

CHAPTER 2 - TRENCH EXCAVATION AND BACKFILL

2.1 GENERAL

This section covers the requirements for trenching and backfilling for underground pipelines. Unless otherwise shown or ordered, pipe shall be laid in an open trench. All incidental clearing, preliminary grading, structure removal, and benching shall be considered a part of the trenching operation.

2.2 SHEETING, BRACING AND SHORING OF EXCAVATIONS

All trench excavations shall comply with current Occupational Safety and Health Administration (OSHA) regulations.

The Developer/Contractor shall be fully responsible for the adequacy of methods and materials used in trench sheeting, bracing, shoring, and other systems provided to protect workers. Injury to or death of workers resulting from inadequate trench safety measures shall be the full and complete responsibility of the Developer/Contractor. All damages resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Developer/Contractor, and the Developer/Contractor shall perform all necessary repairs or reconstruction at its own expense resulting from such damage.

2.3 CONTROL OF GROUNDWATER

All trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing, and pipe embedment operations. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in all cases where the static groundwater is above the bottom of any trench or bell hole excavation, such groundwater shall be lowered to the extent necessary to keep the trench free from water and the trench bottom stable when the work within the trench is in progress. When dewatering is required, the Contractor shall be required to obtain the Utah State Dewatering Permit (General Permit for Construction Dewatering & Hydrostatic Testing). Under no circumstances shall the sanitary sewer be used for disposal of trench water. Surface water shall be prevented from entering trenches as well.

2.4 TRENCH EXCAVATION

Excavation for pipelines shall be located as shown on the Drawings or as staked in the field. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:

2.4.1 Authorized Over-Excavation:

Where ledge-rock, cobble rock, stones or other material render the trench material unsuitable for pipe bedding, as determined by the City Engineer / Public Works Representative, bedding material shall be imported and placed. The trench shall be excavated to a minimum depth of six-inches (6") below the bottom of pipe.

Where unstable material is encountered in the excavation, foundation material shall be required in order to stabilize the bottom of the trench. It is the Contractors responsibility in such cases to provide and place sufficient material to stabilize the bottom of the trench to allow for proper placement of the pipe.

2.4.2 Unauthorized Over-Excavation:

Any excavation carried below the elevation required to install the pipe as specified in these Specifications, or directed by the City Engineer / Public Works Representative, shall be considered to be unauthorized. Such excavation shall be backfilled in accordance with these Specifications for "Imported Granular

Material" and "Gravel Foundation for Pipelines and Pipeline Structures," all at the Developer/Contractor's expense.

2.4.3 Trench Width:

The trench shall be excavated such that the pipe is always centered in the trench. The minimum clear trench width at the horizontal diameter of the pipe must not be less than the outside diameter of the pipe plus twelve inches (12") on each side of the pipe.

Trench width for pipeline structures, valves, or other accessories shall be sufficient to leave at least twelve inches (12") clear between their outer surfaces and the trench. Backfill with earth under structures or valves will not be permitted. Any unauthorized excess excavation below the elevation indicated for foundation of any structures shall be backfilled in accordance with these specifications for "Imported Granular Materials," and "Gravel Foundation for Pipe & Pipeline Structures," at the Developer/Contractor's expense.

2.4.4 Trenches in Embankments:

Before laying pipes that are to be in fill or embankment areas, the embankment shall first be placed and compacted to the specified density to a depth of not less than two feet (2') above the top of the proposed pipe. After placing and compacting the embankment, the trench for the pipe or conduit shall be excavated through the fill and fine graded and the pipe installed as specified.

2.4.5 Placement of Excavated Material:

All excess material shall be hauled away from the construction site and disposed of in an area obtained by the Developer/Contractor and approved by the City Engineer / Public Works Representative. The Developer/Contractor shall be responsible for all rights-of-way, easements, and access associated with the disposal of excess excavated material. It shall further be responsible to obtain permission from the property owner or person controlling the property where the Developer/Contractor plans to dispose of excavated material. No compensation will be made to the Developer/Contractor for disposal of excess excavated material.

Non-excess excavated material shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters and irrigation ditches shall be kept clear or other satisfactory provisions shall be made for street drainage and continuity of irrigation.

Grading of the area surrounding the trenches, including excavated materials, shall be performed as necessary to prevent surface water from flowing into trenches, or other excavations. Control of groundwater shall be as specified in section 2.05, Control of Groundwater.

2.4.6 Fine Grading the Trench Bottom:

The bottom of the trench shall be accurately graded and prepared to provide uniform bearing and support on undisturbed soil or compacted granular bedding at every point along the entire length of the pipe. Bell holes shall be excavated after the trench bottom has been fine graded. Bell holes shall be only large enough to permit making the joints and to assure that any portion of the joint or bell does not support the pipe.

2.5 TRENCH BACKFILL

Trench backfill for piping consists of three (3) zones: foundation, pipe embedment, and backfill.

Foundation - is defined as the region below the pipe embedment.

Pipe Embedment - is a commonly used term that refers to the region including the bedding and pipe zones, or any region within one foot (1') of any pipe, pipeline structure, or accessory.

Granular Backfill - is defined as the region above the pipe embedment zone to the bottom of the structural street cross section.

All fill materials shall be compacted as specified in this section.

The City Engineer / Public Works Representative shall determine the suitability of excavated materials for use as foundation or backfill. When the excavated materials are not satisfactory the Developer/Contractor shall provide imported granular material.

2.5.1 Imported Granular Material:

Imported granular material for foundation, bedding, and backfill shall be cleaned crushed rock or gravel, free from sod, vegetation, and other organic or deleterious material. Slag will not be allowed in the pipe embedment. Imported granular material shall conform to the following gradation specifications:

- 1) Foundation Material: One hundred percent (100%) less than six-inch (6") and maximum of five percent (5%) less than three-quarter-inch (3/4"). Recycled concrete will not be allowed in the public right-of-way.
- 2) Pipe Embedment Material:
 - a. Storm Drain and Sanitary Sewer: Washed aggregate, maximum size one-and-one-half-inch (1 1/2"), minimum size three-quarter-inch (3/4"). Recycled concrete will not be allowed in the public right-of-way.
 - b. Culinary Water and Pressure Irrigation: Washed sand (for all mains and services, regardless of pipe material). Recycled concrete will not be allowed in the public right-of-way.
 - c. Washed Sand: Friable river or bank aggregate, free of loam and organic matter. Graded as follows.

Sieve	Percent Passing by Weight
3/8	100
100	1 - 10

- 3) Granular Backfill Material: Three-inch to four-inch (3"-4") well-graded engineered fill meeting A-1-a, (AASHTO M 145 or ASTM D3282). Recycled concrete will not be allowed in the public right-of-way.

Sieve	Percent Passing by Weight
4"	100
2"	80 -95
1"	55- 85
3/8"	40 – 70
No. 4	25 – 55
No. 10	20 – 50
No. 40	10 – 30
No. 200	2 - 15

AASHTO Soil Classification System (from AASHTO M 145 or ASTM D3282)											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	---	---	---	---	---	---	---	---	---	---
0.425 (No. 40)	30 max	50 max	51 min	---	---	---	---	---	---	---	---
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	---		---	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min*
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			
*Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL - 30.											

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL - 30

2.5.2 Foundation Material Placement:

When over-excavation is authorized by the City Engineer / Public Works Representative, foundation material shall be placed in the foundation zone and below. The foundation material shall be placed so that the trench can be properly fine graded as specified. The foundation material shall be deposited over the entire trench width and compacted in layers. The layers shall have a maximum uncompacted thickness of six-inches (6”).

The material shall then be fine graded in accordance with the specification for fine grading herein.

2.5.3 Pipe Embedment Material Placement:

- 1) Storm Drain: After the pipe is in place, embedment material shall be placed at any point below the mid-point of the pipe simultaneously and uniformly on both sides of the pipe up to one-half the diameter of the pipe (i.e. to the spring-line of pipe). (See Standard Trench Detail drawing.) Embedment material shall be placed with care to prevent displacement of or damage to the pipe during the embedment process. Embedment material shall be scattered alongside the pipe and not dropped into the trench in compact masses.

- 2) Sanitary Sewer: After the pipe is in place, embedment material shall be placed at any point below the mid-point of the pipe simultaneously and uniformly on both sides of the pipe up to one-half the diameter of the pipe (i.e. to the spring-line of pipe). Pipe shall then be “haunched” for the entire length of the pipe prior to placement of remaining embedment material. (See Standard Trench Detail drawing.) Embedment material shall be placed with care to prevent displacement of or damage to the pipe during the embedment process. Embedment material shall be scattered alongside the pipe and not dropped into the trench in compact masses.
- 3) Culinary Water and Pressure Irrigation: After the pipe is in place, the embedment material shall be deposited over the entire trench width and shall have a maximum un-compacted thickness of eight-inches (8”) per lift. Each lift shall then be compacted to the specified density requirement before placement of additional lift(s). (See Standard Trench Detail drawing.) Embedment material shall be placed with care to prevent displacement of or damage to the pipe during the embedment process. Embedment material shall be scattered alongside the pipe and not dropped into the trench in compact masses.

2.5.4 Granular Backfill Material Placement:

Granular backfill shall be from top of embedment material to the level shown on the Drawings. The backfill material shall be deposited over the entire trench width and shall have a maximum un-compacted thickness of twelve-inches (12”) per lift. Each lift shall then be compacted to the specified density requirement before placement of additional lift(s). (See Standard Trench Detail drawing.) Backfill shall be compacted by means of sheepfoot rollers, pneumatic tire rollers, vibrating rollers, or mechanical tampers.

2.5.5 Compaction:

Within the public right-of-way the in-place density shall be a minimum of 95% of laboratory standard the maximum dry density as determined by AASHTO T-180 (Modified Proctor). In other areas the in-place density shall be a minimum of ninety percent (90%) of the maximum dry density as determined by AASHTO T-180 (Modified Proctor).

If the required relative density is not attained, Developer/Contractor will be required to make any adjustments in compaction equipment, thickness of layers, moisture content and compactive effort necessary to attain the specified minimum relative density.

2.6 PRIVATE PROPERTY ACCESS AND RESTORATION

At road crossings or where existing driveways occur on a road, the Developer/Contractor shall make provisions for trench crossings either by means of backfill, tunnels, or temporary bridges.

Any disturbance to property caused by the Developer/Contractor’s activity shall be restored to the satisfaction of the owner of the property. If necessary, shrubs, fences, or other objects shall be removed carefully. If work must occur on a lawn, the lawn shall be cut to a width of two feet (2’) wider than the intended work area (one foot (1’) on each side). The lawn sod shall be stacked separately from and shall not be mixed with other excavated material.

After the sod is removed, if excavation is necessary, the topsoil shall be removed to a depth of twelve inches (12”), or the actual depth of the topsoil, whichever is less. The topsoil shall be stored separately from and shall not be mixed with other excavated material.

Following completion of the backfilling and the compaction of the trench, the Developer/Contractor shall replace topsoil, lawn sod, shrubs, fences, and other items that may have been removed from within the work area and shall clean up and remove any rocks, dirt or any other debris that remain from the construction work. The Developer/Contractor shall obtain a release from the property owner stating that the repairs have been made to the

satisfaction of the Owner. A copy of said release shall be delivered to the City Engineer / Public Works Representative.

2.7 RESTORATION OF CONSTRUCTION SITE

During the progress of the Work, the Developer/Contractor shall clean up all construction debris, excess excavation, and excess materials, and shall restore all fences, irrigation structures, ditches, culverts, and similar items. The Developer/Contractor shall stockpile the excavated trench material so as to do the least damage to adjacent grassed areas, or fences, regardless of whether these are on private property or public rights-of-way. All excavated materials shall be removed from grassed and planted areas and these surfaces shall be left in a conditions equivalent to their original surface and free from all rocks, gravel, boulders, or other foreign materials.

2.8 DEVELOPER/CONTRACTOR'S RESPONSIBILITY

The Developer/Contractor will be responsible to see that the backfilling and compaction are properly and adequately done. Settlement of trenches within a period of one (1) years after final acceptance of the project shall be considered incontrovertible evidence of inadequate compaction, and the Developer/Contractor shall be responsible for correcting the condition in accordance with the provisions of these Specifications. This includes the replacement of sidewalk, curb and gutter, and other surface improvements.