Part 1 - General

1.01 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, if any.

1.02 Summary

A. This section includes the following:
   1. Mass Grading is included in this section.
   2. Subgrade preparation for walks and paved areas is included in this section.
   3. Aggregate Base for paving systems is included in this section.
   4. Excavating and backfilling of underground utility lines and appurtenances.

1.03 Definitions

A. Subgrade is the undisturbed earth or compacted soil layer immediately below aggregate subbase, aggregate base course, paving materials, or topsoil materials.

B. Embankment is completed earth fill after compaction and consolidation are finished.

1.04 Submittals

A. Test Reports: Submit the following reports directly to the Engineer from the testing services with a copy to the Contractor.
   1. Field reports of the in place soil density tests.
   2. One optimum moisture/maximum density curve for each different soil encountered or used.

1.05 Quality Assurance

A. Testing and Inspection Service: The Owner shall employ and pay for a registered Geotechnical Engineer to perform soil testing and inspection service for quality control during earthwork
operations. The Geotechnical Engineer shall provide continuous on-site observation by experienced personnel during construction of controlled earthwork.

1.06 Job Site Conditions

A. Site Information: Data in subsurface investigation reports was used for the basis of the design and is available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect/Engineer and then only after acceptable temporary utility services have been provided.

   a. Provide minimum of 72-hour notice to Owner and Architect/Engineer, and receive written notice to proceed before interrupting any utility.
   b. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

C. Use of Explosives: Use of explosives is not permitted.

Part 2 - Products

2.01 Soil Materials

A. Aggregate Base Course & Subbase:
1. Aggregate base course and aggregate subbase shall be composed of materials consisting of crushed stone, crushed or screened gravel, caliche, sand, or a combination of such materials. Aggregate base course and aggregate subbase shall be free from vegetable matter and all other deleterious materials, including silt and clay balls.

2. When the stationary plant method is used, aggregate base course and aggregate subbase will be accepted based on periodic samples taken from the roadway. When a road mix method is used, aggregate base course and aggregate subbase will be tested for acceptance on samples taken from the watered and completely processed windrow.

3. The aggregate will be tested in accordance with applicable ASTM or AASHTO methods.

4. The aggregate materials shall be combined in such proportions that the resulting composite blend meets the requirements of one of the classes in table 2.1.1, unless otherwise shown on the plans:

**Table 2.1.1 Base Course And Subbase Gradation**

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I-B</td>
</tr>
<tr>
<td>2&quot;</td>
<td></td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>100</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>80-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>30-60</td>
</tr>
<tr>
<td>No. 10</td>
<td>20-45</td>
</tr>
<tr>
<td>No. 200</td>
<td>3-10</td>
</tr>
<tr>
<td>Two Fractured Faces</td>
<td>50% or</td>
</tr>
<tr>
<td>(Plus 4 Material)</td>
<td>more</td>
</tr>
</tbody>
</table>

B. Satisfactory Embankment/Soil Materials:

1. Materials complying with ASTM D-2487 soil classification groups GW, GP, GM, SM, SW & SP.

C. Embankment/Soil Materials Requiring Special Care In Compaction:

1. Materials complying with ASTM D-2487 soil classification groups GC, SC & ML.

D. Unsatisfactory Embankment/Soil Materials:
1. Materials complying with ASTM D-2487 soil classification groups MH, CL, CH, OL, OH & PT.

Part 3 - Execution

3.01 Excavation

A. Site Excavation: All excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered unless otherwise indicated on the plans.

1. Stability of excavations
   a. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
   b. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
   c. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

2. Dewatering
   a. Prevent surface water from flowing into excavations and from flooding 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. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

3. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
   a. Operate warning lights as recommended by authorities having jurisdiction.
b. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
c. Perform excavation by hand within drip-line of large trees to remain. Protect root systems from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

B. Excavation for Pavements: Pavement systems shall be placed on a previously prepared subgrade scarified to at least 8 inches in depth and compacted.

C. Trench Excavation for Pipes and Conduit:

1. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.
2. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

   a. For pipes or conduit less than 6 inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
   b. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads ensure continuous bearing of pipe barrel on bearing surface.

D. Cold Weather Protection:

1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.02 Backfill And Fill

A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under landscaped areas, use excavated or borrow material which is free of rocks and debris greater than 1" in diameter.
2. Under curbs, gutters, walks, and pavements, use imported fill or existing soils which conform with Section 2.1, B "Satisfactory Soil Materials."
3. Under piping and conduit and equipment, use structural fill for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.
4. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
   a. Concrete is specified in Division 3.
   b. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Architect/Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

B. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Acceptance of construction below finish grade including, where applicable, damp-proofing, and perimeter insulation.
   2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
   3. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
   4. Removal of trash and debris from excavation.
   5. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.03 Placement And Compaction

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

B. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

   1. When existing ground surface has a density less than that specified under "Density Requirements" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

C. Compaction Methods: When compacting cohesionless free-draining materials such as sands and gravels, the material shall be deposited in layers and compacted by treads of a crawler-type tractor, surface or internal vibrators, smooth or pneumatic rollers, hand or power tampers or by other means approved by the Architect/Engineer. Compaction of cohesive soils shall be accomplished by sheep's foot rollers, heavy pneumatic rollers, hand or power tampers or by other means approved by the Architect/Engineer. The thickness of the horizontal layers after compaction shall not exceed six (6) inches compacted thickness if compaction is performed by
tractor treads, surface vibrators or similar equipment, or not more than the penetrating depth of the vibrator head if compaction is performed using hand-operated tampers.

D. Density Requirements: Compact soil to the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D 1557; and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

1. Embankment: Place all materials to at least 90% of maximum dry/relative density.
2. Embankment Under Building Footprints: Place all materials to at least 95% of maximum dry/relative density under building footprints and to a point at least 10 feet beyond the footprint area.
3. Walks and Paved Areas: Recompact subgrade to at least 95% of maximum dry/relative density for top 6". Remove and replace unsuitable materials as needed to comply with subgrade density requirements.
4. Landscaped Areas: Place all materials between 85 and 90% of maximum dry/relative density. In no case shall densities exceed 95% of maximum dry/relative density.

E. Moisture Control: The material, while being compacted, shall contain the optimum moisture for compaction distributed uniformly throughout the layers. Only enough water should be added to the fill material will not be allowed. Fill material at a moisture content outside 2% above or below optimum moisture may be rejected by the Engineer's field representative, and removed at the Contractor's expense.

F. The Contractor shall be required to add moisture to the material in the excavation if, in the opinion of the Engineer, it is not possible to obtain proper and uniform moisture content and distribution by adding water on the fill surface.

G. 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.

3.04 Embankment and Trench Backfill Placement

A. Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.

B. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
3.05 Grading

A. General: 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 indicated, or between such points and existing grades.

B. Embankment construction shall conform to the grades shown on the plans with a tolerance of plus or minus 0.1 feet.

C. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
2. Curbs, Gutters and Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.06 Pavement Base Course

A. General: Base course consists of placing base course material, in layers of specified thickness, over prepared subgrade or subbase surface. See other Division 2 sections for paving specifications.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of base course.

C. Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each base course layer. Compact and roll at least a 12" width of shoulder simultaneously with compacting and rolling of each layer of base course.

D. Placing: Place base course material on prepared subgrade or subbase in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base material during placement operations.
1. When a compacted base course is shown to be 6" thick or less, place material in a single layer. When shown to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

3.07 Field Quality Control

A. General: Notify Geotechnical Engineer at least two (2) working days in advance of any field operations of the controlled earthwork.

B. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2922 (nuclear method), as applicable.

   a. Field density tests performed by the nuclear method in accordance with ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.

   b. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the A/E.

2. Testing Frequency: The Contractor shall notify the Engineer at least two working days in advance of any field operations of the controlled earthwork, or of any resumption of operations after stoppages. Tests of fill materials and embankments will be made at the following suggested minimum rates.

   a. One field density test for each 10,000 square feet of original ground surface prior to placing fill or floor slab construction.

   b. One field density test for each 250 cubic yards of fill placed or each layer of fill for each work area, whichever is the greater number of tests.

   c. One moisture-density curve for each type of material used, as indicated by sieve analysis and plasticity index.

   d. Misc. Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least two tests at each stairway or retaining wall location to verify required design bearing capacities.

   e. Paved Areas: Make at least one field density test of subgrade for every 2000 sq. ft. of paved area, but in no case less than 3 tests. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying paved area, but in no case less than 3 tests.
3. Report of field density tests: The geotechnical engineer shall submit, daily, the results of field density tests required by these specifications.

4. If in the opinion of the Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at Contractor's expense.

3.08 Erosion Control

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

3.09 Maintenance

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. 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.

D. Settling: Where settling is measurable or observable at excavated 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.
3.10 Disposal of Excess and Waste Materials

A. Removal from Owner's Property: Remove excess excavated material, waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

End of Section 02210