TOWN OF GEORGETOWN

CONSTRUCTION STANDARDS

Chapter 8

Trenching, Backfill & Compaction

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CHAPTER 8
TRENCHING, BACKFILL AND COMPACTION

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8.00.0 GENERAL

8.01.0 DESCRIPTION

(A) This section covers excavation and trenching including drainage, dewatering. preparation of subgrades. pipe bedding. backfilling, compaction, and finish grading for underground pipe lines, service lines, and appurtenances.

(B) Reference detail drawing in the appropriate chapter of these CONSTRUCTION STANDARDS. All work performed according to this section must comply with the general requirements contained within Chapter 1.

(C) Responsible Party shall contact Colorado 811, one call utilities location service, before beginning any excavation

8.02.0 QUALITY ASSURANCE

8.02.1 Soils Report

All quality assurance criteria within the approved soils report shall be followed.

8.02.2 Quality Control

(A) Responsible Party is responsible for all costs associated with Quality Control.

(B) Soil compaction tests shall be performed in accordance with**:**

1) ASTM D 698 or ASTM D 1S57, Standard Modified Method of Test for Moisture Density Relationships of Soils

2) ASTM D 2049, Standard Method of Test for Relative Density of Cohesionless Soils

8.02.3 Construction Staking

(A) Construction staking shall be performed with qualified, competent personnel under the direction of a professional land surveyor registered in the State of Colorado.

(B) All survey notes & and construction staking notes shall be entered into bound, hard cover field books.

(C) Staking of the work shall be at fifty-foot (50') stations (maximum).

(D) Offsets shall be staked so that vertical and horizontal alignment may be checked.

(E) All survey data that is developed by the Responsible Party or the Responsible Party's surveyor in performing surveys that are required by the work shall be available to the Town for examination throughout the construction period.

8.03.0 JOB CONDITIONS

8.03.1 Drainage and Groundwater

(A) All excavations and trenches shall be kept free from excess goundwater during construction.

(B) Any water that is encountered in the trench shall be removed to the extent necessary to provide a firm subgrade to permit joints to be made in the dry, and to prevent the entrance of water into the pipeline.

(C) Surface run-off shall be diverted as necessary to keep excavations and trenches free from water during construction.

(D) The excavation or trench shall be kept free from water until the structure or pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

(E) Water shall be prevented from entering into previously constructed pipe.

(F) Except for storm drains, the pipe under construction shall not be used for dewatering.

8.03.2 Sequencing

(A) Pipeline installation shall be performed within two hundred (200) linear feet of trench excavation. If construction is occurring in an open field, this distance may be increased at the Town's discretion.

(B) Initial trench backfill shall be performed within fifty (50) linear feet of pipeline installation. If construction is occurring in an open field, this distance may be increased at the Town's discretion.

(C) Where excavation is a burden to automotive or pedestrian traffic, the building of an open trench and the duration of that opening is to be minimized. The Responsible Party shall coordinate the amount and duration of road closure with the Town.

8.03.3 Underground Obstructions

(A) The Responsible Party shall field verify all drawing & record information obtained from the Town or other affected utility company.

(B) The Responsible Party shall notify each utility OWNER and request utilities to be field located by surface markings at least fourty-eight (48) hours, prior to trenching or excavation. This may be accomplished by calling the Utility Notification Center of Colorado.

(C) In situations where conflicts may exist, the Responsible Party shall expose and verify the size, location, and elevation of underground utilities and other obstructions sufficiently in advance of construction to permit changes to be made to the construction drawings.

(D) In the case of a conflict, the Rcsponsible Party shall notify the Town and affected utility company. The proposed work may then be modified by the Design Engineer and after the Town's Representative's approval.

(E) Existing improvements. adjacent property, utilities, trees and plants that are not to be removcd shall be protecterd from injury oc damage resulting from the Responsible Party's operations. If damage should occur, the Responsible Party shall make repair such that damaged materials be restored in original or better condition, as directed by the Town Representative, utility or property owner in question.

(F) If the Responsible Party removes any underground obstructions, the following shall apply:

1. Drainage culverts may be salvaged, stored, and reused in the original location if approval is obtained from the Town Representative. All other underground obstructions shall be replaced with new materials.

2. The area in which the underground obstruction was located shall be restored to original or better condition.

8.04.0 MAINTENANCE AND CORRECTION

8.04.1 Trench Settlement

The Responsiblc Party shall maintain and rcpair all trench settlement and make necessary repairs to pavement, sidewalks or other structures which may be damaged as a result of backfill ettlement. Responsible Party shall warrant work for a period of one (1) year after final completion and acceptance of the work.

8.04.2 Subcontractor

The Responsiblc Party may perform such maintcnance and repairs by subcontract. If the Responsiblc Party chooses to subcontract the warranty work, Responsiblc Party shall submit to the Town Reprepresentative a copy of the subcontract or the work anthorization as evidence of the Responsiblc Party's faithful intention to perform any repairs which may become necessary during the one- (1) year warranty period.

8.10.0 CONSTRUCTION SPECIFICATIONS

8.11.0 PREPARATION

(A) Topsoil shall be stripped from areas that are to be disturbcd by construction and stockpiled.

(B) Topsoil shall be segregated from non-organic, trench excavation material and debris.

8.12.0 TRENCHING

(A) Trenches shall be excavated by open-cut methods, except where boring or tunneling is indicated, shown on drawings, or approved by the Town Representative.

(B) Trench width shall be maintained to within three inches (3") of that specified on plans.

(C) Care shall be used when operating mechanical equipment in locations where it may cause damage to trees buildings, culverts, or other existing property, utilities, or structures above or belowground.

(D) Mechanical equipment shall be designed and operated in such a manner that the bottom elevation of the trench can be controllcd with uniform trench widths and vertical sidewalls which extend from the bottom of the trench to an elevation one foot (1') above the topof the installed pipe.

(B) Trench alignment shall be accurate to permit pipe to be aligned properly with an eight-inch (8") minimum clearance between the pipe and the sidewalls of the trench. The trench sidewall shall not be undercut in order to obtain clearance.

(F) Responsible Party shall over-excavate minimum of six inches (6") below the bottom of the pipe whcrevcr the trench bottom is rock. shale, or other unsuitable material. Over-excavation shall be backfilled and compacted with acceptablc granular material. Granular material shall conform to Section 8.22.0 of these CONSTRUCTION STANDARDS.

(G) Preparation of Trench Bottom:

1. Trench bottoms shall be graded uniformly to provide clearance for each section of pipe.

2. Loose material, water, and foreign objects shall be removed from the trench.

3. The Responsible Party shall provide a firm subgrade that is suitable for application of bedding material.

4. Wherever unstable material is encountered in the bottom of the trench, said material shall be over-excavated to a depth suitable for construction of a stable subgrade. The depth suitable for construction of a stable subgrade shall be determined by the Town Representative. The over-excavation shall be backfilled with stabilization material and compacted as required by the Town Representative. Stabilization material shall conform to Section 8.21.0 of these CONSTRUCTION STANDARDS.

(H) Stockpiling Excavated Materials:

1. Suitable material for backfilling shall be stockpiled in an orderly manner at a minimum of four feet (4') from the edge of the trench.

2. Excess excavated materials not suitable or not required for backfilling shall be removed from the site and disposed.

3. Excavated material shall not be stockpiled against existing structures or appurtenances.

4. Excavated materials containing any hazardous material shall be disposed of at an approved site in accordance with an abatement plan to be prepared by the Responsible Party or other qualified professional in accordance with all federal, state, and local ordinances.

(I) Limiting Trench Widths:

1. Trenches shall be excavated to a width necessary to provide an eight-inch (8") minimum working space between the pipe and the trench walls for proper pipe installation, joining and bedding.

2. The minimum trench width at an elevation twelve inches (12) above the top of the installed pipe shall be the pipe diameter of the pipe plus 24 inches, or thirty inches (30") whichever is greater. If the width of the trench, twelve inches (12") above the top of the pipe, exceeds the maximum allowable trench width, a higher strength pipe or special pipe bedding shall be provided as required by 80' soil-loading conditions and as approved by the Town Representative.

8.13.0 PIPE BEDDING

(A) Placement and Compaction:

1. Bedding material shall be distributed and graded to provide uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. Pipe shall not be supported by the bells.

2. To prevent lateral displacement, granular bedding material shall be deposited and compacted uniformly and simultaneously on each side of the pipe.

3. Granular bedding material shall be compacted in accordance with these CONSTRUCTION STANDARDS.

(B) Ground water barriers shall be constructed in such a manner to prevent passage of water through bedding material for the full depth of the granular bedding material and the full width of the trench.

1. Ground water barriers, if shown on the approved construction plan, shall be approximately four feet (4') long and spaced not more than four hundred feet (400') apart.

2. Material for ground water barriers shall be as specified by the ditch company which controls the irrigation ditch to be crossed. In absence of that direction, bentonite Town shall determine the best the material to be used.

8.14.0 BACKFILLING AND COMPACTION

(A) Trenches shall be backfilled promptly after the pipe has been installed and inspected. Backfill around manholes and valve boxes shall be compacted with hand-operated equipment.

(B) Backfill material shall be deposited in uniform horizontal layers which may not exceed six inches (6") of compacted depth in all areas. Other thickness may be used with the prior written approval of the Town Representative.

(C) Methods and equipment that are that are appropriate for the backfill of the material shall be employed. Backfill equipment or backfilling methods that transmit damaging shocks to the pipe shall not be used.

(D) Compaction shall not be performed by jetting or water settling.

(E) If compaction cannot be obtained with job excavated material, trench backfill material shall be imported.

(F) Topsoil shall be replaced to the depth of stripping over all areas that are to receive vegetation.

(G) Excess excavated materials and materials not suitable foe backfill shall be removed from the site.

8.15.0 FIELD QUALITY CONTROL

(A) Field Compaction Control:

1. Field tests will be conducted to determine compliance of compaction methods with specified density in accordance with ASTM D 2922 (Test for Density of Soil and Soil-Aggregate in Place by Nuclear Method).

2. Compaction tests shall be performed at a depth of one-and-one-half feet (1-1/2') above the top of the pipe and in one-foot (1, vatical increments up to the finish grade.

3. Compaction tests shall be performed at least once every one hundred (100) linear feet as measured along the length of the pipe.

4. If the Town Representative determines that reliable and uniform results are produced by the Responsible Party's construction techniques, the frequency of testing may be changed subject to the Town Representatives discretionn. but no more than three hundred (300) linear feet.

(B) Compaction shall be to the following minimum densities (refcrcncc ASTM D 698 or AASHTO T 99 unless otherwise indicated:

1. Barrier Material - 95 Percent of Maximum Standard Density.

2. Pipe Bedding:

   a. Compacted Granular Material - 80 percent of Maximum Relative Density (ASTM D 2049)

   b. Carefully Compacted Select Soil - 90 Percent of Maximum Standard Density

   c. Barrier Material - 95 Percent of Maximum Standard Density

3. Trench Backfill:

   a. Paved roadways, sidewalks, and other areas to be paved: Top Two Feet (2') - 98 Percent of Maximum Standard Density

      Remainder of Trench - 95 Percent of Maximum Standard Density

   b. Gravel Roadways - 95 Percent of Maximum Standard Density

   c. Fields and All Other Areas - 90 Percent of Maximum Standard Density

   d. Under Footings, Foundations, Structures, 100 Percent of Maximum Standard Density or in Conformance with the Approved Soils Report and Recommendations

(C) Moisture Content:

1. All compacted backfill shall be within two percent (2%) (plus or minus) of the optimum moisture content of the soil as determined by ASTM D 698.

2. Water shall be added to the material or the material shall be harrowcd, disced, bladed, or otherwise worked to insure a uniformn moisture content, as specificified.

8.20.0 MATERIAL SPECIFICATIONS

8.21.0 STABILIZATION MATERIAL

(A) If the existing soil in the trench bottom is judged to be unsuitable by the Town Representative, the top six inches (6") of the pipe subgrade shall be removed and replaced with stabilization material.

Stabilization material shall conform to ASTM D 448 or CDOT No. 4, according to Table 8.21.0:

TABLE 8.21.0 Stabilization Material

	Percent Passing
2 Inch	100
1-l/2 1nch	90-100
1 Inch	20-55
3/4 Inch	0-15
3/ Inch	0-5

(B) Geotextiles used for erosion control,drainage and silt fence shall conform to CDOT requirements of 712.08 in the Standard Specifications for Road and Bridge Construction.

8.22.0 BEDDING MATERIALS

(A) Granular Material. Uniformly-graded material conforming to AASHTO M6, according to Table 8.22.0:

TABLE 8.22.0 Bedding Material

Passing	Percent
3/8 Inch	100
No. 4	95-100
No.16	45-80
No. 50	10-30
No.100	2-10

(B) Select Soil. Excavated matcria1 which is free from rocks. c1ods, and stones greater than one-and-one-half inches (1-1/2") in any dimension and which mcets other .requirements of trench backfill material.

(C) Barrier Material -- Soil Classification:

1. GC - Clayey gravel, grave1-sand-c1ay mixtures.
2. GC - Clayey Sands, sand-clay mixtures.
3. CL --lnorganic clays of low to medium plasticity, gravely clays,, sandy clays, silty clays, clean clays.
4. Material may be finely divided, suitable, job-excavatedated material free from stones, organic matter, and debris.

8.23.0 TRENCH BACKFILL MATERIAL

(A) Trench backfill material shall be placed from a point twelve inches (12") above the pipe to twelve inches (12") below the ground surface or to the bottom of the pavement subgrade which ever is greater.

(B) Trench backfill material shall be either soil excavated from the trench or imported soil.

1. Any soil used for trench backfill shall be free from frozen matter, stumps. roots, brush, other organic matter, cinders or other corrosive material, hazardous material, debris, and any rocks or stones which are larger than six inches (6") in any dimension. Rocks or stones which are larger than three inches (3") in any dimension shall not be placed within one foot (l') of pavement subgrade or within one foot (l') of the finished surface of unpaved areas or within one foot of the pipe.

2. If imported soil is used for ttrench backfill, it shall meet CDOT specifications for Class 2 structure backfill.

8.24.0 STRUCTURE BACKILL (FLOW-FILL)

8.24.1 General

At the Responsible Party's option. structure backfill (flow-fill) meeting the following requirements may be used in lieu of structure backfill (Class 1 and Class 2) upon prior approval of the Town Representative.

TABLE 8.24.0 Flow-Fill

Ingredients	Pounds Per Cubic Yard
Cement (0.45 Sack)	42
Water (39 gallons)	325 (or as needed)
Coarse Aggregate (Size No.57)	1700
Sand (ASTM C-33)	1845

The maximum desired twenty-eight day (28) strength os sixty (60) psi (not a specification requirement). The above combination of material or equivalent may be used to obtain the desired flowable fill.

Structural backfill (flow-fill) will on1y be allowed over any water or sanitary sewer 1ine at the discretion of the Town's Representative and shall be no more than two (2) feet thick.

8.24.2 Compaction

Compaction of structural backfill will not be required if material meeting the above requirements is used.