

Chapter 14. TRENCHING, BACKFILLING, & COMPACTING - UTILITIES

14.1 General

This chapter addresses trenching, backfilling and compacting for wet and dry utilities in the public Right of Way and public easements for both new projects and repair. All trenching activities shall comply with the requirements of OSHA's "Construction Industry Standards" as well as all applicable Federal and State regulations for safety.

14.2 Equipment

14.2.1 Trenching Equipment

The use of trench digging equipment will be permitted in places where its operation will not cause damage to existing structures or features, in which case hand methods shall be employed.

14.2.2 Tracked Vehicles

No tracked vehicles shall be permitted on streets' subgrade unless otherwise accepted by the Engineering Division. Damaged facilities will be restored to original condition at the Developer's expense.

14.2.3 Haul Routes

Haul routes for equipment and materials may be restricted as a condition of the Permit.

14.3 Trenching for Utilities

14.3.1 Excavation for Utility Trenches

General

Contractors are responsible for the location of utilities prior to digging and responsible for the protection of Existing Underground Utilities. The Engineering Division requires all contractors working in the City of Northglenn to implement the Subsurface Utility Engineering requirements.

Types of Utility Excavation

The construction of any repair activity within the street or alley shall be accomplished by open cut, jacking, boring or a combination of these methods, as approved by the required permit(s). The Engineering Division is the entity to approve any change from the approved permit(s). Only for pipes 6" or less in diameter, crossings under sidewalks or curbs may be made by tunneling.

Location of Underground Structures

The Developer shall proceed with caution in the excavation of the trench, so that the exact location of underground structures, both known and unknown, may be determined. The contractor shall locate all existing underground utilities, by non-destructive means, before trench excavation. The Engineering Division may require "potholing" and visual location of certain utilities.

Open Trenches

Once trenches are excavated, the Contractor shall proceed diligently towards completion of the work and completion of the backfill. The Engineering Division reserves the right to limit the length of open trench during construction.

Flow Fill

Excavated material may be used as fill for the trench if the material meets requirements of borrow material and approved in the Right of Way permit. If the material is unacceptable, it shall be stockpiled separated and disposed of by the Contractor. All small projects are required to utilize flow fill instead of native soil backfill. The Right of Way Permit process shall determine if the Contractor is required to use flow fill.

Trees

The Contractor shall protect trees that are adjacent to their excavation to ensure that roots and/or branches are not adversely affected by the excavation equipment.

14.3.2 Removal of Pavement

Open Pavement Cuts

Open pavement cuts shall not be permitted on any street unless approved in the Right of Way permit.

Placement of Pavement Cuts

The pavement cut shall follow a line parallel to the roadway centerline and at least two (2) feet beyond the trench side wall. All pavement cuts parallel to the direction of travel shall be placed on the lane line or at the center of the aligned travel lane. For bicycle lanes, the cut shall be at the line or the edge of the gutter. Longitudinal joints are not allowed in the wheel path.

Repair of Damage Beyond Original Cut

If pavement adjoining the original pavement cut is damaged during construction, additional pavement shall be removed and repaired after trench backfilling. The additional pavement shall be removed with the original cuts. The additional pavement damaged by the Contractor shall be repaired at the Contractor's expense.

Disposal of Excavated Paving

The Contractor shall be responsible for the disposal of pavement. If the asphalt pavement is milled and/or concrete pavement is rubblized, it may be acceptable as backfill as accepted by the Engineering Division.

Excavation Near Failed Pavement

When the proposed excavation falls within three (3) feet of a section of failed pavement, the failed area shall be removed up to sound pavement and patched. Scarring, gouging, or other damaged pavement adjacent to a patch shall be removed and the pavement repaired.

14.3.3 Utility Crossings

All utility trenches that are located in existing streets shall be backfilled with flowable fill after the utility line has been installed. Refer to Section 14.3.4 for flowable fill criteria.

14.3.4 Backfill

Ordinary/Native Backfill

This shall consist of material excavated from the site except rubbish, frozen material, broken pavement, stones, or other consolidated material greater than three (3) inches in diameter, organic muck, or other materials considered unacceptable by the Inspector.

Imported Backfill

Imported backfill for trenches shall meet the requirements of CDOT Class 6.

Structure Backfill

This material shall be Class I structure backfill, conforming to CDOT Standard Specifications, Section 703. Class I structure backfill shall be used on all bridges, box culverts, or where otherwise specified.

Flowable Fill

This material shall be required as utility trench backfill unless otherwise directed by the Engineering Division. This requirement applies to all locations under existing pavement. Vibration of flowable fill shall be required unless otherwise approved by the Engineering Division. The approved mix for flowable fill is shown below:

Table 14.1: Flowable Fill Mixtures

Flow Fill Ingredients	Pounds/Cubic Yard
Cement	42 (0.45 sack)
Water	325 (39 gallons as needed)
Coarse Aggregate (No. 57)	1700
Sand (ASTM C-33)	1845

The maximum desired 28-day strength is 90-150 psi. The combination of material listed above, or an equivalent, may be used to obtain the desired flowable fill. Flowable fill shall not be used as a temporary or permanent street surface. Trenches shall be initially backfilled to the level of the original surface. After flowable fill has cured, the top surface of the flowable fill shall be removed to the depth necessary to allow repair of the permanent surface.

Conventional Backfill

Conventional backfill is “nonflowable fill.”

Backfill Lifts

Backfill material shall be placed in uniform loose lifts, not to exceed eight (8) inches prior to compaction. Alternate methods may be considered by the Engineering Division.

Compaction

Each layer shall be compacted to a density not less than 95 percent of maximum density, in accordance with AASHTO T99 and at the moisture content as specified in the soils or pavement design report. If the moisture content is not specified, soils shall be compacted at +/- 2 percent.

Categories of Conventional Backfill

Backfill lifts under existing or proposed streets, curbs, gutters, sidewalks, and alleys is divided into 3 categories: initial, intermediate, and final lifts as defined below.

- **Initial Lift (bedding).** This is designated as Class B and generally comprised of a washed, clean gravel material, consisting of the section from the bottom of the excavation to a point 12 inches above the top of the underground structure installation. Placement and compaction of the initial layer shall be as specified by the utility to protect their installation. Sections deeper than described above for class B will not be allowed.
- **Intermediate Lift.** This is generally comprised of native material, consisting of the section above the initial layer to a point within six (6) inches of the ground level or the bottom of the pavement section, whichever is

greater. Excavated material may be used in the intermediate layer provided that it is deemed suitable by the Engineering Division.

- **Final Lift.** This includes both roadbase and surfacing material. Roadbase material shall be CDOT Class 6 aggregate course as specified in the Pavement Design Report or as specified by the Engineering Division.

14.3.5 Trench Cover

Subgrade

- **Compaction.** After the backfill has been placed and compacted as specified, it shall be cut and trimmed to the required depth and cross section (Refer to **Standard Drawing R-16**). Trench cover subgrade shall be free of all rock over three (3) inches in size. It shall be compacted to not less than the densities required for the given soil classification as required in the Geotechnical Report (Refer to **Chapter 5 – Design Report Requirements**). This density requirement also applies to all utility trenches within the public Right of Ways. Compaction shall be evaluated by standard tests, at the time of constructing curb, gutter, sidewalk, pavement, and/or other permanent trench cover structure.
- **Excess Excavated Material.** All excess excavated material shall be removed and disposed of outside the legal limits of the Right of Way as the work progresses, unless the approval of the Engineering Division is obtained for disposal of the material within the legal limits of the Right of Way.
- **Condition Restored.** All parts of the roadway and various structures disturbed shall be restored in accordance with these Standards.
- **Compaction Equipment.** Compaction equipment must be on the job site before excavation is started. Compaction equipment must be capable of compacting within the trench width limits to avoid bridging the ditch.

14.3.6 Backfill Materials

Native Soils Backfill

The Contractor may use native soil from the trench for backfill if it is suitable, compactable and is free of asbestos, organic matter, roots, debris, rocks larger than 6” in diameter, clods, clay balls, broken pavement and other deleterious materials. Backfill material shall be so graded that at least 40% of the material passes a No. 4 sieve. The coarser materials shall be well distributed throughout the finer material. The backfill material shall not be used as pipe bedding. The native backfill is not permitted unless specifically approved by Engineering Division on the Construction Plans and/or Right of Way permit.

Imported Material for Backfill

Imported material shall conform to that specified for native earth backfill or imported sand.

14.3.7 Pipe Bedding

Imported sand used for pipe bedding shall consist of natural or manufactured granular material, or combination thereof, free of deleterious amounts of organic material, mica, loam, clay, and other substances. Under no circumstances will decomposed granite, rock dust, or native earth backfill be allowed or used for bedding.

Table 14.2: Pipe Bedding Gradation

Sieve Size	Percent Passing by Weight
3/8 inch	100
No. 4	75-100
No. 30	12-50
No. 100	5-20
No. 200	0-15

Imported sand shall have a coefficient of permeability greater than 0.014 measured in accordance with ASTM D2434 or a minimum sand equivalent of 30 per ASTM D2419. Imported sand shall have a saturated resistivity greater than 1,000 ohm-cm, a neutral pH, and chlorides less than 100 ppm.

Table 14.3: Crushed Rock Gradation

Sieve Size	Designated Rock Size			
	1-1/2 Inch	1-Inch	3/4-Inch	3/8-Inch
	Percent Passing	Percent Passing	Percent Passing	Percent Passing
2 inches	100	-	-	-
1-1/2 inches	90 - 100	100	-	-
1 inch	20 - 55	90 - 100	100	-
¾ inch	0 - 15	30 - 60	90 - 100	-
½ inch	-	0 - 20	30 - 60	100
3/8 inch	0 - 5	-	0 - 20	90 - 100
No. 4	-	0 - 5	0 - 5	30 - 60
No. 8	-	-	-	0 - 10

Use ¾ inch size unless indicated otherwise in the Construction Drawings.

14.3.8 Crushed Rock for Below Ground Installations

Gravel or crushed rock material shall contain less than 1% asbestos by weight or volume and conform to the following gradation:

14.3.9 Granular Material for Structural Backfill

Granular material for structural backfill shall be free of asbestos, organic materials, clay balls, and shall have the following gradation:

Table 14.4: Backfill Gradation

Sieve Size	Percent Passing by Weight
¾ Inch	100
½ Inch	95 - 100
3/8 Inch	50 - 100
No. 4	20 - 65
No. 8	10 - 40
No. 40	0 - 20
No. 200	0 - 5

Excavated material may be used for structural backfill provided it conforms to the specifications for structural backfill material.

14.3.10 Concrete for Below Ground Installations

- Concrete Anchors, collars, cradles, encasements, supports, and thrust blocks shall be Class B.
- Provide anchor blocks at valves in pipe having unrestrained mechanical joints.
- Provide support blocks at valves in ductile iron pipe or steel pipe.

14.3.11 Mortar

Mortar and grout shall be a mixture of cement, sand and water. Mortar shall consist of not more than one-part cement to two and one-half parts sand by damp loose volume. The quantity of mixing water shall be not more than necessary for handling and placing.

14.3.12 Water for Compaction

Water used in compaction shall have a pH of 7.0 to 9.0. Water shall be free of acid, alkali, or organic materials injurious to the pipe or coatings. Saltwater will not be allowed.

14.3.13 Structures

All structures construction shall be completed as per CDOT Requirements.