SECTION 31 23 23
FILL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade, paving, and site structures.

B. Backfilling and compacting for utilities outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.03 RELATED REQUIREMENTS

A. Section 01 57 13 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

B. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.

1.04 PRICE AND PAYMENT PROCEDURES

A. See Section 01 22 00 - Unit Prices, for general requirements applicable to unit prices for earthwork.

1.05 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

1.06 REFERENCE STANDARDS

A. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).

B. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)); 2012 (Reapproved 2021).

C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017, with Editorial Revision.

D. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2017a, with Editorial Revision.

1.07 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Proposed Fill Material: For each soil type proposed for use, include the following:
   1. Classification per ASTM D 2487-00, Plasticity Index (PI), and Liquid Limit (LL).
   2. Proctor tests results.

C. Fill Composition Test Reports: Results of laboratory tests on actual materials use

D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

E. Compaction Density Test Reports.

1.08 QUALITY ASSURANCE

A. Employ services of a Geotechnical Consultant, approved by Architect Engineer for the following services:
   1. Develop filling and compaction techniques best suitable to site conditions at the time of construction.
   2. Observe site filling.
   3. Analyze soil materials proposed to be used as fill.
   4. Perform applicable laboratory and field tests.

B. An independent testing agency shall perform field quality test, as specified in Section 014533 - Special Inspections

C. Perform all testing work in accordance with the following:
   1. Fill Properties:
      a. Plasticity Index shall be determined as per ASTM D4318-00 "Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils".
      b. Sieve Analysis shall be as per ASTM D422-63(1998) "Standard Test Method for Particle-Size Analysis of Soils".
      c. Water Content Density Relationship shall be determined as per ASTM D 1557 "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3)"Modified Proctor Test.
      d. Relative density shall be determined as per ASTM D4253-00 "Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table".

D. Compacted fill that does not reach the required density may be rejected by Geotechnical Consultant with approval from Architect Engineer. Recompact the Work to the required density, or remove the material in the area(s) affected, and replace removed material with fill compacted to the required density.

1.09 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. Review size of earthmoving equipment with Geotechnical Consultant. Ensure that the silty clay soils on site will not lose strength during earthmoving operation

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Imported borrow or local borrow capable of forming a stable embankment and free of roots and other unsatisfactory debris.
   1. Do not use with 5 feet of building or pavement.
   2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

B. Structural Fill: Imported borrow or local borrow.
   1. Graded.
   2. Free of debris and rocks larger than 6 inches except within upper 18 inches of finished subgrade maximum rock size is 1-1/2 inch.
   3. Conforming to ASTM D2487 Group Symbol GC, SC and CL.
   4. Plasticity Index less than 20.

C. Concrete for Fill: As specified in Section 033000 (03300); compressive strength of 2500 psi.

D. Granular Fill: Graded from 1/4 inch to 1-1/2 inch; 1 to 2 inch for use around trees.

E. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

F. Topsoil: Friable loam; imported borrow or local borrow.
   1. Free of roots, rocks larger than 1 inch, subsoil, debris, large weeds and foreign matter.

2.02 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 22 00 for additional requirements.

D. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Maintain optimum moisture content of fill materials to attain required compaction density.
   1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
   2. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

E. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

F. Correct areas that are over-excavated.
   1. Load-bearing foundation surfaces: Fill with concrete or structural fill.
   2. Under pavement, slabs-on-grade, and similar construction: Use structural fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density within 2% of optimum moisture content.
   3. Other areas: Use general fill, flush to required elevation, compacted to minimum 90 percent of maximum dry density.

G. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under pavement, slabs-on-grade, and similar construction: Use structural fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density within 2% of optimum moisture content.
   2. Other areas: Use general fill, flush to required elevation, compacted to minimum 90 percent of maximum dry densit

H. Reshape and re-compact fills subjected to vehicular traffic.

I. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect Engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 FILL AT SPECIFIC LOCATIONS

3.05 FIELD QUALITY CONTROL.

A. The contractor shall employ and pay for services of an independent testing agency to perform field quality control tests, as specified in Section 01 40 00.

B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor").

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

D. Frequency of Tests (General or Structural fill): One for each 2500 sq. ft. of lift.

E. Frequency of Tests (Trench fill) : One for every 200 lineal feet of trench per lift of fill in place.

3.06 PROTECTION AND MAINTENANCE

A. Protection Of Graded Areas: Protect newly graded areas from traffic, erosion, and effects of ponding of water. Keep free of trash and debris.
   1. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
   2. Provide and maintain positive surface drainage to prevent ponding and subsequent saturation of excavation or fill materials. Saturated soils shall be removed and replaced or shall be dried to specified moisture content and recompacted without additional charge to Owner.

B. Reconditioning Compacted And/Or Excavated Areas: Where completed areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction. Failure of the disturbed soil to reach the required density, as evidenced by density tests, is cause for rejection by Geotechnical Consultant after obtaining approval from Architect Engineer of the work in the affected area(s). Remove and replace soils which cannot recompact to the required density.

C. Settling: Where settling is measurable or observable at fill areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.07 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION