

PART 1 – GENERAL**1.1 RELATED SECTIONS**

- A. Section 01 33 00 – Submittal Procedures
- B. Section 01 45 00 – Quality Control
- C. Section 31 05 16 – Aggregates for Earthwork
- D. Section 31 05 19 – Geotextiles
- E. Section 31 20 00 – Earth Moving
- F. Section 31 23 00 – Excavation and Fill
- G. Section 31 23 16 – Excavation and Backfill for Utilities
- H. Section 31 25 00 – Erosion and Sedimentation Controls
- I. Section 32 13 13 – Concrete Paving
- J. Section 32 90 00 – Planting

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
 - 2. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 3. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 - 4. ASTM D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
 - 5. ASTM D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
 - 6. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
 - 7. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)
 - 8. ASTM D4829 – Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
 - 9. ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- B. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO T99 – Moisture-Density Relations of Soils Using a 5.5-lb Rammer and 12-in. Drop
 - 2. AASHTO T180 – Moisture-Density Relations of Soils Using a 10-lb Rammer and 18-in. Drop
- C. International Building Code (IBC) 2021
- D. Occupational Safety and Health Administration (OSHA) Standards 29 CFR

- E. Local Jurisdictional Codes and Regulations (as applicable)

1.3 DEFINITIONS

- A. 1.3.1 Earthwork: All excavation, filling, backfilling, and grading operations required to prepare the site for construction.
- B. 1.3.2 Compaction: The process of increasing soil density by mechanical means to achieve specified soil properties.
- C. 1.3.3 Borrow Soil: Soil imported from off-site for use as fill.
- D. 1.3.4 Subgrade: The prepared surface on which subsequent construction or fill is placed.

1.4 SUBMITTALS

- A. Action Submittals
 - 1. Soil Reports including geotechnical investigation and analysis.
 - 2. Proposed excavation and earthwork plan with sequencing and equipment.
 - 3. Sources and specifications of imported fill materials including gradation and compaction characteristics.
 - 4. Compaction test plan and quality control procedures.
 - 5. Proposed erosion and sediment control plan related to earthwork operations.
 - 6. List of equipment to be used in earthwork operations.
- B. Informational Submittals
 - 1. Copies of permits and approvals related to earthwork.
 - 2. Material test reports for fill materials.
 - 3. Daily earthwork logs indicating volume of excavation/fill and compaction results.
 - 4. Certification of compliance for compaction and moisture content.
 - 5. Safety plan specific to excavation and earthwork activities.
 - 6. Records of field density tests and laboratory testing results.

1.5 QUALITY ASSURANCE

- A. Qualifications
 - 1. Engage a qualified geotechnical engineer to review soil conditions, perform testing, and provide recommendations.
 - 2. Employ experienced personnel and licensed contractors specializing in earthwork operations.
- B. Testing
 - 1. Perform soil classification, moisture content, and compaction testing per ASTM and AASHTO standards.
 - 2. Testing laboratory shall be accredited and independent from the contractor.
 - 3. Field density tests shall be conducted at a frequency not less than one test per 500 square feet per lift or as required by governing codes.

C. Verification

1. Verify excavation limits, subgrade elevations, and compaction levels prior to placement of fill or construction.
2. Perform pre-construction survey and documentation of existing site conditions.

D. Safety

1. Earthwork shall comply with OSHA requirements for excavation safety, including shoring, sloping, and protective systems.
2. Provide barricades, signage, and protective measures to secure excavation areas.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. Deliver fill materials in a dry, uncompacted condition and free from debris, organic matter, and frozen materials.

B. Storage

1. Stockpile imported and on-site soils separately to prevent mixing of unsuitable materials.
2. Protect stockpiles from contamination and erosion by wind or rain.

C. Handling

1. Handle materials to prevent segregation or contamination.
2. Maintain moisture content within specified limits during handling and placement to ensure compaction quality.

1.7 WARRANTY

- A. Provide a warranty for earthwork materials and workmanship against defects for a period of one year from date of substantial completion.
- B. Warranty shall cover settlement, inadequate compaction, erosion, or failure of earthwork to perform as specified.
- C. Contractor shall promptly repair or replace defective work at no additional cost to the Owner.

PART 2 – PRODUCTS

2.1 SOILS AND FILL MATERIALS

A. General Requirements

1. Fill material shall be free from organic matter, roots, debris, frozen soil, and other deleterious materials.
2. Material shall meet gradation requirements per ASTM D2487 Soil Classification System as specified in project documents.

B. On-Site Soils

1. On-site soils may be used if tested and approved by the geotechnical engineer.
- C. Imported Fill
 1. Imported fill shall comply with project specifications and be approved prior to delivery.
 2. Gradation, plasticity, and compaction characteristics shall be provided by supplier.

2.2 GEOTEXTILES AND EROSION CONTROL MATERIALS

- A. Geotextiles shall conform to Section 31 05 19 and be used where indicated to separate fill materials or stabilize subgrade.
- B. Erosion control blankets and sediment barriers shall comply with Section 31 25 00.

2.3 MANUFACTURERS

- A. 2Soil Suppliers
 1. ABC Earth Materials Inc.
 2. XYZ Aggregate Supply Company
 3. National Fill Material Providers
- B. Geotextile and Erosion Control
 1. TenCate Geosynthetics
 2. Propex Operating Company LLC
 3. Huesker, Inc.
- C. Testing Laboratories
 1. SoilTech Laboratories
 2. GeoTest Engineering Services
 3. National Materials Testing, Inc.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that site conditions are ready to receive work and that underground utilities and structures are located and protected.
- B. Notify Engineer of any discrepancies or unsuitable conditions before proceeding.
- C. Verify that subgrade is free of frost, standing water, soft spots, debris, and frozen materials.

3.2 PREPARATION

- A. Clearing and Grubbing
 1. Remove trees, shrubs, roots, debris, and topsoil as indicated.

- B. Stripping and Stockpiling
 - 1. Strip topsoil from areas to be excavated or filled and stockpile separately.
- C. Excavation
 - 1. Excavate to subgrade elevations as indicated.
 - 2. Remove unsuitable or unstable soils as directed.
- D. Subgrade Preparation
 - 1. Scarify and loosen subgrade surface where required to achieve bonding with fill.
 - 2. Moisture condition subgrade to optimum moisture content for compaction.

3.3 FILL PLACEMENT AND COMPACTION

- A. Placement
 - 1. Place fill in horizontal lifts not exceeding 8 inches loose thickness unless otherwise approved.
 - 2. Maintain moisture content within plus or minus 2% of optimum moisture content.
- B. Compaction
 - 1. Compact each lift to not less than 95 percent of maximum dry density as determined by ASTM D698 or D1557.
 - 2. Use appropriate compaction equipment such as rollers, rammers, or vibratory compactors.
- C. Testing
 - 1. Perform field density tests at required frequencies.
 - 2. Provide results to Engineer for acceptance.
- D. Correction of Deficiencies
 - 1. Remove or rework areas failing to meet compaction or moisture requirements.
 - 2. Retest after corrective action until specified requirements are met.

3.4 GRADING

- A. Uniformly grade and shape earthwork areas to required elevations and slopes.
- B. Provide positive drainage away from structures and as indicated on drawings.
- C. Finish surfaces smooth and free of irregularities.

3.5 EROSION AND SEDIMENTATION CONTROL

- A. Implement erosion control measures during and after earthwork to prevent sediment runoff.
- B. Maintain temporary erosion control devices until permanent stabilization is established.

3.6 FIELD QUALITY CONTROL

- A. Inspection and Testing

1. Engineer or testing agency will perform periodic inspections and testing.
 2. Contractor shall cooperate and provide access and documentation.
- B. Non-Conformance
1. Immediately correct non-conforming work.
 2. Additional testing and inspection may be required at Contractor's expense.

3.7 PROTECTION

- A. Protect completed earthwork from disturbance or damage by subsequent construction activities.
- B. Repair or rework any damaged areas to meet original specifications.

3.8 CLEANING

- A. Remove surplus materials, debris, and equipment from site.
- B. Leave site in a clean and orderly condition.

END OF SECTION