

**SECTION 312316
EXCAVATION**

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**SECTION 312316
EXCAVATION**

PART 1 - GENERAL

1.1 SCOPE

- A. Work under this section shall include all excavation, handling and re-handling, backfilling, compaction of earth material and disposal of any and all deleterious materials encountered during excavation. Other work under this section shall include all dewatering of excavated areas of trenches, backfilling around structures, preparation of subgrades, surfacing and grading and other incidental or appurtenant earthwork operations necessary to complete work in a satisfactory manner. Moreover, the Contractor must assume all responsibility for any added obstacles or conditions, foreseen or unforeseen, and encountered or manifest during the execution of the work.
- B. Contractor shall provide all services, labor, materials, and equipment required for all earthwork and related operations necessary to complete the work shown on the drawings or specified in these specifications, or as determined in the field jointly by Contractor and Engineer.
- C. Tests for compaction and density shall be conducted by an independent testing laboratory selected by the Owner and approved by the Engineer. Costs of compaction tests performed by an independent testing laboratory shall be paid for directly by the Owner. Contractor shall make all necessary excavations and shall supply samples of materials necessary for conducting compaction and density tests. Costs of all retests made necessary by failure of materials to conform to requirements of these specifications shall be paid for by the Contractor.

1.2 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 - ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse Aggregated
 - ASTM D 422 (1963; R 1998) Particle-Size Analysis of Soils
 - ASTM D 1140 (1997) Amount of Material in Soils Finer than No. 200 (75-micrometer) Sieve
 - ASTM D 1556 (190;R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - ASTM D 1557 (1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/cu. Ft. (2,700 kN-m/cu.m.)
 - ASTM D 2167 (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method

- ASTM D 2487 (1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- ASTM D 2922 (1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- ASTM D 2937 (1994) Density of Soil in Place by the Drive-Cylinder Method
- ASTM D 3017 (1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
- ASTM D 4318 (1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- B. Georgia Department of Transportation Standard Specification, Construction of Roads and Bridges (Georgia D.O.T. Specifications)
- C. Federal Register (CFR) – OSHA Regulations, 29 CFR Part 1926, Subpart P

1.3 DEFINITIONS

- A. Compaction – The degree of compaction is specified as percent of compaction. Maximum or relative densities refer to dry soil densities obtainable at optimum moisture content.
- B. Excavation Slope - Excavation slope shall be defined as an inclined surface formed by removing material from below existing grade.
- C. Embankment Slope – Embankment slope shall be defined as an inclined surface formed by placement of material above existing grade.
- D. Topsoil – Material obtained from excavations suitable for topsoil is defined as natural, friable soil, characteristic of representative soils in the vicinity that produce heavy growths of crops, grass, or other vegetation. Topsoil shall be free from roots, stones greater than two inches, and other materials that hinder grading, planting, and maintenance operations, and free from objectionable weed seeds and toxic substances.

1.4 QUALITY ASSURANCE

- A. A minimum of two weeks prior to any excavation the Contractor shall submit an Excavation Plan and or Sheeting and Shoring Plan designed, signed and sealed by a Georgia Professional Engineer for review and approval by the Owner and Engineer.
- B. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- C. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
 - 1. for inspections, tests, or approvals covered by Paragraphs C and D below;
 - 2. As otherwise specifically provided in the Contract Documents.

- D. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- E. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.
- G. Uncovering Work as provided in Paragraph E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.
- H. Soil Tests – The testing service shall take samples and perform moisture content, gradation, compaction, and density tests during placement of backfill materials to check compliance with these specifications at locations designated by the Engineer and provide such assistance as necessary for sampling and testing. The Engineer may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these specifications.

Tests will be performed in accordance with the following:

| <u>Test</u> | <u>Standard Procedure</u> |
|--------------------------------|---------------------------|
| Moisture Content | ASTM D 3017 |
| Gradation | ASTM C 136 |
| Density in-place | ASTM D 1556 |
| Moisture-density Relationships | ASTM D 1557 |

Test results shall be furnished to the Engineer.

1.5 CONDITIONS

- A. Elevations of the existing ground and the elevations of existing grades of structures are believed to be reasonably correct, but do not purport to be exactly so, and, together with any schedule of quantities are presented only as an approximation. The Contractor shall satisfy himself, however, by actual examination of the site of the work as to the existing elevations and the amount of work required under these sections. If the Contractor is not willing to accept any

ground surface elevations indicated upon the Drawings for payment, he shall so notify the Engineer prior to starting excavation work.

- B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.
- C. The Contractor shall locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
- D. 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.
- E. Do not interrupt existing utilities serving facilities occupied and used by Owner or others except when permitted in writing by Engineer then only after acceptable temporary utility services have been provided.
- F. All excavated and filled areas for structures, trenched, fills, topsoil, areas, embankments, pavement, drainage ditches and channels shall be maintained by Contractor in good condition at all times until final acceptance by Owner. All damage caused by erosion or other construction operations shall be repaired by Contractor using materials of same type as damaged material.
- G. No classifications of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of type, character, composition, or condition thereof.
- H. Earthwork within the rights-of-way of State Department of Transportation, County Road Department, City Street Department, or utility companies shall be done in accordance with requirements and provisions of permits issued by those agencies for construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these specifications.
- I. Contractor shall control grading in a manner to prevent water running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water will not be interrupted in existing gutters, other surface drains, or temporary drains. Material for backfill or for protection of excavation in public roads from surface drainage shall be neatly placed and kept shaped so as to cause the least possible interference with public travel. Free access must be provided to all fire hydrants, water valves and private drives.
- J. All earthwork operations shall comply with applicable OSHA Construction Standards.
- K. It is understood and agreed that Contractor has made a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and floodplains, particularly in areas where construction activities may encounter water-bearing sand and gravels or limestone solution channels. Contractor shall be responsible for providing all services, labor, equipment, and materials necessary or convenient to him for completing the work within the time specified in these specifications.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record location of utilities remaining, rerouted utilities, and new utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.7 PROTECTION

- A. Protect trees, shrubs, lawns, and other features remaining as portion of final landscaping. Protect benchmarks, R/W markers, monuments, iron pins, property corner markers, etc. If such markers are disturbed or destroyed, Contractor shall provide services of a registered land surveyor to replace the markers at no expense to the Owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory soil materials are limited to soil classified in accordance with ASTM D 2487 as GM, GC, SW, SP, SM, SC, ML, and CL.

Unsatisfactory soil materials are classified in accordance with ASTM D 2487 as Pt, OH, OL, CH, and MH.

- B. Satisfactory soil material shall be free of clay rock or gravel larger than 2” in any dimension, debris, waste, frozen materials, organics, vegetation and other deleterious matter.
- C. Borrow Shall consist of sand or sand-clay soils capable of being readily shaped and compacted to the required densities, and shall be free of roots, trash and other deleterious material.
- D. All soils used for structural fills shall have a PI (plastic index) of less than 10 and a LL (liquid limit) of less than 30. Fill soils shall be dried to appropriate moisture contents prior to compaction.
- E. Additionally, fill soils used for the top 2 feet of fill beneath roads and parking lots shall have no more than 15% passing the #200 sieve. Fill soils used for house lots shall have no more than 25% passing the #200 sieve.
- F. Contractor shall furnish all borrow material.
- G. Contractor shall be responsible for and bear all expenses in developing borrow sources including securing necessary permits, drying the material, haul roads, clearing, grubbing, and excavating the pits, haul roads, placing, restoration of pits applicable state and local laws and regulations.

2.2 SOURCE QUALITY CONTROL

- A. If tests indicate materials do not meet specified requirements, change material and retest.
- B. Provide materials of each type from same source throughout the work.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum. Coordinate with Section 01050- Surveying and Field Engineering.
- B. Identify known below grade utilities. Stake and flag locations.
- C. Identify and flag above grade utilities.
- D. Maintain and protect existing utilities remaining which pass through work area.
- E. Notify all utility companies prior to grading and where required to remove utilities.
- F. Upon discovery of unknown utility or concealed conditions, discontinue affected work; notify Owner/Engineer immediately.

3.2 DEWATERING

- A. Contractor shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water from any sources entering the excavations or other parts of the work. Dewatering shall be accomplished by methods that will ensure a dry excavation and preservation of final lines and grades of bottoms of excavations. Methods of dewatering may include sump pumps, well points, deep wells, or other suitable methods, which do not damage or weaken structures, foundations, or subgrades. Shallow excavations may be dewatered using open ditches provided such ditches are kept open and free-draining at all times. Dewatering methods used shall be acceptable to Engineer. Footing pits or trenches shall be protected by small earth dikes and plastic covers when they are left open in rainy weather.
- B. Unless specifically authorized by Engineer, groundwater encountered within the limits of excavation shall be depressed to an elevation not less than twelve (12) inches below the bottom of such excavation before pipe laying or concreting is started and shall be so maintained. No concrete structures shall be exposed to unequal hydrostatic forces until the concrete has reached its specified 28-day strength. Water shall not be allowed to rise above bedding during pipe laying operations. Contractor shall exercise care to prevent damage to pipelines or structures resulting from floatation, undermining, or scour. Dewatering operations shall commence when ground or surface water is first encountered and shall be continued until such times as water can safely be allowed to rise in accordance with provisions of this section.
- C. Standby pumping equipment shall be kept on the job site. A minimum of one standby unit (one for each ten in the event well points are used) shall be available for immediate installation should any pumping unit fail. Installation of well points or deep wells shall be adequately sized to accomplish the work. Drawings or design of proposed well point or deep well dewatering systems shall be submitted to Engineer for review.

- D. Contractor shall not operate dewatering devices (i.e., pumps, etc.) before the hour of 8:00 AM and after the hours of 8:00 PM in a residential area unless otherwise approved by Engineer or Owner.
- E. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected area shall be excavated and replaced with foundation backfill at no cost to Owner. Foundation backfill shall be placed in bottom of trench to within 6" of the bottom of pipe. Six (6) inches of bedding stone shall be placed over the top of the foundation backfill.
- F. Contractor shall dispose of water from the work in a suitable manner without damage to adjacent property. Conveyance of water shall be such as to not interfere with construction operations or surrounding property owners. No water shall be drained into work completed or under construction without prior consent of Engineer. Contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.
- G. Storm water runoff shall be controlled by means of temporary erosion control methods specified in Section 312500- Soil Erosion and Sediment Control, as shown on drawings or as directed by Engineer.
- H. Water shall be disposed of in such a manner as not to be a menace to public health and in accordance with applicable Environmental Protection Agency, Corps of Engineers, and State Environmental Protection Division Standards and Permits.
- I. Permanent French drains under and around structures shall be installed where shown. Excavation of a trench as shown on the drawings is required. A non-woven drain geotextile such as Polyfelt TS700 shall be initially draped in the trench. No. 57 stone shall be placed in the trench followed by a 6-inch diameter perforated PVC pipe as shown on the drawings. Crushed stone shall be placed such that the granular layer is extended to finished grade. Filter fabric shall be lapped over the top of the stone. The permanent French drain must have daylight into a lower elevation area of the site. A headwall and an animal screen shall be provided at the outlet end of the pipe to protect it from future clogging.

3.3 SHEETING, SHORING, AND BRACING

- A. See section 315000 – Excavation Support and Protection.

3.4 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated or graded and stockpile in designated area.
- B. Do not excavate wet topsoil.
- C. Stockpile topsoil to height not exceeding 8 feet. (Cover to protect from erosion).

3.5 GENERAL EXCAVATION

- A. Excavation shall include removal of all material from an area necessary for the construction of a roadway, structure, dam or dike. Excavation shall provide adequate working space and clearances for the work to be performed therein. Excavation for structures shall conform to the elevations and dimensions shown with a tolerance of plus or minus 0.10 feet.
- B. Contractor shall be responsible for any problems caused to property owners in residential areas due to excessive dust caused by excavation operations. Preparations shall be made by Contractor to control excessive dust in or near any residential area.
- C. Where quicksand, soft clay, spongy, swampy or other materials unsuitable for subgrade or foundation purposes are encountered below excavation limits, they shall be removed to a level of suitable material as directed by the geotechnical engineer.
- D. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrians and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of next day until excavations are backfilled. All excavations shall be barricaded in such a manner as to prevent persons from falling or walking into any excavation.

3.6 BORROW EXCAVATION

- A. Wherever the backfill of excavated areas or the placement of embankments or other fills require material not available at the site, suitable material shall be obtained from other sources. This may require the opening of borrow pits at points not immediately accessible to the work. In such cases, Contractor shall make arrangements with the property owner and shall pay all costs incident to the borrowed material including royalties, if any, for the use of the material. Before a borrow pit is opened, the quality and suitability of the material to be obtained shall be approved by the Geotechnical Engineer. Also soil tests required for approval of the borrowed material proposed shall be at the Owner's expense.

3.7 SUBSURFACE OBSTRUCTIONS

- A. In excavating, backfilling, and laying pipe, care must be taken not to remove, disturb, or injure any existing water, telephone, gas pipes, storm drainage pipe, headwalls or catch basins, or other conduits or structures, without the approval of the Engineer. If necessary, the Contractor at his own expense, shall sling, shore up, and maintain such structures in operation, and shall repair any damage to them. Before final acceptance of the work, he shall return all structures to as good condition as before the work started.
- B. The Contractor shall give sufficient notice to any utility of his intention to remove or disturb any pipe, conduit, etc., and shall abide by their regulations governing such work. In the event that any subsurface structure becomes broken or damaged in the execution of the work, the Contractor shall immediately notify the proper authorities, and shall be responsible for all damage to persons or property caused by such breaks. Failure of the Contractor to promptly notify the affected authorities shall make him liable for any needless loss so far as interference with the normal operations of the utility.

- C. When pipes or conduits providing service to adjoining buildings are broken during progress of the work, the Contractor shall repair them at once.
- D. Delays such as would result in buildings or residences being without services overnight or for a needlessly long period during the day will not be tolerated. Should it become necessary to move the position of a pipe, conduit or structure, it shall be done by the Contractor in strict accordance with the instructions given by the Engineer or the utility involved.
- E. The Owner or the Engineer will not be liable for any claim made by the Contractor based on underground obstructions being different from the indicated in these Contract Documents or plans.

3.8 EXCESS SUITABLE FILL AND UNSUITABLE MATERIALS

- A. Materials removed by excavation, which are suitable for the purpose, shall be used to extent possible for backfilling pipe trenches and for making embankment fills, subgrades or for such other purposes as may be shown on Drawings. Excess suitable fill material shall be stockpiled and stabilized in designated areas. Materials not suitable for such purposes shall be considered waste material and shall be disposed of at the Contractor's expense, unless otherwise allowed by the owner.
- B. Stockpiled fill materials shall be spread in uniform layers and neatly leveled and shaped, as shown on drawings. Spoil banks shall be provided with sufficient and adequate openings to permit surface drainage of adjacent lands.
- C. Unsuitable materials, consisting of rock, wood, vegetable matter, debris, soft or spongy clay, peat, and other objectionable material so designated by the Geotechnical Engineer, shall be removed from the work site and disposed of by Contractor at his expense.
- D. No waste material shall be dumped on private property. Dumping waste material on public or private property without a permit from Georgia Environmental Protection Division is illegal.

3.9 ROCK REMOVAL

- A. See Section 312316.26 - Rock Removal of these specifications.

3.10 COMPACTION

- A. Control soil compaction and moisture content during construction in accordance with the following requirements.
- B. Fill Placement- once the subgrade has been approved, the exposed surface and all subsequent fill lifts shall be compacted to at least 95% of the maximum dry density in accordance with ASTM D 698, current edition. These soils shall be placed maintaining the moisture content within 3% of the optimum moisture content.

3.11 BACKFILL AND FILLS

- A. Place acceptable soil material in layers to required elevations.
- B. Ground Surface preparations – 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.
- C. When existing ground surface has a density less than that specified under “Compaction” for particular area classifications, break up ground surface, pulverize, bring moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- D. Placement and Compaction - Place backfill and materials in layers not more than 6” 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.
- E. 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.
- F. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying material uniformly around structure to approximately same elevation in each lift.

3.12 TOLERANCES

- A. Unpaved areas within 0.1 feet of elevations shown on the drawings provided such deviation does not create low spots that do not drain.
- B. Paved Areas – Subgrade to within 0.05 feet of the drawing elevations less the compacted thickness of the base and paving.
- C. Building Pads – Subgrade to within 0.05 feet of the drawing elevations less the thickness of the concrete slab.

3.13 FINISHED GRADING

- A. All areas covered by the project including excavated and filled sections, stockpile areas and adjacent transition areas shall be smooth graded and free from irregular surface changes.
- B. Degree of finish shall be that originally obtainable from either blade grader or scraper operations supplemented with hand raking and finishing, except as otherwise specified.
- C. The finished surface of unpaved areas shall be not more than 0.10’ above or below the established grade or approved cross-section.

- D. Ditches and lagoon banks shall be finish graded, dressed and seeded within fourteen (14) calendar days of work to reduce erosion and permit adequate drainage.

3.14 PROTECTION

- A. Graded areas shall be protected from traffic, erosion, settlement, or any washing away that may occur from any cause prior to acceptance.
- B. The Contractor shall be responsible for protection of below grade utilities shown on the drawings or indicated to him by the Owner at all times during earth work operations.
- C. Repair or re-establishment of graded areas prior to final acceptance shall be at the Contractor's expense.
- D. Site drainage shall be provided and maintained by Contractor during construction until final acceptance of the project. Drainage may be by supplemental ditching or pumping if necessary, prior to completion of permanent site drainage.

3.15 DRAINAGE

- A. The Contractor shall be responsible for providing surface drainage away from all construction areas. This shall include maintenance of any ditches that exist or may be constructed by others in the immediate vicinity of the work. Contractor shall provide proper and effective measures to prevent siltation of wetlands, streams, and ditches both on the Owner's property, and those properties downstream.

3.16 PRE-DENSIFICATION AND PROOFROLLING

- A. At completion of clearing, grubbing and stripping of topsoil, stump holes or other depressions shall be cleared of loose material and debris and shall then be backfilled with approved fill. The backfill shall be placed in six-inch thick loose lifts and compacted to 95% of the maximum dry density in accordance with the ASTM D 698, current edition.
- B. Following the clearing and grubbing of trees and underbrush and stripping of topsoil, the fill subgrade shall be evaluated by the Geotechnical Engineer or his representative prior to fill placement. Proof-rolling of the subgrade soil shall be performed where possible. Proof-rolling shall be accomplished with a loaded dump truck or other approved rubber tired equipment. Overlapping passes of the vehicle shall be made across the site in one direction and then right angles to the original direction.
- C. Proof-rolling shall not be performed on excessively soft areas or areas of high water table. Recommendations for these areas will be made by the Geotechnical Engineer at the time of construction. These recommendations may include undercutting soft areas, trenching of soils for drainage or the placement of bridge lifts.

3.17 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction – Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed. An experienced geotechnical engineer shall observe all proof-rolling and all fill and liner placement. Submit one copy of results of all compaction tests and observations of pre-densification to Owner and Engineer.
- B. Perform field density test in accordance with ASTM D 2937 (drive cylinder method), ASTM D 2167 (rubber balloon method), as applicable, or nuclear method ASTM D 2922.
- C. Perform at least one field density test for each layer of fill for every 5,000 square feet of area.
- D. If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, provide additional compaction and testing at no additional expense.
- E. Coordinating of testing will be the responsibility of the Contractor..

END OF SECTION 312316