

SECTION 31 23 16
EXCAVATION AND FILL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Excavating topsoil.
 2. Excavating subsoil for buildings, pavements, and landscape.
 3. Backfilling building perimeter to subgrade elevations.
 4. Backfilling site structures to subgrade elevations.
 5. Filling under pavements or slabs-on-grade.
 6. Undercutting and filling over-excavation.
 7. Disposal of excess material.
- B. Related Sections:
1. Section 02 41 16 - Structure Demolition: Demolition of buildings prior to excavation.
 2. Section 31 10 00 - Site Clearing: Clearing site prior to excavation.
 3. Section 31 25 13 - Erosion Controls: Controlling sediment and erosion from Work of this section.
 4. Section 31 23 17 - Trenching: Excavating and backfilling for utilities.
 5. Section 31 23 18 - Rock Removal.
 6. Section 32 91 19 - Landscape Grading: Finish grading with topsoil to contours.

1.2 REFERENCES

- A. SCDOT Standard Specifications:
1. Standard Specifications for Highway Construction, 2007, published by the South Carolina Department of Transportation.
- B. 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.
- C. 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 D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 6. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 7. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 8. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 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.
- C. Dewatering Plan: Describe dewatering methods to be used to keep excavations dry if required.
- D. Samples: Submit, in air-tight containers, 10-pound sample of each type of fill to testing laboratory.
- E. Materials Source DOT Approval: Submit certification that aggregate and soil material suppliers are approved by the State Department of Transportation.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Division 200 - Earthwork of the SCDOT Standard Specifications.
- B. Maintain one copy of document on site.
- C. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Project location.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil: Original surface soil typical of the area which is capable of supporting native plant growth. It shall be free of large stones, roots, waste, debris, contamination, or other unsuitable material which might hinder plant growth.
- B. Subsoil: 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.
- C. Granular Fill: Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SW, SP, SP-SM, or SP-SC.
- D. Structural Fill: Clean coarse aggregate Gradation No. 57 conforming to Sections 801 of the SCDOT Standard Specifications.
- E. Borrow Material: Conform to subsoil requirements.

2.2 ACCESSORIES

- A. Geotextile Fabric: Non-woven, non-biodegradable, conforming to Section 804 of the SCDOT Standard Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.
- C. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- D. Verify underground structures are anchored to their own foundations to avoid flotation after backfilling.
- E. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION FOR EXCAVATION

- A. Call Local Utility Line Information service as 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.
- C. Notify utility company to remove and relocate utilities.
- D. Protect utilities indicated to remain from damage.
- E. Protect plant life, lawns, rock outcropping, and other features remaining as portion of final landscaping.
- F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or regraded without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site and protect from erosion.
- D. Remove from site excess topsoil not intended for reuse.

3.4 SUBSOIL EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation work.

- B. Excavate subsoil to accommodate building foundations, structures, slabs-on-grade, paving, landscaping, and construction operations.
- C. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity.
- D. Slope banks with machine to angle of repose or less until shored.
- E. Do not interfere with 45-degree bearing splay of foundations.
- F. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- G. Trim excavation. Remove loose matter.
- H. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume. Remove larger material as specified in Section 31 23 18.
- I. Notify Engineer and testing agency of unexpected subsurface conditions.
- J. Correct areas over excavated with granular fill and compact as required for fill areas.
- K. Remove excess and unsuitable material from site.
- L. Repair or replace items indicated to remain damaged by excavation.
- M. Excavate subsoil from areas to be further excavated, re-landscaped, or regraded.
- N. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.
- O. Remove from site excess subsoil not intended for reuse.
- P. Benching Slopes: Horizontally bench existing slopes greater than 3:1 to key placed fill material into slope to provide firm bearing.
- Q. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 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 excavations 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 left in place as part of the completed Work, cut off minimum 18 inches below finished subgrade, or design sheeting and shoring to be removed at completion of excavation work.
- 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.

3.6 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.

3.7 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 into sumps or 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.

3.8 PROOF ROLLING

- A. Proof roll areas to receive fill, pavement and building slabs to identify areas of soft yielding soils.
 - 1. Use loaded tandem-axle pneumatic tired dump truck or large smooth drum roller.
 - 2. Load equipment to maximum 50 tons gross weight and make a minimum of four passes with two passes perpendicular to the others.
- B. Undercut such areas to firm soil, backfill with granular fill, and compact to density equal to or greater than requirements for subsequent fill material.
- C. Do not proof roll or undercut until soil has been dewatered.

3.9 BACKFILLING

- A. Scarify subgrade surface to depth of 4 inches.
- B. Compact subgrade to density requirements for subsequent backfill materials.
- C. Backfill areas to contours and elevations with unfrozen materials.

- D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- E. Place fill material in continuous layers and compact in accordance with Schedule at end of this Section.
- F. Employ placement method that does not disturb or damage other work.
- G. Maintain optimum moisture content of backfill materials to attain required compaction density.
- H. Support foundation walls and structures prior to backfilling.
- I. Backfill simultaneously on each side of unsupported foundation walls and structures until supports are in place.
- J. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet, unless noted otherwise.
- K. Make gradual grade changes. Blend slope into level areas.
- L. Remove surplus backfill materials from site.

3.10 BRIDGING DEGRADED SOILS – Not Used

3.11 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Top Surface of Backfilling Within Building and Paved Areas: Plus or minus 1 inch from required elevations.
- C. Top Surface of Backfilling Within Landscape Areas: Plus or minus 2 inches from required elevations.

3.12 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.
- D. Repair or replace items indicated to remain damaged by excavation or filling.

3.13 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Independent laboratory, field inspecting, testing, adjusting, and balancing.
- B. Request visual inspection of bearing surfaces by Engineer and inspection agency before installing subsequent work.
- C. Laboratory Material Tests: In accordance with ASTM D1557 or AASHTO T180.

- D. In-Place Compaction Tests: In accordance with the following:
 - 1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
 - 2. Moisture Tests: ASTM D3017.
- E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
- F. Frequency of Tests:
 - 1. Building and Pavement Areas: Twice per lift for every 5,000 square feet.
 - 2. Landscape Areas: Twice per lift for every 10,000 square feet.

3.14 SCHEDULES

- A. Under Pavement and Slabs:
 - 1. Maximum 8-inch compacted depth.
 - 2. Compact material to a minimum of 95 percent of maximum density, except the top 12 inches.
 - 3. Compact top 12 inches to a minimum of 98 percent of maximum density.
- B. Under Landscape Areas:
 - 1. Maximum 8-inch compacted depth.
 - 2. Compact to minimum 90 percent of maximum density.
- C. Footing Foundation Fill:
 - 1. Structural fill to maximum 12-inch compacted depth.
 - 2. Compact to 98 percent of maximum density.

END OF SECTION