

Section 02317

EXCAVATION AND BACKFILL FOR STRUCTURES

1.0 GENERAL

1.01 SECTION INCLUDES

- A Excavation, backfilling, and compaction of backfill for structures.
- B References to Technical Specifications:
 - 1. Section 01200 – Measurement and Payment Procedures
 - 2. Section 01350 - Submittals
 - 3. Section 01760 – Project Record Documents
 - 4. Section 01450 - Testing Laboratory Services
 - 5. Section 01500 – Temporary Facilities and Controls
 - 6. Section 02255 – Bedding, Backfill, and Embankment Materials
 - 7. Section 01570 - Trench Safety System
 - 8. Section 01564 - Control of Ground Water and Surface Water
 - 9. Section 02220 - Site Demolition
 - 10. Section 02200 – Site Preparation
 - 11. Section 02252 - Cement Stabilized Sand
 - 12. Section 01562 - Waste Material Disposal
- C Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 698, “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort”
 - b. ASTM D 4318, “Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils”
 - c. ASTM D 1556, “Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method”
 - d. ASTM D 2922, “Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)”
 - e. ASTM D 3017, “Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)”
 - 2. Occupational Safety and Health Administration (OSHA)
 - 3. Texas Department of Transportation (TxDOT)
 - a. Tex-101-E, Preparing Soil and Flexible Base Materials for Testing
 - b. Tex-110-E, Particle Size Analysis of Soils
- D Definitions:
 - 1. Backfill - material meeting specified quality requirements, placed and compacted under controlled conditions around pavements, structures and utilities.

2. Foundation Backfill - natural soil or manufactured aggregate meeting Class I requirements and Geotextile fabrics as required to control drainage and material separation placed and compacted where needed to provide stable support for the structure foundation base. Foundation backfill may include crushed aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab.
3. Foundation Base - provides a smooth, level working surface for the construction of the concrete foundation.
4. Foundation Subgrade - the surface of the natural soil which has been excavated and prepared to support the foundation base or foundation backfill, where needed.
5. Over-Excavation - excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below the foundation as shown on the Plans.

1.02 MEASUREMENT AND PAYMENT UNIT PRICES

- A Unless indicated as a Bid Item, no separate payment will be made for Excavation and Backfill for Structures under this Section. Include cost in Bid Items for construction of structures.
- B If Excavation and Backfill for Structures is included as a Bid Item, measurement will be based on the Units shown in Section 00300 – Bid Proposal and in accordance with Section 01200 – Measurement and Payment Procedures.

1.03 SUBMITTALS

- A Make Submittals required by this Section under the provisions of Section 01350 – Submittals.
- B Submit for each structure a work plan for excavation and backfill with a complete written description which identifies details of the proposed method of construction and the sequence of operations for construction relative to excavation and backfill activities. The descriptions, with supporting illustrations, shall be sufficiently detailed to demonstrate to the Engineer that the procedures meet the requirements of the Plans and Technical Specifications.
- C Submit product quality, material sources, and field quality information in accordance with this Section.
- D Submit field red lines documenting location of structures as installed, referenced to survey Control Points, under the provisions of Section 01760 – Project Record Documents, 1.04C. Include location of utilities and structures encountered or rerouted. Give horizontal dimensions, elevations, inverts and gradients.

1.04 TESTING

- A Testing and analysis of product quality, material sources, or field quality shall be performed by an independent testing laboratory provided by the Owner under the provisions of Section 01450 - Testing Laboratory Services and as specified in this Section.

1.05 PROTECTION OF PEOPLE AND PROPERTY

- A Contractor shall conduct all construction operations under this Contract in conformance with the practices described in Section 01500 - Temporary Facilities and Controls.

2.0 PRODUCTS**2.01 MATERIALS**

- A Contractor shall provide materials used as embedment, backfill, back-dressing, and embankment identified on the Plans in accordance with Section 02255 – Bedding, Backfill and Embankment Material.

2.02 EQUIPMENT

- A Perform excavation with equipment suitable for achieving the requirements of this Section.
- B Use equipment which will produce the degree of compaction specified. Backfill within 3 feet of walls shall be compacted with hand operated equipment. Do not use equipment weighing more than 10,000 pounds closer to walls than a horizontal distance equal to the depth of the fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

3.0 EXECUTION**3.01 PREPARATION**

- A Employ a Trench Safety Plan as specified in Section 01570 - Trench Safety Systems.
- B Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 01564 - Control of Ground Water and Surface Water.
- C Remove existing pavements and structures, including sidewalks and driveways, in accordance with requirements of Section 02220 - Site Demolition, as applicable.
- D Area shall be cleared and grubbed under the provisions of Section 02200 - Site Preparation prior to excavation.

- E Strip and stockpile topsoil under the provisions of Section 02200 - Site Preparation
- F Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work. Notify Engineer and obtain instructions before proceeding in such areas.

3.02 EXCAVATION

- A Perform excavation work so that the underground structure can be installed to depths and alignments shown on Plans Drawings. Use caution during excavation work to avoid disturbing surrounding ground and existing facilities and improvements. Keep excavation to the absolute minimum necessary. No additional payment will be made for excess excavation not authorized by Engineer.
- B Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.
- C Prevent voids from forming outside of sheeting. Immediately fill voids with grout, concrete fill, cement stabilized sand, or other material approved by Engineer.
- D After completion of the structure, remove sheeting, shoring, and bracing unless Engineer has approved in writing that such temporary structures may remain. Remove sheeting, shoring, and bracing in such a manner as to maintain safety during backfilling operations and to prevent damage to the Work and adjacent structures or improvements.
- E Immediately fill and compact voids left or caused by removal of sheeting with cement stabilized sand or material approved by Engineer.

3.03 DEWATERING

- A Maintain ground water control as directed by Section 01564 - Control of Ground Water and Surface Water and until the structure is sufficiently complete to provide the required weight to resist hydrostatic uplift with a minimum safety factor of 1.2.
- B Maintain the ground water surface a minimum of two feet below the bottom of the foundation base.

3.04 FOUNDATION EXCAVATION

- A Notify Engineer at least 48 hours prior to planned completion of foundation excavations. Do not place the foundation base until the excavation is accepted by the Engineer.
- B Excavate to elevations shown on Plans Drawings, as needed to provide space for the foundation base, forming a level undisturbed surface, free of mud or soft material. Remove pockets of soft or otherwise unstable soils and replace with foundation backfill material or a material as directed by the Engineer. Prior to placing material

over it, re-compact the subgrade, scarifying as needed, to 95 percent of the maximum Standard Proctor Density according to ASTM D 698. If the specified level of compaction cannot be achieved, moisture condition the subgrade and re-compact until 95 percent is achieved, over-excavate to provide a minimum layer of 24 inches of foundation backfill material, or other means acceptable to the Engineer.

- C Fill unauthorized excessive excavation with foundation backfill material or other material as directed by the Engineer.
- D Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in a satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement.
- E Soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to the required subgrade, shall be removed and replaced with foundation backfill material, as directed by Engineer, at no additional cost to the Owner.
- F Place foundation base, or foundation backfill material where needed, over the subgrade on same day that excavation is completed to final grade. Where base of excavations are left open for longer periods, protect them with a seal slab or cement-stabilized sand.
- G Where directed by the Plans Drawings, all crushed aggregate, and other free draining Class I materials, shall have a Geo- textile filter fabric separating it from native soils or select material backfill. The fabric shall overlap a minimum of 12 inches beyond where another material stops contact with the soil.
- H Crushed aggregate, and other Class I materials, shall be placed in uniform layers of 8-inch maximum thickness. Compaction shall be by means of at least two passes of a vibratory compactor.

3.05 FOUNDATION BASE

- A After the subgrade is properly prepared, including the placement of foundation backfill where needed, the foundation base shall be placed. The foundation base shall consist of a 12-inch layer of crushed aggregate or cement stabilized sand. Alternately, a 4-inch minimum seal slab may be placed. The foundation base shall extend a minimum of 12 inches beyond the edge of the structure foundation.
- B Where the foundation base and foundation backfill are of the same material, both can be placed in one operation.

3.06 BACKFILL

- A Complete backfill to surface of natural ground or to lines and grades shown on Plans Drawings. Use existing material that qualifies as select material, unless indicated otherwise. Deposit backfill in uniform layers and compact each layer as specified.
- B Do not place backfill against concrete walls or similar structures until laboratory test breaks indicate that the concrete has reached a minimum of 85 percent of the specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin backfill operations until the slab or intermediate walls have been placed and concrete has attained sufficient strength.
- C Remove concrete forms before starting backfill and remove shoring and bracing as work progresses.
- D Maintain fill material at no less than 2 percent below and no more than 2 percent above optimum moisture content. Place fill material in uniform 8-inch maximum loose layers. Compaction of fill shall be to at least 95 percent of the maximum Standard Proctor Density according to ASTM D 698 under paved areas. Compact to at least 90 percent around structures below unpaved areas.
- E Where backfill is placed against a sloped excavation surface, run compaction equipment across the boundary of the cut slope and backfill to form a compacted slope surface for placement of the next layer of backfill.
- F Place backfill using cement stabilized sand in accordance with Section 02252 - Cement Stabilized Sand.

3.07 FIELD QUALITY CONTROL

- A Tests will be performed initially on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with TxDOT Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is a noticeable change in material gradation or plasticity.
- B In-place density tests of compacted subgrade and backfill will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at the following frequencies and conditions:
 - 1. A minimum of one test for every 100 cubic yards of compacted backfill material.
 - 2. A minimum three density tests for each full work shift.
 - 3. Density tests will be performed in all placement areas.
 - 4. The number of tests will be increased if inspection determines that soil types or moisture contents are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density.

- C At least three tests for moisture-density relationships will be initially performed for each type of backfill material in accordance with ASTM D 698. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.
- D If tests indicate work does not meet specified compaction requirements, recondition, re-compact, and retest at Contractor's expense.

3.08 CLEAN-UP AND RESTORATION

- A Perform clean-up and restoration in and around construction zone in accordance with Section 01140 - Contractor's Use of Premises.
- B In unpaved areas, grade surface as a uniform slope from installed appurtenances to natural grade and stabilize as indicated on Plans.

3.09 PROTECTION OF THE WORK

- A Maintain excavation and embankment areas until start of subsequent work. Repair and re-compact slides, washouts, settlements, or areas with loss of density at no cost to the Owner
- B Prevent erosion at all times. Do not allow water to pond in excavations.
- C Distribute construction traffic evenly over compacted areas, where practical, to aid in obtaining uniform compaction. Protect exposed areas having high moisture content from wheel loads that cause rutting.

END OF SECTION