

SECTION 31 23 17
TRENCHING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Excavating trenches for utilities and utility structures.
 2. Bedding.
 3. Backfilling and compacting to subgrade elevations.
 4. Sheeting and Shoring.
 5. Dewatering.
 6. Compacting backfill material.
- B. Related Sections:
1. Section 33 23 13 - Erosion Controls: Diversion of water from excavations.
 2. Section 31 23 16 - Excavation and Fill: Topsoil and subsoil removal from site surface.
 3. Section 31 23 18 - Rock Removal: Removal of rock found during excavating.
 4. Section 31 25 13 – Erosion Controls: Controlling sediment and erosion from Work of this section.
 5. Section 33 11 16 - Water Utility Distribution Piping: Water piping and appurtenances.
 6. Section 33 31 00 - Sanitary Utility Sewerage Piping: Sanitary sewer piping and bedding.
 7. Section 33 41 00 - Storm Utility Drainage Piping: Storm sewer piping and bedding.
 8. Section 33 46 00 - Subdrainage: Building perimeter drainage, filter aggregate, filter fabric, and granular cover.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 5. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- C. SCDOT Standard Specifications:

1. Standard Specifications for Highway Construction, 2007, published by the South Carolina Department of Transportation.

1.3 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.
- B. Utility Structures: Manholes, catch basins, inlets, valve vaults, hand holes, and other utility access structures as indicated on Drawings.
- C. Trench Terminology:
 1. Foundation: Area under bottom of trench supporting bedding.
 2. Bedding: Fill placed under utility pipe.
 3. Haunching: Fill placed from bedding to center line of pipe.
 4. Initial Backfill: Fill placed from center line to 6 to 12 inches above top of pipe.
 5. Final Backfill: Fill placed from initial backfill to subgrade.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of South Carolina.
- C. Dewatering Plan if required: Describe methods of dewatering and disposal of water.
- D. Product Data: Submit data for geotextile fabric indicating fabric and construction.
- E. Samples: Submit to testing laboratory, in air-tight containers, 10-pound sample of each type of fill.
- F. Materials Source: Submit name of imported fill material suppliers.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Division 200 of SCDOT Standard Specifications.
- B. Maintain one copy of document on site.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.7 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 BACKFILL MATERIALS

- A. Subsoil Fill: Clean natural soil with a plasticity index of 15 or less that is free of clay, rock, or gravel lumps larger than 2 inches in any dimension; debris; waste; frozen material; and any other deleterious material that might cause settlement. Suitable material excavated from the site may be used as subsoil fill under optimum moisture conditions.
- B. Granular Fill: Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SW, SP, SP-SM or SP-SC.
- C. Foundation Stone: Clean course aggregate Gradation No. 57 conforming to Sections 801 of the SCDOT Standard Specifications.
- D. Bedding and Haunching Material:
 - 1. Rigid Pipe: Granular Fill.
 - 2. Flexible Pipe: Foundation Stone.
- E. Bedding for Structures: Foundation Stone.
- F. Initial Backfill to 6 inches Minimum Above Utility:
 - 1. Rigid Pipe: Subsoil Fill.
 - 2. Flexible Pipe: Foundation Stone.
- G. Final Backfill to Subgrade:
 - 1. Under Pavement: Granular Fill.
 - 2. Under Landscape: Subsoil Fill.

2.2 ACCESSORIES

- A. Geotextile Fabric: Non-woven, non-biodegradable conforming to Section 804 of the SCDOT Standard Specifications.
- B. Concrete: Concrete conforming to Section 701 of the SCDOT Standard Specifications.
 - 1. Compressive strength of 3,000 psi at 28 days.
 - 2. Air entrained.
 - 3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
 - 4. Maximum slump of 3.5 inches for vibrated concrete and 4 inches for non-vibrated concrete.
 - 5. Minimum cement content of 564 lbs per cubic yard for vibrated and 602 lbs. per cubic yard for non-vibrated concrete.

PART 3 EXECUTION

3.1 PREPARATION

- A. Call local utility line information service indicated on Drawings not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum locations.

- C. Protect plant life, lawns, rock outcropping, and other features remaining as portion of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.
- F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.2 LINES AND GRADES

- A. Excavate to lines and grades indicated on Drawings.
 - 1. Owner reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
- B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.3 TRENCHING

- A. Excavate subsoil required for utilities.
- B. Remove lumped subsoil, boulders, and rock up of 1/3 cubic yard, measured by volume. Remove larger material as specified in Section 31 23 18.
- C. Perform excavation within 48 inches of existing utility service in accordance with utility's requirements.
- D. Do not advance open trench more than 200 feet ahead of installed pipe.
- E. Remove water or materials that interfere with Work.
- F. Trench Width: Excavate bottom of trenches maximum 16 inches wider than outside diameter of pipe or as indicated on Drawings.
- G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.
- H. Maintain vertical faces to an elevation equal to 12 inches above top of pipe.
 - 1. When Project conditions permit, side walls may be sloped or benched above this elevation.
 - 2. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this Section.
- I. Support Utilities and Structures:
 - 1. Keep trench width at top of trench to practical minimum to protect adjacent or crossing utility lines
 - 2. Support utilities crossing trench by means acceptable to utility company.
 - 3. Do not interfere with 45-degree bearing splay of foundations.
 - 4. Provide temporary support for structures above and below ground.
- J. When subsurface materials at bottom of trench are loose or soft, excavate to firm subgrade or to depth directed by Engineer.
 - 1. Cut out soft areas of subgrade not capable of compaction in place.

2. Backfill with foundation stone and compact to density equal to or greater than requirements for subsequent backfill material.
- K. Trim Excavation: Hand trim for bell and spigot pipe joints where required. Remove loose matter.
- L. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.
- M. Place geotextile fabric over trench foundation stone prior to placing subsequent bedding materials.

3.4 SHEETING AND SHORING

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
- C. Design sheeting and shoring to be removed at completion of excavation work unless approved by Engineer.
- D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- E. Repair damage to new and existing Work from settlement, water, or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 SURFACE WATER CONTROL

- A. Control and remove unanticipated water seepage into excavation.
- B. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Section 31 25 13.
- C. Divert surface water and seepage water within excavation areas into sumps or settling basins prior to pumping water into drainage channels and storm drains.

3.6 DEWATERING

- A. Design and provide dewatering system to permit Work to be completed on dry and stable subgrade.
- B. Operate dewatering system continuously until backfill is minimum 2 feet above normal ground water table elevation.
- C. When dewatering system cannot control water within excavation, notify Engineer and stop excavation work.
 1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
 2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.

- D. Modify dewatering systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.
- E. Discharge ground water and seepage water within excavation areas through filter bags or into settling basins prior to pumping water into drainage channels and storm drains.
- F. Remove dewatering and surface water control systems after dewatering operations are discontinued.

3.7 BEDDING, HAUNCHING, AND INITIAL BACKFILL

- A. Place bedding full width of trench to the depth indicated on Drawings and compact to 95 percent maximum density. Excavate for pipe bells.
- B. Install utility pipe and conduit in accordance with the respective utility section.
- C. Support pipe uniformly along entire length of pipe.
- D. Carefully place haunching material to center of pipe, rod and tamp material to fill voids and provide uniform support of pipe haunches. Compact to 90 percent maximum density.
- E. Carefully place initial backfill to 6 inches above top of pipe or to depth indicated on Drawings. Compact to 95 percent maximum density.

3.8 FINAL BACKFILLING TO SUBGRADE

- A. Backfill trenches to contours and elevations with unfrozen fill materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place fill material in continuous layers and compact in accordance with schedule at end of this Section.
- D. Employ placement method that does not disturb or damage utilities in trench or foundation perimeter drainage.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Do not leave more than 50 feet of trench open at end of working day.
- G. Protect open trench to prevent danger to the public.

3.9 DISPOSAL OF EXCESS MATERIAL

- A. Dispose of excess material offsite and legally.
- B. Furnish Engineer with certificate of disposal site or agreement from private property owner.

3.10 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.

3.11 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557 or AASHTO T180.
- C. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
 - 2. Moisture Tests: ASTM D3017.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.
- E. Frequency of Tests: Two tests per lift for every 1000 feet of trench.

3.12 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.13 SCHEDULE OF COMPACTION

- A. Under Pavement and Slabs:
 - 1. Granular Fill in maximum 8-inch loose lifts.
 - 2. Compact to minimum 95 percent maximum density except the top 12 inches.
 - 3. Compact top 12 inches to minimum 98 percent maximum density.
- B. Under Landscape Areas:
 - 1. Subsoil Fill in maximum 8-inch loose lifts.
 - 2. Compact to minimum 90 percent maximum density.
- C. In Unstable or Unsuitable Trench Foundation Areas:
 - 1. Foundation Stone in maximum 12-inch loose lifts.
 - 2. Compact to 98 percent maximum density.

END OF SECTION