

**SECTION 02000  
GRADING AND EXCAVATION**

**PART 1 GENERAL**

**1.01 - Section Includes**

- A. Protection.
- B. Stripping and Respreading Topsoil
- C. Unclassified Excavation and Embankment.
- D. Rock Excavation and Boulder Removal.
- E. Borrow.
- F. Dewatering
- G. Grading

**1.02 - Description Of Work**

- A. Protection: includes, but is not limited to, sheeting, shoring and bracing, earth stabilization, and protection of existing utilities and structures necessary to prevent damage to the work, property, life and limb, due to earth moving operations.
- B. Stripping and Respreading Topsoil: includes stripping, stock piling, and spreading of a maximum of 8 inches of topsoil.
- C. Unclassified Excavation and Embankment: includes excavation, storing, and rehandling of all normal earth materials, such as loam, silt, gumbo, peat, clay, soft shale, sand, gravel and fragmentary rock or boulders, or any other material encountered, regardless of its nature, which may be handled in a manner similar to normal earth materials from existing ground surface to subgrade for pavement or to finish grade outside the paved areas. It also includes:
  - 1. Site preparation.
  - 2. Removal and disposal of excess excavated material.
  - 3. Loading and hauling of the material from the area being excavated to the embankment.
  - 4. The placing and proper compaction of excavated material in an embankment within the Project limits of this Contract.
  - 5. Disking and aeration of wet soil in order to remove moisture from the material.
  - 6. Furnishing and applying water as required to obtain proper moisture content and compaction.
  - 7. Rework and retesting of areas and materials where failing tests occur.
  - 8. The finish grading of earth surfaces.
  - 9. Dewatering.
- D. Rock Excavation and Boulder Removal: includes the excavation, storing, and rehandling of granite, trap, quartzite, chert, limestone, sandstone, hard shale, or slate in natural ledges or displaced masses that are so firmly cemented together that they cannot be removed without continuous use of pneumatic tools or blasting. This item shall also include the removal of rock fragments or boulders which occur on the surface or in subsurface deposits mixed with earth, sand, or gravel when their size, number, or location prevents them from being handled in a manner normal to unclassified excavation.
- E. Borrow: includes providing material to the project site necessary for the construction of embankment from borrow areas as indicated in the Contract Documents or borrow areas provided by the Contractor. It also includes:
  - 1. The stripping, stock piling, and spreading of a maximum of 8 inches of topsoil.
  - 2. The finish grading of the earth surfaces.
  - 3. The site preparation.
  - 4. The placing and proper compaction of excavated material in an embankment within the Project limits of this Contract.
  - 5. Water required for moisture conditioning of the material.
  - 6. Loading and hauling of the material from the borrow site to the embankment.
  - 7. Disking and aeration of wet soil in order to remove moisture from the material.
  - 8. Furnishing and applying water as required to obtain proper moisture content for compaction.
  - 9. Material testing as required by the Contract Documents.

10. Implementation and maintenance of temporary erosion and sediment control at the borrow site.
  11. Restoration of the borrow site.
  12. Rework and retesting of areas and materials where failing test occur.
- F. Grading – This work item includes the uniform grading of surfaces within specified tolerances, including, but not limited to, maintaining lines, grades, crowns, cross slopes and compaction.
- G. Dewatering – This work includes the removal of groundwater from the excavation utilizing a well system, portable pumps, or some other means appropriate to maintain a reasonably dry excavation.

### **1.03 - Submittals**

- A. If the Contractor is to provide a borrow site and the Contractor is not the owner of the borrow site, prior to commencing work on the borrow site, the Contractor shall be responsible to obtain written authorization from the owner of the borrow site, to utilize the area as a borrow site and provide such authorization to the Engineer. Upon completion of the restoration of the borrow site, the Contractor shall also be responsible to obtain written acceptance from the owner of the borrow site regarding its restoration, and provide a copy of such acceptance to the Engineer.
- B. Submit samples and test results as set forth in the Contract Documents.
- C. Submit certificate of compliance indicating the materials incorporated into the work comply with the Contract Documents.

### **1.04 - Delivery, Storage and Handling**

Store cleared, grubbed, and excavated material in locations which will minimize the interference with operations, minimize environmental damage, facilitate proper drainage, and protect adjacent areas from flooding, runoff and sediment disposition.

### **1.05 - Scheduling And Conflicts**

Schedule work to minimize disruption of public streets and facilities.

### **1.06 - Special Requirements**

- A. Use of explosives is forbidden unless provided for in the Contract Document Special Provisions.
- B. All work and materials incorporated into this Project shall conform to all applicable local, state, and federal requirements.
- C. During the progress of work, the Contractor shall conduct his operation and maintain the area of his activities so as to minimize the creation and dispersion of dust per Section 01300.

### **1.07 - Job Conditions**

Elevations shown for existing work and ground are reasonably correct, but are not guaranteed to be absolutely accurate. If discrepancies are noted, reference Section 01025 for method of adjustment.

## **PART 2 PRODUCTS**

### **2.01 - Embankment Construction**

All materials used for the construction of embankments shall meet the following requirements:

- A. A minimum optimum density of 95 pcf (ASTM D698).
- B. Plasticity index of less than 19, per AASHTO M145.
- C. Free from organic and other deleterious matter.
- D. Soils to be placed below water shall be clean granular material.

### **2.02 - Borrow**

Material incorporated in the Project as a part of this item shall meet the requirements for suitable material for use in embankment construction.

## **PART 3 EXECUTION**

### **3.01 - General**

- A. Prior to all excavating, become thoroughly familiar with the site and site conditions.
- B. Nothing in this Specification shall be deemed to allow the use of protective systems less effective than those required by the Occupational Safety and Health Administration (OSHA) and other applicable code requirements.

- C. The Contractor shall keep Project free from drainage ponding due to construction operations.
- D. High Ground Water Conditions (when present)
  - 1. Prior to site grading and any excavation, an effective means of controlling groundwater shall be established to "predrain" the site and minimize disturbance of the bearing soils.
  - 2. Use a series of ditches, French drains, and/or drain lines to lower the groundwater level to at least 2 feet below the excavation depth. This system can be incorporated into the pavement underdrain system.
  - 3. Avoid operating heavy equipment directly on soft saturated soils; consider performing earthwork with track-mounted construction equipment to minimize subgrade disturbance.

### **3.02 - Protection**

- A. Contractor shall provide all necessary sheeting and shoring including all labor, material, equipment and tools required or as necessary to maintain the excavation in a condition to provide safe working conditions, to permit the safe and efficient installation of all items of the work, and to protect adjacent property. Contractor shall be held liable for any damage which may result to property from excavation or construction operations. Sheet piling and timbers in excavations shall be withdrawn in a manner so as to prevent subsequent settlement of structures.
- B. Provide the necessary traffic control protection according to Section 1200 to prevent accidents, to avoid all hazards and to protect the public, the work and property at all times.
- C. The Contractor shall be responsible for damages to any party whatsoever by reason of the Contractor's neglect in providing proper safeguards to prevent damage to property, life and limb.
- D. Protect structures, utilities, sidewalks, pavements, and other facilities from damage due to settlement, lateral movement, undermining, washout and other hazards created by earth operations.

### **3.03 - Utilities**

- A. Locate existing underground utilities in areas of work before starting excavations,.
- B. Provide adequate means of protecting utilities that remain in place during earthwork operations.
- C. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility company immediately for directions.
- D. Cooperate with Owner and utility companies in keeping respective services and facilities in operation and repair any damaged utilities to satisfaction of utility company.
- E. Do not interrupt existing serving facilities occupied and used by Owner or others, except when permitted in writing by Owner.
- F. Accurately locate and record abandoned and active utility lines rerouted or extended on Project record drawings.
- G. In case water, gas pipes, conduits, or other utilities are broken in the prosecution of the work, stop work and give immediate notice to the proper authorities. Contractor shall be responsible for any damage to persons or property caused by such breaks. Failure to give prompt notice to the authorities shall make the Contractor responsible for any needless loss of water, gas, energy, or for interruption of services.

### **3.04 - Finish Elevations and Lines**

Secure the services of a surveyor licensed in the State of Iowa for setting and establishing the elevations, line and layout of the work. Take care to preserve all data and monuments set by the surveyor, and if displaced or lost, immediately replace them to the approval of the Engineer at no additional cost.

### **3.05 - Unclassified Excavation**

- A. Do not start unclassified excavation suitable temporary erosion and sediment control measures are in place as set forth in Section 01300.
- B. After the site has been cleared and stripped, the site shall be cut and filled to the indicated subgrade as shown or specified.
- C. Following clearing and grubbing, remove a minimum of 6 inches of topsoil from the area to be excavated. The topsoil shall be stockpiled in a location that will minimize interference with the

operations of the Contractor and does not pose a threat of flooding, erosion and/or sediment damage to adjacent properties. Avoid compacting the topsoil; do not operate equipment on the stockpile except when moving it.

- D. Following removal and stockpiling of the excavation area and the embankment area topsoil, and site preparation of the embankment area, materials suitable for incorporation into embankments shall be excavated and transported to the embankment location.
- E. Excavate the area to the elevations and cross sections as indicated in the Contract Documents.
- F. Prepare and/or restore the excavation location as set forth in Sections 01400 and/or 02900.
- G. When excavation has reached the required subgrade elevations, notify the Engineer who will make an inspection of conditions.
- H. If excess excavated material exists, it shall be disposed of legally off-site in accordance with the Contract Documents.
- I. All material other than non-organic firm solid earth, sand or gravel shall be removed from the excavation.
- J. Excavation for all footings, foundation walls, pits, etc. shall be large enough to provide adequate clearance for the proper execution for the work within them.
- K. Excavations scheduled to extend below groundwater shall not be started until the area has been dewatered.
- L. No footings or slabs shall bear on soil within two feet of existing grade. Where subgrade is within two feet of existing grade, remove soils to two feet below existing grade and backfill with compacted fill.
- M. When excavations reach subgrade elevations as shown on the Drawings, or as specified herein, the Engineer will observe the bottom material. Where, in the opinion of the Engineer, unsuitable foundation material is found at the level of the subgrade, original material below the excavation necessary for construction according to grades shown or specified, shall be removed and replaced with material and placing methods as specified under compacted fill.
- N. Excavations that are undercut beneath the foundation shall extend beyond the perimeter of the foundation one-foot plus a distance at least equal to the depth of undercut below footing grade.
- O. Contractor shall backfill and compact all overexcavated areas not required to complete the work at Contractor's expense.

### **3.06 - Rock Excavation And Boulder Removal**

- A. If rock or boulders are encountered which cannot be handled in a manner similar to normal earth material, contact the Engineer. The Engineer shall review the conditions and, if appropriate, authorize the work to proceed and be paid as rock excavation.
- B. The Engineer will measure the rock excavation quantity after completion of rock excavation.
- C. When excavation to the finished grade line results in a roadbed consisting of loose or solid rock, excavate 1 foot below the finished grade of the roadbed and backfill to the required grade with suitable soil.
- D. When large rock fragments or boulders 12 inches in diameter or greater are encountered, they shall be legally disposed offsite. They shall not be incorporated in any embankment within the Project limits without the written approval of the Engineer.

### **3.07 - Embankment Construction**

- A. Do not start embankment construction until suitable temporary erosion and sediment control measures are in place as set forth in Section 01300.
- B. Adjust existing utility fixtures to finish grade as set forth in Section 02600.
- C. Following clearing and grubbing and topsoil removal and stockpiling as set forth in "Unclassified Excavation", prepare the embankment by scarifying, moisture conditioning and compacting the upper 6 inches of the existing ground.
- D. Construct subsequent layers of the embankment by placing 8-inch (uncompacted) lifts of material within the acceptable moisture range, and then compacting the lifts.

- E. The type of compaction used as part of this item shall be as indicated in the Contract Documents and as described below. If no compaction type is specified, Type A shall apply.
  - 1. Type A - The compaction equipment shall pass over the properly conditioned material a minimum of one pass per inch of uncompacted thickness of the material being compacted. Additional passes shall be made until the tamping feet of the roller penetrate no more than 3 inches in an 8-inch lift. The compaction equipment used in this compaction method shall conform to the Iowa DOT Standard Specification 2001.05 Paragraph A.
  - 2. Moisture and Density Control
    - a. Areas outside of vehicular/bike pedestrian areas - The top 6 inches of existing ground shall be compacted to 90 percent of optimum density (ASTM D698). The moisture limits shall be +4 percent to -2 percent of the optimum moisture content. If this method is specified in the Contract Documents, the Contractor shall submit the test results as set forth in Section 01110.
    - b. All other areas than those listed in Paragraph 3.07.E.2.a. – The embankment material shall be compacted to a minimum of 95 percent of optimum density (ASTM D698). If this method is specified in the Contract Documents, the Contractor shall submit the test results as set forth in Section 01110. The moisture limits shall be +4 percent to -2 percent of the optimum moisture content.
- F. The embankment shall be crowned and smooth in order to shed water if rain should occur during construction.
- G. Embankment shall not be constructed on frozen subgrade, or with frozen material.
- H. Unsuitable soils may be incorporated into the Project in accordance with the Standard Details, or disposed of offsite.
- I. The location of the embankment shall be prepared as set forth in Section 01400 and/or restored as set forth in Section 02900.

### **3.08 - Borrow**

- A. Excavation from a borrow site shall not commence until suitable temporary erosion and sediment control measures are in place as set forth in Section 01300.
- B. The Contractor shall utilize borrow sites when sufficient suitable material is not available within the Project limits.
- C. The Contractor may use a site indicated in the Contract Documents or may request approval of a borrow site at some other location.
- D. If a borrow site is not specified in the Contract Documents, the Contractor is responsible to provide a location from which suitable soil may be excavated for incorporation into embankments.
- E. Prior to excavation the borrow site shall be prepared according to Section 01400. Following completion of excavation, the borrow site shall be restored according to Section 02900.

### **3.09 - Cold Weather Protection**

Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg. F. (2 deg. C.). Material shall not be placed on frozen ground.

### **3.10 - Stability of Excavations**

- A. Sloped sides of excavations shall comply with state and local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
- B. Maintain sides of slopes of excavations in a safe condition until completion of backfilling.

### **3.11 - Shoring and Bracing**

- A. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
- B. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
- C. Maintain shoring and bracing in excavations regardless of the time period excavations will be open. Carry down shoring and bracing as excavation progresses.

- D. Provide permanent steel sheet piling or pressure treated timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops as required and leave permanently in place.

### 3.12 - Dewatering

- A. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding the project site and surrounding area.
- B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
- C. Convey water removed from excavations and rainwater to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for structure. Do not use trench excavations as temporary drainage ditches.
- D. Dewater to at least two feet below the top of subgrade elevation.

### 3.13 - Grading

- A. General
  - 1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades. During construction the Contractor shall maintain lines and grades including crown and cross-slope of sub-base course.
  - 2. After grading, the subgrade surface shall be compacted to the depth and percentage of the maximum dry density for each area classification.
- B. Grading Tolerances: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface change, and as follows:
  - 1. Unpaved areas near buildings, parking areas and sidewalks:  $\pm 0.10$  ft.
  - 2. Unpaved areas away from buildings, parking areas and sidewalks:  $\pm 0.25$  ft.
  - 3. Grading surface of fill under building slab:  $+0.04$  ft to  $-0.10$  ft.
- C. Shoulders

Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12-inch width of shoulder simultaneously with compacting and rolling of each layer of subbase course.
- D. Protection of Graded Areas
  - 1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
  - 2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- E. Reconditioning Compacted Areas

Where completed, compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

### 3.14 - Clean-Up

Upon completion of the work of this Section, place in stockpile areas all excess excavated material, and remove from the site all rubbish, trash and debris resulting from operations. Leave the site in a neat and orderly condition.

**END OF SECTION 02000**