

SECTION 02200 – EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. THIS SECTION INCLUDES:

1. Project conditions
2. Quality assurance
3. Rough Grading
4. Proof rolling
5. Submittals
6. Excavating
7. Backfill and fill
8. Trenching
9. Rock removal
10. Disposal

1.02 RELATED DOCUMENTS / SECTIONS

- A. Contract documents and drawings, geotechnical soils report. Refer to appropriate related sections as necessary.

1.03 REFERENCES

- A. AASHTO - M147 - Materials for aggregate and soil aggregate.
- B. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb. (4.45 kg) Rammer and an 18-in. (457 mm) drop.
- C. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Course Aggregates.
- D. ANSI/ASTM D698 - Standard Proctor Test - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using a 5.5 lb. (2.49 kg) Rammer and 12 inch (304.8 mm) drop.
- E. ANSI/ASTM D1557 - Modified Proctor Test - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.45 kg) Rammer and 18 inch (457 mm) Drop.
- F. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- G. ASTM D2487 - Classification of Soils for Engineering Purposes.
- H. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- I. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- J. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity

- Index of Soils.
- K. ANSI/ASTM D1556 - Test Method for Density of Soil using the Sand-Cone Method.
- L. GE - Geotechnical Engineer, Engineering Report, Recommendations.
- M. NFPA - Code for explosive materials

1.04 REGULATORY REQUIREMENTS

- A. Verify and comply with all Federal, OSHA, State, County, City or local requirements concerning earthwork, excavation, and related activities.

- B. **WARNING:
NO PERSON(S) SHALL ENTER MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES, TRENCHES, OR EXCAVATIONS WITHOUT PROTECTIVE BREATHING APPARATUS AND AT LEAST ONE OTHER PERSON PRESENT FOR SAFETY AND ABOVE GROUND MONITORING AT ALL TIMES. CONTRACTOR SHALL PROVIDE AND ENSURE USE OF SAFETY KITS, HELMETS, GLOVES, EMERGENCY OXYGEN RESUSCITATOR KITS, AND AIR QUALITY AND GAS DETECTORS FOR VOLATILE, TOXIC, OR EXPLOSIVE GASES OR SUBSTANCES. VERIFY SAFE OXYGEN CONTENT PRIOR TO ENTERING MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES.**

1.05 PROJECT CONDITIONS

- A. Site information: All earthwork, cutting, filling, compaction, and related operations shall conform to the requirements and recommendations of the geotechnical Soils Engineer. In the absence of a qualified geotechnical Soils Engineer, the Contractor shall be responsible for the integrity, suitability, quantity, compaction, selection, and quality of the soils used in the completion of the Work.

- B. Protection of persons and property:
 1. Barricade all open excavations occurring as part of this work and post with warning lights.
 2. Operate warning lights or devices as required or recommended by authorities having jurisdiction.
 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, or other hazards created by earthwork operations.
 4. The Contractor, and all sub-contractors, shall be responsible for all safety measures, procedures, or devices as required by OSHA, Federal, State, or local authorities. No person shall enter a

manhole or other underground structure without protective breathing apparatus, and at least one other person present for safety. All earthwork, trenching, and grading operations shall conform to minimum OSHA requirements for safety, shoring, bracing, and protective measures.

1.06 QUALITY ASSURANCE

- A. Testing and Inspection service: Contractor shall employ and pay for a qualified independent geotechnical testing laboratory to perform soil testing and inspection services during earthwork operations and as specified by the Architect.
- B. Testing Laboratory Specifications: The Contractor shall obtain approval from the Owner/Architect for the Testing Laboratory prior to beginning work.
- C. Field Testing: Allow testing laboratory to test and approve each subgrade and fill layer before further backfill or construction is performed.
 - 1. Field density tests shall be in accordance with ASTM D 698.
 - 2. The placement, location, number, and frequency of tests shall be as directed by the Geotechnical Engineer or Technician (GE or GT.)

1.07 SUBMITTALS

- A. Test reports: Submit the following test reports directly to the Architect and Owner or Owner's representative from the Testing Laboratory, with a copy to the Contractor:
 - 1. Test reports on borrow material.
 - 2. Field reports, in-place soil density tests.
 - 3. One optimum moisture-maximum density curve for each soil type encountered.
 - 4. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

PART 2 - EXECUTION

2.01 ROUGH GRADING

- A. Definition: Cutting, grading, filling, and rough contouring the site for building pads, structures, paving areas, or other improvements.

2.02 EXAMINATION

- A. All existing contours, elevations, structures, utilities, and other improvements shown on the plans are taken from the best information available at the time and are believed to be reasonably true and correct. Any errors, omissions, or discrepancies between the actual field conditions and the plans discovered during construction must be reported immediately to the Architect and the Engineer. Any work done by the Contractor after such discovery without written approval from the Architect or Engineer will be at the Contractor's risk.

2.03 PREPARATION

- A. Identify and verify required lines, levels, contours, and datum.
- B. Utilities: Stake and flag locations of all utilities. Coordinate with all utilities and have existing locations clearly marked prior to construction. Protect above and below grade utilities to remain from damage. Notify prior to construction and coordinate with any utilities that will require removal and/or re-location.
- C. Provide protective measures or devices for all existing features to remain, including but not limited to: trees and vegetation, existing buildings and appurtenances, adjacent property improvements, or other structures.

2.04 EXCAVATION

- A. General: Comply with safety requirements of all Federal, State, County, City, or local authorities having jurisdiction.
- B. Excavate subsoil as shown on approved plans. Make grade changes gradual. Blend slopes into level areas.
- C. Establish grades as shown on approved plans. Remove surplus fill material and dispose of offsite in a legal manner. Surplus fill material may be distributed onsite only with prior consent and approval of Owner. The amount, location, placement and extent of any surplus fill material distributed onsite is at the sole discretion of the Owner.
- D. Do not excavate wet subsoil.
- E. Tolerances: Top surface of subgrade: Plus or minus 1/10 foot, provided positive drainage is established according to the design intent of the

plans and specifications.

- F. As-Built topographic survey:
After rough grades are established, and before building foundations or other site improvements begin, the Contractor shall provide to the Owner at Contractor's expense an as-built topographic survey of the grades and graded areas as shown on the approved plans. The as-built topographic survey must be signed and sealed by a registered Surveyor licensed in the State where the project is located, and must show grading elevations, slopes, and contours to the extent necessary for the Owner to verify that the grading is in compliance with the approved plans and specifications. Do not proceed with any work in any area of the site until Owner is satisfied with results of as-built topographic survey. It is the Contractor's responsibility to schedule the as-built survey and account for the required time to complete the review process with the Owner to avoid delays to the project schedule.

- G. All soils used for fill in earthen dams or water impoundment areas shall be ML or CL low plasticity clays per the Unified Soil Classification, and must be approved by the Geotechnical Engineer. All organics, topsoil, or other unsuitable material shall be removed from the entire fill area. All fill shall be placed in maximum 6 inch lifts, minimum compaction is 95% of standard maximum density. No gravel, aggregate or gravel pipe bedding, or any pervious material shall be placed in the dam or fill area(s). Scarify existing subgrade prior to placing fill.

2.05 ROCK EXCAVATION

- A. Mass Rock as used herein shall be defined as follows:

Solid mineral material that cannot be broken and removed by power shovels of one (1) cubic yard capacity;

Solid mineral material which cannot be excavated except by drilling or blasting;

Solid mineral material which is hard enough to ring when struck by a hammer, and the amount of solid stone shall not be less than one (1) cubic yard in volume;

Solid mineral material which cannot be broken with a heavy single-toothed ripper pulled by the equivalent of a Caterpillar D-8 tractor with a minimum draw bar pull of 56,000 pounds, or by the equivalent of a Caterpillar 977 front end loader.

- B. "Trench Rock" as used herein shall be defined as follows:

Solid mineral material which occurs in a utility trench; and

Solid mineral material which is more than one-half (0.5) cubic yard in volume; and

Solid mineral material which cannot be excavated by the equivalent of a Caterpillar 215 backhoe having a bucket curling force of not less than 24,700 pounds.

- C. When rock is encountered, clear away earth and notify Architect and Owner. Architect/Owner will inspect material and issue written instructions. No rock excavation shall be done without written instructions. No rock excavation shall be done prior to measurement.
- D. Measurement for Rock Excavation shall be as follows:
 - 1. Mass Rock:
 - a. Measurement for mass rock shall be made by taking cross sections or by other appropriate means identifying the contours of rock before and after removal. All rock measurements shall be made and certified by an independent licensed surveyor or engineer approved by the Architect.
 - b. Rock removed prior to measurement shall not receive compensation.
 - c. The quantity of rock shall be calculated using the following limits:
 - 1. To top of rock
 - 2. To 1.0 feet below finished grade of roadway
 - 3. To vertical lines at back of curb
 - 4. To 1.0 feet below foundations and footings
 - 5. To vertical faces located 1.0 feet horizontal distance from each footing or foundation face
 - 6. To 0.5 feet below slabs on grade
 - 7. To finish grade in cut where rock is removed to finish grade. Where it is not so removed, to the finish rock surface.
 - 2. Trench Rock:
 - a. Measurement for trench rock shall be made by taking level

readings at reasonable intervals but not more than 10 feet along the exposed trench length before removal of rock. All rock measurements shall be made and certified by an independent licensed surveyor or engineer approved by the Architect.

- b. Rock removed prior to measurement shall not receive compensation.
- c. The quantity of rock shall be calculated using the following limits:
 - 1. To top of rock
 - 2. To vertical faces 1.0 feet beyond the outside of pipe barrel, each side
 - 3. To 12 inches below pipe barrel for the full trench length having rock
 - 4. To vertical faces located 1.0 feet horizontal distance beyond structures or manholes
 - 6. To 6 inches below bottom of slab for structures

E. Blasting or explosives:

- 1. All blasting or use of explosives shall be done by a company with at least five years documented experience specializing in use of explosives for disintegration of rock.
- 2. All blasting or use of explosives shall be done in strict accordance with the local authority having jurisdiction. Obtain all necessary permits or approvals prior to use of explosives. The Contractor is responsible for all Federal, State, and local safety requirements, ordinances, or laws regarding the use of explosives.
- 3. The Contractor shall conduct a survey with photographs of to document existing conditions of buildings adjacent to or near the location of rock removal prior to blasting. The Contractor shall advise and coordinate with all affected adjacent or nearby property owners in writing of the proposed blasting schedule. Obtain a seismic survey prior to rock excavation to determine maximum charges which may be used without damaging adjacent property, buildings, or structures. Provide seismographic monitoring during all blasting operations.
- 4. All blasting shall be completed before footings or foundation construction begins.

5. Rock which is removed shall come the property of the Contractor and shall be removed from the site and disposed of in a legal manner.
6. When rock is encountered, the Contractor shall immediately notify the Engineer in writing. Classification of rock and volume calculations shall be done in accordance with the specifications and as directed by the Architect. The Engineer and/or the Architect will issue written instructions to the Contractor concerning rock work prior to any rock removal.
7. Payment will not be made for over excavated rock or for replacement materials.

2.06 BACKFILL AND FILL

- A. Fill materials: Fill shall be clean inorganic natural soil. Structural fill shall contain no rock fragments larger than 3 inches in the longest dimension. Soils proposed for fill shall have a minimum density of 120 pounds per cubic foot or greater in Standard Proctor Compaction Test ASTM D698. All fill materials must be approved by the Soils Engineer prior to placement. In the absence of a Soils Engineer, the Contractor is responsible for material or soil selected for fill. Any fill containing large quantities of rock or weathered rock shall not be used as structural fill.
- B. The Contractor shall coordinate testing as required by the Soils Engineer for all fill materials prior to their use.
- C. Execution: Placed fill materials used in backfilling or filling in layers shall not exceed the following loose depths or as directed by the Soils Engineer:
 1. Heavy equipment compaction: 6-8 inches
 2. Hand operated tampers: 4-6 inches
- D. All areas of existing subgrade which require remediation, or are not capable of in-place compaction, shall be excavated and backfilled with structural fill material compacted to a density equal to or greater than requirements for subsequent fill material layers.
- E. Place fill simultaneously on opposite sides of walls, small structures, utility lines, trenches, etc. to avoid displacement or over stressing.
- F. In-place density requirements:
Compact soil to not less than the values given below, expressed as a

percentage of maximum dry density at optimum moisture content:

1. Structural fill: Paved areas, buildings, footings, structures, etc.: 95 percent minimum unless noted otherwise.
2. Unpaved non-structural areas: 90 percent
3. Exterior steps, walks, ramps, etc.: 95 percent
4. Compacted fill behind walls: 95 percent

G. Moisture Control: During compaction, control moisture of subgrades and subsequent lifts to within optimum moisture content tolerances as recommended by the GE. Wet surface or aerate soil as required.

H. Backfilling:

1. Backfill areas to contours and elevations shown with approved unfrozen materials.
2. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.
3. Maintain moisture content within optimum range as specified by the GE.
4. Compaction: See 2.06 (F) above.
5. Slope grades away from buildings or other structures which may be damaged by water a minimum of 2 inches in 10 feet, unless noted otherwise.
6. Tolerances: Plus or minus 1/10 foot.

I. Waterproofing:

All building, structure and foundation walls where finish floor elevation is at or below exterior finish grade shall have a waterproofing system for all wall surface areas up to and 1 inch beyond finish grade. Waterproofing system shall be applied to foundation walls prior to backfill, do not apply waterproofing system to building exterior finish wall brick, stucco, siding, or other material. Waterproofing system shall consist of, at a minimum, of 2 cubic yards of gravel per lineal foot with a perforated drain pipe continuous along perimeter footing and below finish floor, with positive discharge to daylight. All wall surfaces shall be coated with bituminous coatings designed for below grade application CCW MIRADRI 860/861 System by Carlisle Coatings or approved equal. Install all elements per manufacturer's specifications.

- J. Protection of finished work: Protect all finished work. Re-shape and re-compact fills subjected to vehicular traffic as necessary.

2.07 TRENCHING

- A. Comply with all Federal, State, County, City or local regulations regarding safety and construction. See Section 1.05 (4).
- B. Maintain and protect all utilities above and below ground designated to remain. Contractor to coordinate with all utilities and authorities having jurisdiction regarding construction procedures such as utility service connections, maintenance of service(s), notification procedures, tapping or extension specifications, and other related items.
- C. Cut trenches sufficiently wide to enable installation and inspection. The minimum bedding for all pipes is Class B as shown on the plans unless specified otherwise.
- D. Backfill trenches to correct elevations with approved materials only. Do not backfill over porous, wet, or spongy subgrade surfaces.
- E. Maintain maximum moisture content range to ensure required compaction density.

2.08 DISPOSAL

- A. The contractor shall remove from the Owner's property all waste material, unsuitable excavated material, trash and debris, and dispose of it offsite in a legal manner.

2.09 GEOTECHNICAL SOILS STUDY

- A. If a Geotechnical Soils Study has been performed, a copy of the Geotechnical Soils Study will be made available to the Contractor or included in the specifications following this Section. The Soils Study is for reference only. All conclusions, estimates, or decisions made regarding the contents of the Study are the sole responsibility of the person(s) reading the Study.

END OF SECTION 02200