

Earthwork

STD.8712

Scope

This standard covers Enterprise (Company) requirements for excavation, fill, and backfill for roads, parking areas, dikes, firewalls, ponds, tanks, catch basins, and other structures. Excavation and backfilling for underground pipe, conduits, ducts, and other underground utilities are covered by Company Safety Policies Manual Section 3.4 *Excavation and Trenching*. These requirements shall apply to excavation, filling and backfilling by Company forces or by other parties contracted by the Company. Excavation and backfilling shall comply with all applicable federal, state and local requirements.

TABLE OF CONTENTS

1.0	REFERENCES	4
1.1.	Code of Federal Regulations (CFR)	4
1.2.	Occupational Safety and Health Administration (OSHA)	4
1.3.	American Association of State Highway and Transportation Officials (AASHTO)	4
1.4.	American Society for Testing and Materials (ASTM)	4
1.5.	Company Standards, Specifications, and Policies	5
2.0	TERMS AND DEFINITIONS.....	5
3.0	EXCAVATION	6
3.1.	General.....	6
3.2.	Environmental.....	6
3.2.1.	Contaminated Soils.....	6
3.2.2.	Erosion/Sediment Control.....	6
3.3.	Safety	6
3.4.	Rock Blasting	Error! Bookmark not defined.
3.5.	Clearing and Grubbing	6
3.6.	Stripping	6
3.7.	Rough Grading.....	7
3.8.	Rock Excavation	7
3.8.1.	Mechanical Method.....	7
3.8.2.	Blasting Method	7
3.9.	Structural Excavation	7
3.10.	Earthen Structures	7
3.11.	Stockpiling.....	7
3.12.	Drainage.....	7
3.13.	Disposal of Excess Waste Materials.....	8
4.0	FILL AND BACKFILL MATERIAL.....	8
4.1.	General.....	8
4.2.	Material Classification.....	8
4.2.1.	Class I.....	8
4.2.2.	Class II.....	8
4.2.3.	Class III.....	8
4.2.4.	Class IV	8
4.2.5.	Class V	8
4.2.6.	Class VI	9
4.2.7.	Class VII	9
5.0	PLACING AND COMPACTING FILL AND BACKFILL MATERIAL.....	9
5.1.	General.....	9
5.2.	Subgrade Preparation	9
5.3.	Placement	9
5.4.	Compaction	9
5.5.	Finishing.....	10
6.0	TESTING	10
6.1.	Classification Tests	10
6.2.	Compaction Tests.....	10

6.3. Fill Density.....	10
Attachment: Revision Log.....	12

1.0 REFERENCES

When adopted in this standard or in the contract documents, the latest edition of the following codes and standards in effect on the date of contract award shall be used, except as otherwise noted. Short titles will be used herein when appropriate.

1.1. Code of Federal Regulations (CFR)

40 CFR §122.26	Storm water discharges (applicable to State NPDES programs, see § 123.25)
49 CFR Part 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans

1.2. Occupational Safety and Health Administration (OSHA)

29 CFR Part 1926	Safety and Health Regulations for Construction
------------------	--

1.3. American Association of State Highway and Transportation Officials (AASHTO)

T 180	Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457mm (18-in.) Drop
-------	--

1.4. American Society for Testing and Materials (ASTM)

C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
D422	Standard Test Method for Particle Size Analysis of Soils
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft ³ (600 kN-m/m ³))
D1140	Standard Test Methods for Determining the Amount of Material Finer than 75- μ m (No. 200) Sieve in Soils by Washing
D1556	Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2,700 kN-m/m ³))
D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2937	Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.5. Company Standards, Specifications, and Policies

Safety Policies Manual	Section 3.4 Excavation and Trenching
Safety Policies Manual	Section 3.6 – Heavy Motorized Equipment
STD.8704	Ditching
STD.8707	Lowering-In and Backfilling
STD.8715	Blasting Near In-service Pipelines

2.0 TERMS AND DEFINITIONS

The definitions in this section are intended only to be used within this document and should not be applied to any other Company Standards.

Terms	Definitions
CH	Clay of High Plasticity, Fat Clay
CL	Clay
Company	Enterprise (if used in connection with a contract or other agreement, the actual Enterprise entity will be the specific Enterprise entity referenced in the contract).
Company Project Manager	An employee or contingent worker of Enterprise who has the overall responsibility for the project or a defined scope of work. For example, this can be someone in Capital Projects, Field Engineering, Asset Integrity, Maintenance or Operations.
Drawings	Drawings approved by the Company Project Manager for the contracted work
GC	Clayey Gravel
GM	Silty Gravel
GP	Poorly Graded Gravel
GW	Well Graded Gravel, Fine to Coarse Gravel
ML	Silt
OH	Organic Clay, Organic Silt, High Plasticity
OL	Organic Clay, Organic Silt, Low Plasticity
PT	Peat
SC	Clayey Sand
SM	Silty Sand
SP	Poorly Graded Sand
SW	Well Graded Sand, Fine to Coarse Sand

3.0 EXCAVATION

3.1. General

- (1) Excavation operations shall be performed after clearing and grubbing has been completed.
- (2) Proper drainage for excavated areas shall be maintained to prevent the stagnation of water. Excavated areas shall be kept dry by pumping, well point, or other suitable methods approved by the Company Project Manager.
- (3) Materials excavated for the permanent work shall be classified in accordance with the classification system in this standard. Classified material designated for reuse shall be properly segregated and stockpiled.
- (4) Borrow material shall mean suitable material obtained from excavations off the site, or from designated borrow areas at the site. Borrow material shall be classified in accordance with the classification system in this standard before placement in the permanent work.
- (5) Sheet piling and shoring shall be used when necessary for personnel safety and work protection. Sheet piling and shoring shall conform to OSHA requirements.

3.2. Environmental

3.2.1. Contaminated Soils

If unexpected soil contamination is encountered during the work, the work will stop and the Company Project Manager will be notified immediately.

3.2.2. Erosion/Sediment Control

The Contractor shall ensure that erosion/sediment control is maintained in accordance with local, state and federal regulations and any requirements specified in the Contract / PO documents by the Company Project Manager.

3.3. Safety

- (1) The Contractor shall comply with OSHA 29 CFR 1926 and applicable federal, state and local codes.
- (2) A work permit, if required, shall be obtained from the Company Operations prior to performing any earthwork.
- (3) Applicable protective systems shall be used when necessary for personnel safety and work protection. Sheet piling and shoring shall conform to OSHA requirements.
- (4) Spoil piles shall be stored in accordance with OSHA 29 CFR 1926.

3.4. Clearing and Grubbing

- (1) Clearing and grubbing shall consist of the removal and satisfactory disposal of stumps, roots, vegetation, logs, rubbish, and other unsuitable material.
- (2) In the areas designated for clearing and grubbing, all material listed in section 3.5.1 of this standard shall be removed to a depth where suitable material is present to support the engineering design. Depressions made by clearing and grubbing operations shall be filled with suitable material and compacted to conform to the adjacent surface of the original ground.

3.5. Stripping

- (1) Stripping shall consist of the excavation, removal, and stockpiling of topsoil and the excavation, removal, and disposal of unsuitable soils.

3.6. Rough Grading

- (1) General area grading shall be completed to within a tolerance of the elevations shown on the Drawings and specified by the Engineer of Record.
- (2) Roads, parking areas, and building areas shall be excavated or filled to subgrade elevations shown on the Drawings.

3.7. Rock Excavation

3.7.1. Mechanical Method

In areas of soft rock, or where blasting is not permitted, rock may be excavated with mechanical rippers, mechanical breakers, or a mechanically operated drill with a non-explosive demolition agent.

3.7.2. Blasting Method

- (1) If rock blasting is required, the Contractor shall develop a written Rock Blasting Safety Plan for Company Project Manager's approval.
- (2) The Contractor shall obtain permits from authorities having jurisdiction before explosives are brought to the site or drilling is started.
- (3) Explosives shall be stored, handled, and used in accordance with manufacturer's recommendations, local regulations and the agreed upon requirements between the Company Project Manager and the Contractor.
- (4) The Contractor shall be responsible for all blasting operations. Blasting within $\frac{1}{4}$ mile (1,320 feet) of a Company-owned pipeline shall be in strict accordance with Company Standard STD.8715.

3.8. Structural Excavation

- (1) Permanent work shall rest on suitable foundation soil approved by the Engineer. When soft and compressible soil is encountered at footing grades shown on the Drawings, such soil shall be removed and replaced with suitable backfill material or concrete as specified in section 4.0 of this standard.
- (2) Over-depth excavation at footings shall be backfilled with suitable backfill material or concrete as specified in section 4.0 of this standard.

3.9. Earthen Structures

- (1) Earthen structures shall include permanent work items such as ponds, canals, ditches, etc. Excavations for such work shall be made to the lines, grades, and cross sections shown on the drawings.
- (2) Side slopes of excavations shall be cut true and straight and graded to the proper cross section. Unstable soil in the slopes shall be removed. The bottoms of excavations shall be graded to the elevations and configurations shown on the drawings.

3.10. Stockpiling

- (1) Material shall be stockpiled for proper drainage as directed by the Company Project Manager.
- (2) Stockpiling of contaminated soils shall comply with the approved Contaminated Soils Management Plan, or as directed by the Company Project Manager.

3.11. Drainage

- (1) Drainage of cuts, fills, stockpiles, spoil areas, surcharge embankments, and borrow areas shall be maintained at all times to prevent stagnation of surface water following rainfall by

providing temporary ditches, swales, culverts and/or pumping systems as required in each respective site area. Temporary drainage facilities will be removed at the completion of the project or as directed by the Company Project Manager.

3.12. Disposal of Excess Waste Materials

- (1) Insofar as practicable, all suitable materials removed by excavation shall be utilized as fill.
- (2) Excavated material in excess of that required for normal embankment construction will be stockpiled within the construction limits or placed in a designated spoil area beyond the construction limits as directed by the Company Project Manager.
- (3) Material unsuitable for fill and debris removed by clearing, grubbing, stripping, and excavation shall be removed to a disposal area approved by the Company Project Manager.

4.0 FILL AND BACKFILL MATERIAL

4.1. General

- (1) Fill and backfill material shall be obtained from excavation areas, borrow pits, or other approved sources. These materials shall be free of organics, metals, roots, debris, etc. This material shall be classified in accordance with the classification system in section 4.2 below before use in the permanent work.
- (2) Classified fill and backfill material shall be installed at the locations shown on the Drawings.

4.2. Material Classification

4.2.1. Class I

Well-graded sands and gravels, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW)

- Plasticity Index - Non-plastic
- Gradation - D60/D10 4, Percent Passing No. 200 Sieve – 5 percent

4.2.2. Class II

Poorly graded gravels and sands, silty sands, and gravels, little or no fines (GM, GP, SP, SM)

- Plasticity Index – Non-plastic to 4
- Gradation – Percent Passing No. 200 Sieve – 12 percent

4.2.3. Class III

Clayey (or clay-like) gravels and sands, poorly graded mixtures of sand, gravel, and clay (CG, SC)

- Plasticity Index – 7
- Gradation – Percent Passing No. 200 Sieve – 12 percent

4.2.4. Class IV

Clays (inorganic) of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays (CL) (may be used for structural fill if P.I. is 20)

- Liquid Limit – 20-50
- Plasticity Index – 10-20

4.2.5. Class V

Clays (inorganic) of high plasticity, fat clays (CH)

- Liquid Limit – 50

- Plasticity Index – 22

4.2.6. Class VI

Silts (inorganic), and very fine sands, rock flour, micaceous or diatomaceous fine sandy or silty soils, elastic silts (ML)

- Liquid Limit – 20-50
- Plasticity Index – 0-22

4.2.7. Class VII

Organic silts and organic silt-clays of low plasticity (OL), organic clays of medium to high plasticity (OH), peat (PT) and other highly organic soils. Class VII soils are considered unsuitable for fill and backfill material.

5.0 PLACING AND COMPACTING FILL AND BACKFILL MATERIAL

5.1. General

Fill and backfill operations shall be performed after clearing and grubbing have been completed, and areas to be filled have been stripped in accordance with this standard.

5.2. Subgrade Preparation

- (1) Before placing fill material, the subgrade surface shall be scarified to a depth of 6 inches, wetted or dried to produce the specified moisture content, and compacted again to the specified percent of maximum density in accordance with Sections 3.10 and 5.4. Subgrade preparation shall include lime treatment when specified on the Drawings or when the specified density cannot be attained. The percentage of lime required for treatment shall be as recommended by the independent soils testing laboratory. These requirements shall apply under roads, parking areas, dikes, firewalls, ponds, embankments, and other earthen structures.
- (2) At structures, the excavation surfaces on which backfill are to be placed shall be undisturbed soil free of loose material.

5.3. Placement

- (1) Areas to receive fill and backfill shall be free of roots, trash, and other foreign matter.
- (2) Only classified fill and backfill material shall be placed in the permanent work at locations shown on the drawings.
- (3) Fill and backfill shall be placed in loose lifts to develop required density.

5.4. Compaction

- (1) Fill and backfill lists shall be uniformly compacted to the specified percent of maximum density as determined in accordance with the latest ASTM or AASHTO Testing Methods at a moisture content with 2 percent, plus or minus, of optimum.
- (2) The specified compacted density shall be 90 and 95 percent minimum. 90 percent applies where hand-operated equipment is used, such as around building and equipment foundations. 95 percent applies where mechanical equipment is used, such as for roads, railroads, dikes, and general fill areas, places receiving repetitive or heavy loads, or over-excavation of earthen structures.
- (3) If the material to be compacted contains excessive moisture, to allow compacting in accordance with the specified requirements, the material shall be processed to reduce the moisture content. If the soil has less than the specified moisture content, or is likely to lose

- enough moisture to bring the moisture content below requirements before the completion of compaction, water shall be added and the soil lift shall be thoroughly mixed before compaction. These procedures are not necessary for Class I materials.
- (4) To provide a blending and interlocking of adjoining surfaces, the upper surface of each compacted layer of the fill or backfill shall be lightly scarified to a depth of 1 inch before placing the next lift.
 - (5) After compaction of the material, in-place density tests shall be made as specified below. If the material fails to meet the density specified below, the course shall be reworked as necessary to obtain the specified density. The compaction method or equipment on later work may be altered to obtain the specified density.
 - (6) Fill and backfill adjacent to structures, such as retaining walls and pits, shall not be compacted with heavy equipment, but shall be compacted with hand-operated equipment to a minimum distance of 4 feet or greater beyond the sides of the structure.

5.5. Finishing

Compacted surfaces of fills and backfills shall be finish-graded to the cross sections, lines, grades, and elevations indicated on the Drawings.

6.0 TESTING

6.1. Classification Tests

- (1) Plasticity characteristics shall be defined in accordance with the latest ASTM Testing Methods.
- (2) Gradation characteristics shall be defined in accordance with the latest ASTM Testing Methods.

6.2. Compaction Tests

The moisture density relationship for fill and backfill soils shall be determined in accordance with the latest ASTM or AASHTO Testing Methods.

6.3. Fill Density

- (1) The frequency of in-place density tests of compacted fill or backfill shall be designed as follows:
 - One test shall be performed for every 2,500-5,000 square feet of each lift for roads, parking areas, and earthen structures.
 - One test shall be performed for every 200-500 cubic yards of compacted material at structures.
- (2) All instruments used that require calibration must be furnished with a certificate of calibration.
- (3) The number of tests should be increased if a visual inspection determines that the moisture content is not uniform or if the compacting effort is variable and not considered sufficient to attain the specified density. Density and moisture contents can be determined by the drive cylinder method for cohesive fills and balloon density, or sand cone method for less cohesive fills. A nuclear density/moisture meter can also be used provided the unit is properly calibrated and check tests using one of the other methods are performed. Specific test procedures shall be done in accordance with the requirements of the latest ASTM Testing Methods.

Attachment: Revision Log

Revision 0.0			Publish Date: 14 Jul 11
Location of Change	Type of Change	Reason for Change	
N/A	N/A		
Revision 0.1			Publish Date: 15 Aug 13
Location of Change	Type of Change	Reason for Change	
Scope	Correction	Corrected first sentence describing content of standard.	
Scope, section 5.4(7)	Update	Reference to "STD.8713" has been updated to "Safety Policies Manual Section 3.4." STD.8713 was archived due to content being covered in Safety Policies Manual Section 3.4.	
Throughout document	Correction	Corrected formatting and typo errors.	
Revision 1.0			Publish Date: 01 Feb 17
Location of Change	Type of Change	Reason for Change	
Section 1.2	Addition	Added reference to transportation, 49 CFR Part 172.	
Section 1.3-6	Revision	Updated subsections after adding Section 1.2	
Section 1.6	Addition	Added standards, specifications and policies, deleted Safety Policy Manual Section 3.4.; Added reference to STD.8715.	
Section 3.3(2-4)	Addition	Made second sentence (2), added OSHA references for (3) and (4).	
Section 3.4(3)	Addition	Added reference to storing and handling explosives according to Company and Contractor requirements.	
Section 3.4(3)	Deletion	Deleted reference about explosives since section 3.4(3) expanded upon it.	
Section 3.4(4)	Addition	Added blasting requirements.	
Section 3.8.2	Revision	Changed Blasting Plan name to "Rock Blasting Safety Plan."	
Section 6.4	Addition	Added to sentence for Responsible Party for clarity.	
Revision 1.1			Publish Date: 30 May 18
Location of Change	Type of Change	Reason for Change	
Section 1.5	Deletion	Deleted reference to ASTM D423, D424, D2922, and ASTM D3017	

Section 1.5	Addition	Added reference to ASTM D1140, D4318 & D6938,
Section 1.5	Revision	Revised Title for ASTM C136, D422, D698, and D1557
Section 3.10	Revision	Revised reference to ASTM D1557 and AASTHO T180 with “the latest ASTM or AASHTO Testing Methods”
Section 5.4	Revision	Revised reference to ASTM D1557 with “the latest ASTM Testing Methods”
Section 6.1	Revision	Revised reference to ASTM D423 and D424 with “the latest ASTM Testing Methods”
Section 6.2	Revision	Revised reference to ASTM D422 with “the latest ASTM Testing Methods”
Section 6.3	Revision	Deleted “are” and replaced with “shall be done in accordance with the requirements of the latest ASTM Testing Methods”
Section 6.3	Deletion	Deleted reference to ASTM D1556, ASTM D2937, ASTM D2167, ASTM D2922 & ASTM D3017
Revision 2.0		Publish Date: 21 Jul 20
Location of Change	Type of Change	Reason for Change
Section 2.0	Revision	Updated the Terms and Definition Section
Various	Addition / Deletion / Revision	Revised various sections for clarity and understanding.
Various	Revision	Updated Company responsibility to the Company Project Manager.