

## SECTION 030300 – STRUCTURAL EXCAVATION AND BACKFILL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Structural Excavation and Backfill includes:
  - 1. Preparing subgrades for slabs on grade.
  - 2. Excavating and backfilling for building foundations from subgrade.
  - 3. Subsurface drainage backfill for foundation walls.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Structural Special Inspection."
  - 2. Division 1 Section "Temporary Facilities and Controls."
  - 3. Division 3 Section "Cast-in-Place Concrete."
  - 4. Division 31 Section "Dewatering."
  - 5. Division 31 Section "Excavation Support and Protection."
  - 6. Division 31 Section "Earth Moving."
  - 7. Division 31 Section "Drilled Concrete Piers and Shafts."
  - 8. Division 33 Section "Subdrainage."

#### 1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material (flowable fill) used to fill an excavation.
- B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- C. Drainage Course: Free-draining aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- D. Excavation: Removal of material encountered above bearing elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation (Over-excavation): Excavation below bearing elevations or beyond indicated lines and dimensions as directed by Special Inspector and confirmed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
  - 2. Bulk (Mass) Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
  - 3. Unauthorized Excavation: Excavation below bearing elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

- E. Fill: Soil materials used to raise existing grades.
- F. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 3/4 cu. yd. for footing excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
  - 1. Excavation of Footings: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, or other man-made stationary features constructed above or below the ground surface as shown on the structural drawings.
- H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### 1.4 SUBMITTALS

- A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D 2487.
  - 2. Laboratory compaction curve according to ASTM D 698.

### PART 2 - PRODUCTS

#### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, GC, SW, SP, SM, SC, and CL according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. No concentration of large fragments is permitted by Geotechnical Engineer with approval by Architect.
  - 1. Plasticity Index: Less than 30.
  - 2. Maximum dry density of at least 100 pounds per cubic foot.

- C. Unsatisfactory Soils: Soil Classification Groups ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
  - 2. Shot rock, asphalt, and coal fragments.
- D. Subbase Material (Dense Graded Aggregate): Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; meeting Kentucky Transportation Cabinet Standard Specification for dense graded aggregate; with at ¾" maximum nominal size aggregate and not more than 13 percent passing a No. 200 sieve.
- E. Drainage Backfill (Crushed Stone): Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; meeting Kentucky Transportation Cabinet Standard Specification for #57 stone; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

## 2.2 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material Performance Additive:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
    - a. Darafill or Darafill Dry, W.R. Grace & Co.
    - b. Rheomac VMA 362, BASF Corporation – Admixture Systems
- B. Prohibited Admixture: Calcium chloride thiocyanates or admixture containing more than 0.05 percent chloride ions.
- C. Controlled Low Strength Material CLSM (Flowable fill): Self-compacting, flowable concrete material. Provide blend of cement, flyash, and sand with minimum cementitious content as follows:
  - 1. Excavatable flowable fill: 100 lb cement and 250 lb fly ash per cubic yard.
  - 2. Structural flowable fill (250 psi): 175 lb cement and 200 lb fly ash per cubic yard. Add CLSM performance additive at manufacturer's recommended dosage rate, adjusting water content to provide desired flow and strength characteristics

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

### 3.3 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
  - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 24 inches outside of concrete forms at grade beams.
    - b. 12 inches outside of concrete forms at footings.

### 3.4 STRUCTURAL EXCAVATION

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for footings and foundations: Trim bottoms to required lines and grades to leave solid base to receive other work.
  - 2. Remove loose soil, debris, and excess surface water from the bearing surface prior to concrete placement.

### 3.5 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Special Inspector determines that unsatisfactory soil is present, notify Architect and receive direction. Once received, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. A loader scraper is also permitted. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### 3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2000 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

### 3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.8 BACKFILL, GENERAL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.9 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact engineered fill material in layers to required elevation.

C. Place fill on subgrades free of mud, frost, snow, or ice.

### 3.10 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight. Maintain the moisture content as such.

### 3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
  - 1. Scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.

### 3.12 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### 3.13 SUBBASE UNDER CONCRETE SLABS-ON-GRADE

- A. Place subbase on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact subbase under cast-in-place concrete slabs-on-grade as follows:
  - 1. Place subbase 6 inches or less in compacted thickness in a single layer.
  - 2. Compact each layer of subbase to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.14 FIELD QUALITY CONTROL

- A. General: The Owner will employ a testing agency which meets the requirements of ASTM E329 to perform tests and to submit test reports. Failure to detect any defective materials shall not prevent later rejection when such defect is discovered, or obligate the Architect or Owner for final acceptance.
  - 1. See Section 014110 – Structural Special Inspections for testing and inspection to be performed.
  - 2. Test results will be reported in writing to the Architect, Engineer, and General Contractor within 24 hours after tests.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent backfill or foundation placement only after test results for previously completed work comply with requirements.
- C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
  - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 030300