

**SECTION 31 23 18  
EARTHWORK FOR STRUCTURES**

**PART 1 - GENERAL**

**1.01 RELATED SECTIONS**

- A. Division 1 Sections

**1.02 REFERENCES**

ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.

ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>).

ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

**1.03 DEFINITIONS**

- A. Granular Subbase: Fill directly beneath slabs-on-grade.
- B. Backfill: Fill immediately behind foundation elements or retaining walls.
- C. Structural Fill: Fill under the structure other than the granular subbase.

**1.04 SUBMITTALS**

- A. Upon request, submit soil test reports performed by the Structural Testing/Inspection Agency.

**1.05 QUALITY ASSURANCE**

- A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

**1.06 SURVEY**

- A. Prior to construction, have structure location staked and certified by a licensed surveyor. If discrepancies between actual lines and elevations exist, notify Architect/Structural Engineer before proceeding with layout of structure.

**1.07 SUBSURFACE CONDITIONS**

- A. Copies of a subsurface investigation of the site will be made available upon request. The data is not intended as a representation or warranty of the continuity of such conditions. Owner will not be responsible for interpretation or conclusions drawn by the Contractor. The data is made available for the convenience of the Contractor and is not guaranteed to represent all conditions that may be encountered.

- B. Contractor may examine the site and make his own subsurface explorations at no additional cost to the Owner. Notify Owner prior to making any subsurface explorations.

**1.08 EXISTING UTILITIES**

- A. Locate existing underground utilities by careful hand excavation. If utilities are to remain in place, provide protection from damage during construction operations.
- B. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Do not interrupt existing utility service facilities occupied and used by Owner or others, unless written permission is given by the Architect and then only after temporary utility services have been provided.
- C. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Architect immediately for directions.
- D. Repair damaged utilities to satisfaction of utility owner.

**1.09 NOTICE**

- A. Notify the Architect/Structural Engineer 48 hours prior to the beginning of any excavation work.

**PART 2 - PRODUCTS**

**2.01 GRANULAR SUBBASE**

- A. Granular Subbase: Clean, fine-graded material with at least 10 to 30 percent of particles passing a No. 100 sieve but not contaminated with clay, silt, or organic material. The material shall have a uniform distribution of particle sizes ranging from No. 4 to the No. 200 sieve. Refer to ASTM C 33, Table 1, for limitation of deleterious material finer than No. 200 sieve. Unwashed size No. 10 per ASTM D 448 and manufactured sand from a rock-crushing operation is acceptable.

**2.02 BACKFILL**

- A. Backfill: Sound and free-draining, such as sand, gravel or crushed stone with less than 10% passing the 200 sieve. Maximum diameter shall be 1-1/2 inches.

**2.03 STRUCTURAL FILL**

- A. Soil Structural Fill: Native soils with a plasticity index less than 35%, a liquid limit less than 55%, a maximum dry density greater than 95pcf and a maximum particle size of 3 inches.
- B. Shot Rock Structural Fill: Reasonably well graded shot rock from outside sources with a maximum rock size of 12 inches and less than 20 percent passing a No. 4 sieve.
- C. Structural Fill shall be free of organics, debris and deleterious materials.

**PART 3 - EXECUTION**

**3.01 STRIPPING**

- A. Strip vegetation, topsoil, roots, and other unsuitable material to a depth determined by the Structural Testing/Inspection Agency but not less than one foot, nor less than 10 feet outside the perimeter of the structure.

- B. Stockpile sufficient amounts of topsoil as required to cover areas to be landscaped with a minimum of six inches of material.

### **3.02 EXCAVATION**

- A. Excavation shall be considered unclassified. Excavations shall comply with U.S. Department of Labor, Occupation Safety and Health Administration (OSHA) regulations.
- B. Perform excavation to the depths and limits on the Drawings and as specified herein.
- C. Do not excavate to full depth when there is probability of frost forming or ground freezing in excavation before concrete is placed.
- D. Under-cut existing old fill materials within the building area as directed by the geotechnical engineer.
- E. Ground water may be encountered during the foundation excavation. Provide a system for controlling the ground water to a level at least three feet below the lowest point of the excavation.
- F. Keep excavations dry by sloping ground away from holes and trenches.

### **3.03 PROOFROLLING**

- A. After stripping or excavation and before any fill placement, fill areas shall be proofrolled with a minimum of two coverages of a loaded dump truck or scraper in each of two perpendicular directions.
- B. Areas found to be soft or pumping shall have the soft soil removed and replaced with structural fill and compacted as outlined herein.

### **3.04 PLACEMENT OF STRUCTURAL FILL**

- A. Do not place structural fill on subgrade that contains frost, mud or is frozen.
- B. Soil Structural fill shall be placed and compacted in 8-inch thick loose layers.
- C. Compact soil structural fill to 98 percent of the maximum dry density as measured by Standard Proctor, ASTM D698, with water content within +3/-3 percent of the optimum moisture content.
- D. Compact shot rock fill in 12-inch layers using six complete passes of 5-ton class vibratory roller, or 8 passes of a D-8 class crawler tractor. A pass is defined as a complete coverage of the surface with roller drum overlapping 2 feet, or D-8 track overlapping 50 percent. No water content control will be required.

### **3.05 PLACEMENT OF BACKFILL**

- A. Backfill behind wall shall be placed in layers of six inches.
- B. Compact backfill behind walls to 95 percent of the maximum dry density as measured by Standard Proctor, ASTM D698, with water content within +3/-3 percent of the optimum moisture content.

**3.06 PLACEMENT OF GRANULAR SUBBASE**

- A. Do not place granular subbase on subgrade that contains frost, mud or is frozen.
- B. Compact granular subbase to 95 percent of the maximum dry density as measured by Standard Proctor, ASTM D698, with the water content within +3/-3 percent of the optimum moisture content.

**3.07 CLEAN UP**

- A. Remove excess excavated materials from job site and upon completion leave site in clean condition.

**END OF SECTION**