall support and otherwise protect all pipes, conduits, cables, poles, and other existing services where they cross the trench or are otherwise undermined or affected by his work. The Contractor shall restore the support of an undermined existing utility using select backfill compacted to 95 percent maximum density as determined by ASTM D-698 or WSDOT Test Method 606, as applicable.

D. CUTTING OF ASPHALT PAVEMENT, AND CONCRETE SIDEWALKS, CURBS AND DRIVEWAYS

Where the excavation is made in an existing paved street, the asphalt surface shall be cut on each side of the trench prior to excavation, to provide a vertical joint in the surface. Cutting of the asphalt will be made with a saw designed for the cutting of asphalt. The use of a jackhammer, wheel cutter, or other similar tool may be allowed by the City Engineer only when the Contractor can demonstrate that the alternate method provides a neat straight edge.

Prior to excavating across a concrete structure such as a curb, sidewalk, or driveway, the Contractor shall cut and remove a section of the structure in order to provide for his excavation. The dimensions of the removed section shall be such that the Contractor's excavation will not result in undermining of the remaining structure. The Contractor shall cut the concrete structure with a diamond saw or other equipment designed for that purpose such that a neat, straight, vertical edge is left on the remaining concrete structure. The Contractor shall similarly cut and remove any such concrete structure undermined or damaged by his construction work.

Following proper backfill and compaction of his excavation, as specified herein, the Contractor shall repair streets, replace the curbs, sidewalks, or driveways in conformance with the Drawings and Specifications, and permit requirements. Surface restoration shall be performed in accordance with Technical Specifications - "Surface Restoration"

E. CLEARING AND GRUBBING

Contractor shall do all clearing and grubbing and removal of structures, etc. necessary to permit proper installation of the pipeline and to eliminate the possibility of stumps, logs, brush, or rubbish being mixed with the backfill material. A sufficient amount of all stumps and stump roots shall be removed so that any future removal of any remaining parts of the stumps and/or roots will not damage the pipeline. All stumps, roots, logs, brush and rubbish shall be removed and disposed of in conformance with the requirements of local authorities controlling air pollution, and solid waste disposal.

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Should the area in which construction takes place be served by rural mail carrier service, the Contractor shall cooperate with the mail service and re-install, in a convenient location, any rural mail boxes which will have to be removed or be blocked by construction operations. As soon as the work is completed, all mail boxes removed shall be replaced undamaged in their original location.

As soon as the work is completed, all signs, guardrails, utility poles, fences, etc., which were moved for the construction operation shall be replaced undamaged in their original location. Damaged items shall be replaced by the Contractor with new items of equal quality.

F. DUST AND MUD CONTROL

The Contractor shall take appropriate action to control dust and mud caused by his operations. This shall include, but not be limited to, watering of exposed areas, cleaning of roadways, etc. This is considered a normal part of the construction project.

G. TRENCH EXCAVATION

1. General Trench Excavation. General trench excavation shall include whatever materials that are encountered to the depths shown on the Drawings or as required to properly install the pipe.

2. Trench Width. The maximum trench width in the pipe zone shall be 2 feet plus the O.D. of the pipe and the minimum trench width in the pipe zone shall be 1 foot plus the O.D. of the pipe. This width shall be maintained to the top of the pipe. The maximum clear width above the top of the pipe will not be limited except in cases where excess width of excavation would cause damage to adjacent structures or utilities. The determination of the safe trench width is the sole responsibility of the Contractor.

3. Unsuitable Material. When natural soil conditions exist in the bottom of the trench that are unsuitable for proper pipe installation, the Contractor shall immediately notify the City Engineer. The Contractor may then be requested to over-excavate the trench below the design grade to a depth specified by the City Engineer and place foundation material, or the Contractor may be requested to install a geotextile stabilization fabric.

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4. Shoring, Sheeting, and Bracing of Trenches. The Contractor shall adequately sheet and brace the trench during excavation whenever necessary to satisfy trench safety standards, prevent cave-ins, or to protect adjacent structures or property. Where sheeting and bracing are used, the Contractor shall increase trench widths for the bracing material accordingly. The sheeting must be kept in place until the pipe has been placed, backfilled at the pipe zone, tested for defects, and repaired if necessary. All sheeting, shoring, and bracing of trenches shall conform to the requirements of the public agency having jurisdiction.

H. DEWATERING EXCAVATION AREA

All groundwater, seepage, or stormwater that may occur or accumulate in the excavation during the progress of the work shall be removed. In areas where the nature of soil and hydrostatic pressures are of such a character as to develop a quick condition in the earth mass of the trench, the dewatering operation shall be conducted so that the hydrostatic pressure will be reduced to or near zero in the immediate vicinity of the trench. All excavations shall be kept free of water during the construction. The Contractor shall dispose of all waste and water removed from the trench. Disposal shall be in accordance with all state and local regulations.

I. LOCATION OF EXCAVATED MATERIALS

During trench excavation, the excavated material shall be located within the construction easement or right-of-way so that the excavated material will not obstruct any private or public traveled roadways or streets, or cause undue damage to the streets. The Contractor shall provide means of containing overly saturated soils, i.e., muck, or remove the muck from the work area as it is excavated, if such soils are encountered in the excavation. The intent is to prevent excessive damage or disruption to street rights-of-way or easement beyond what would normally occur during such work. Pile and maintain material from trenches so that the toe of the slope of the material excavated is at least two feet from the edge of the trench. It shall be the Contractor's responsibility, however, to determine the safe loading of all trenches.

J. DISPOSAL OF MATERIALS

The Contractor shall dispose of all excavated material, which is not required for, or is unsuitable for, backfill. The Contractor's method of disposal shall comply with regulations of the governing body having jurisdiction.

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K. TRENCH BACKFILL

1. General. The term backfill, as hereafter used, is the filling of the trench to the natural ground level or the finish grade line shown on the Drawings. All backfill material shall be placed into the trench so that free fall of the materials into the trench is prevented until at least two feet of cover is provided over the pipe. Under no circumstances shall sharp or heavy pieces of material be allowed to drop directly onto the pipe. Methods of backfilling, other than as specified herein, shall be used only upon the approval of the City Engineer.

2. Foundation Material/Trench Stabilization Fabric. Foundation material or stabilization fabric will only be required when standard bedding requirements will not adequately support the pipe. Foundation material shall be a well-graded 2 1/2"-0 or 1 1/2"-0 crushed rock.

As an alternative to over-excavation and placement of foundation material, a geotextile stabilization fabric may be used if field use proves acceptable and is approved by the City Engineer. The fabric material shall be placed on the bottom of the trench and the bedding material placed over the fabric to proper pipe grade. The fabric width shall be one foot wider than the trench bottom. Fabric material shall be Mirafi 500X or approved equal.

3. Bedding and Select Backfill. Bedding and select backfill materials shall be subject to the approval of the City Engineer. Acceptable materials include well-graded 3/4"-0 crushed rock.

A minimum 4-inch depth of bedding shall be placed on the trench bottom, compacted to 85 percent of the maximum density as determined by ASTM D-698 or WSDOT Test Method 606, as applicable, and smoothed to provide uniform bedding so the pipe is supported along its full length and not by the bells. It shall be understood that the 4-inch depth is a minimum depth only, not an average depth and does not preclude the Contractor at his option from placing additional depth of bedding to facilitate his work. Once the pipe is properly installed, the bedding material shall be brought up to the spring line of the pipe in 4-inch lifts and compacted to 85 percent density. Care shall be used to ensure that the bedding material is properly worked under the haunch of the pipe for its full length.

Select backfill shall then be brought up from the spring line to a minimum of 6 inches for water lines, and 12 inches for sewer and storm sewer lines above the top of the pipe, leveled and compacted to 85 percent of ASTM D-698 or WSDOT Test Method 606, as applicable, density. Compaction of the bedding and select backfill by hand tamping will

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be allowed if the 85 percent density is achieved; otherwise, mechanical tamping will be required.

4. General Backfill. General backfill will consist of material excavated from the trench, or material imported by the Contractor. General backfill material shall be free of vegetative matter, boulders (10-inch plus), frozen material and any other unsuitable material, and shall have a moisture content that will allow for the required compaction of the general backfill material unless approved otherwise by the City Engineer. Use of backfill material containing consolidated masses 10-inch in diameter or greater is prohibited. When necessary, the Contractor shall selectively separate suitable general backfill material from unsuitable general backfill material. When the City Engineer determines that the native material excavated from the trench is unsuitable or unacceptable for use as general backfill, the City Engineer may require the Contractor to remove the unsuitable material from the project site and import suitable general backfill material. When imported general backfill must be placed in or below the groundwater, the imported general backfill shall be free draining granular material with less than 20 percent passing a No. 4 sieve and less than 3 percent passing a No. 200 sieve.

All general backfill material shall be pushed first onto the slope of the backfill previously placed and allowed to roll down into the trench. The Contractor shall not push the backfill material directly into the trench until at least two feet of cover is provided over the pipe.

5. Compaction. In roadways, driveways, under curbs and sidewalks, general backfill shall be placed in horizontal lifts and compacted to 90 percent of the laboratory density as determined by ASTM D-1557 or WSDOT Test Method 606, as applicable. The method of compaction shall be selected by the Contractor. The Contractor shall exercise extreme care to avoid damage to the pipe during compaction of the trench. Where materials consist of cobbles and coarse gravels, compaction of each lift shall be accomplished by at least five passes of an appropriate vibrating type compactor. When materials are such that meaningful in-place density test cannot be run, then the Contractor and City Engineer will agree on a method of compaction which will provide adequate compaction.

In sections where specific compaction requirements are not specified, or required by the City Engineer, general backfill shall be compacted, as a minimum, to a density equal to that of the natural ground adjacent to the trench. All trenches shall be maintained for a period of one year after final acceptance of the project. Any settlement of the trenches during the one-year guarantee period shall be remedied promptly at the request of the City Engineer and at no cost to the City.

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6. Controlled Density Fill (flowable fill or lean mix backfill). When called for on the Drawings or Specifications, or where required by state highway or county road crossing permits, the Contractor shall backfill trenches with controlled density fill. The controlled density fill shall be placed in the trench in such a manner to ensure the trench is completely filled. The controlled density fill shall be protected from traffic loads for a three-hour period after which required surface restoration work may be performed.

Controlled density fill material shall be a flowable cement, sand, and Fly Ash Pozzolanic, or other approved materials, mixture that contains 75 to 120 pounds of Type II cement per cubic yard. The sand and other aggregates shall generally conform with the requirements of ASTM C-33. Air-entraining agent shall be added at the rate of 3 to 5 oz. per cubic yard. The material shall have a 28-day compressive strength of 100-200 psi and have a slump of 7 inches \pm 1/-1/2-inch at the time of placement. The Contractor shall provide a mix design and data on the controlled density fill material he proposes to use along with typical compression test results.

7. Canal or Irrigation Ditch Crossing. Where the trench crosses a canal, irrigation ditch or culvert, the backfill shall be compacted the entire trench depth with mechanical tampers to 90 percent of the laboratory density as determined by ASTM D-1557. All backfill material in the canal or ditch liner and in the trench cut-off wall shall be imported clay or a soil/bentonite mixture as approved by the City Engineer. Unless required otherwise, the soil/bentonite mixture shall be 1 part bentonite to 10 parts soil by weight. A high grade bentonite material shall be used. The ditch lining, conduit or pipe shall be restored to its original condition. The crossing shall be water tight and free of any leakage or seepage. The Contractor shall be fully responsible for repairing canal or ditch banks at no cost to the City should leakage occur at the crossing.

L. RESTORATION, FINISHING, AND CLEANUP

The Contractor shall restore or replace all paved surfaces, graveled surfaces, curbing, sidewalks, trees and shrubbery, lawns, pastures and fences, or other existing facilities disturbed by his work unless otherwise specified. Restoration and cleanup shall be a continuing operation and shall be diligently pursued until completed. All surplus material and temporary structures as well as excess excavation shall be removed by the Contractor and the entire site of Contractor operations shall be left in a neat and clean condition as outlined in the General Conditions. Surface restoration shall be performed in accordance with Technical Specifications - "Surface Restoration." All other existing facilities shall be replaced or restored equal to their original condition.